a quarter century of IFIP

edited by
h. zemanek

IFIP

north-holland

A QUARTER CENTURY OF IFIP

The IFIP Silver Summary

25th Anniversary Celebration of IFIP
Munich, F.R.G., 27 March, 1985

NORTH-HOLLAND
AMSTERDAM · NEW YORK · OXFORD · TOKYO

A QUARTER CENTURY OF IFIP

The IFIP Silver Summary

Proceedings of the
25th Anniversary Celebration of IFIP
Munich, F.R.G., 27 March, 1985

edited by

Heinz ZEMANEK
IFIP Honorary Member
Vienna, Austria

H. Zemanek

1986

NORTH-HOLLAND
AMSTERDAM · NEW YORK · OXFORD · TOKYO

ISBN: 0 444 70003 x

Publishers:
ELSEVIER SCIENCE PUBLISHERS B.V.
P.O. Box 1991
1000 BZ Amsterdam
The Netherlands

Sole distributors for the U.S.A. and Canada:
ELSEVIER SCIENCE PUBLISHING COMPANY, INC.
52 Vanderbilt Avenue
New York, N.Y. 10017
U.S.A.

PRINTED IN THE NETHERLANDS

PREFACE BY THE EDITOR

What you have in your hands is more than the proceedings of the Symposium that was held to celebrate the 25th Anniversary of IFIP — it does include the papers read there, but it also includes papers invited and submitted for being printed only in this volume, and it includes information on IFIP, a summary of its people and bodies. The volume, however, is not a perfect report on a perfect federation — real international work is further away from perfection than national professional work. That already applies to the language: the English of this volume is not the English the professional editor of an English speaking country would request. The reader of English or American mother tongue must realize that his native language has the privilege of being the international language in general today and of computers in particular. There is a price for the advantage of expressing and reading everything ine one's own language (in contrast to those who must learn and apply a foreign language) — and this price is tolerance for unusual, for a little irregular, for slightly incorrect English, for a language which offends here and there the ears and the eyes of the owner of the language. It would have been possible to improve some of the texts (including my own ones) considered, but the editor choose to keep many papers in the shape as received and to correct others only slightly. The deviations are information, as the editor points out in his paper of this volume, and they are part of the international life.

Many dimensions of the Federation are touched, none is completely worked out. There is an amount of redundancy in the papers. Again — the editor could have aimed at some form of systematic completeness and compactness. He did not. It is left to the imagination of the reader to fill obvious holes and to develop the picture of IFIP conform to the alterations coming up every couple of years. And the redundancy reflects an unavoidable aspect of IFIP life.

It is also obvious that many more people in and around IFIP could have contributed to this volume; the selection of the invitees and the actually included papers have properties of a personal enterprise. On the other hand, my intentions were repeatedly explained before the IFIP General Assembly and Council and further propositions were invited. I have included what I got and nobody should complain. It was proposed to include many pictures and I followed this advice — to a certain extent. Because a picture book on the celebration or on IFIP at large would have required a particular photographic effort which had not been proposed nor organized. Most pictures are simply occasional shots.

The tables and the lists can not expected to be error-free — IFIP does not have the bureaucracy to aim at 99% correctness. Anyone who discovers errors is invited to communicate them to the IFIP Secretariat - hopefully, there will be an updating service in the IFIP Bulletin.

This book is neither a scientific proceedings volume nor a reading book nor an IFIP handbook — it is a combination of all and it is left to the reader to pick what he looks for or what he likes when he opens the book. Here is a live abstract monument of IFIP and of the people who were involved in IFIP.

It should be possible to enjoy this monument.

Heinz Zemanek

CONTENTS

(P) *Main paper of the Symposium* (D) *Discussant's Contribution*

Obituaries

The IFIP Silver Summary

Index

MAIN PAPERS COMMENTED BY THE EDITOR

Ashley W. GOLDSWORTHY, IFIP President Elect, Australia

IFIP - THE FIRST 25 YEARS

A TRIBUTE TO THE SIX PAST PRESIDENTS OF IFIP

The Chairman of the Celebration Protocol Committee, IFIP Vice-President and since the Golden IFIP meeting in Tokyo 1985 IFIP President Elect, pays tribute to the past presidents and summarizes the IFIP achievements during their terms. This is a summary of the IFIP history, of the main events and developments.

The seven Presidents of IFIP

A TRIBUTE TO ALL THE VOLUNTEERS AND WORKERS OF IFIP

In response to the tribute, the seven presidents of IFIP return the tribute to all those without whom their achievements would not have been possible. A special word of thanks goes to all the staff members, the assistants and secretaries.

HISTORICAL PAPERS

Isaac L. AUERBACH, IFIP Founder and First President, USA

PERSONAL RECOLLECTIONS ON THE ORIGIN OF IFIP

The Founding President of IFIP describes how a group of representatives of national professional organizations started in parallel ICIP, the precedent to the IFIP Congresses under the auspices of Unesco and counted as the first IFIP Congress, and IFIP, the International Federation for Information Processing.

Isaac L. AUERBACH, USA

IFIP - THE EARLY YEARS : 1960 - 1971

The first President of IFIP - he served for two terms until 1965 - continues his description of the early history of IFIP, the years of formation and consolidation under his leadership.

Pierre A. BOBILLIER, past IFIP President, Switzerland

IFIP RECENT HISTORY

The President of IFIP who served the longest time - two full terms from 1977 to 1983 before that two terms as IFIP Secretary from 1969 to 1975 - depicts the period of IFIP during which he served as a member of the IFIP Executive Body - a time of impressive growth.

Anatol A. DORODNICYN, past IFIP President, USSR

IFIP, SOME LOOKS IN PAST AND FUTURE

President from 1968 to 1971, Vice-President or Trustee during another 13 years - the Doyen of the IFIP General Assembly Members - summarizes his view and adds a few critical remarks.

Richard I. TANAKA, USA

IFIP: THE NEXT DECADE

Having chaired the IFIP Activity Planning Committee from 1972 to 1974 and presently chairing the Long Range Planning Committee, the IFIP President from 1974 to 1977 characterizes the present situation of IFIP and sets indicators for the goals during the next ten years.

Kaoru ANDO, Japan

ON THE FUTURE OF IFIP

TOWARDS THE INFORMATION AGE

The IFIP President in office now (1983 - 1986) investigates possibilities and necessities of the work of the federation. He begins with a retrospective of the Congresses, the World Conferences, the work of the Technical Committees and Working Groups and the Affiliate Members. He considers how to keep the IFIP organization prepared for the "information age" and then looks into the future: he urges three points: 1. Strengthening TC and WG activities, 2. Establishing closer coordination between developed and less developed countries in information processing applied technology and 3. Maintaining flexible and sensitive multi-national organizations.

PHILOSOPHICAL AND GENERAL PAPERS

Harry D. HUSKEY, USA

AN ASSESSMENT OF THE CONCEPTION AND THE POSITION OF INFORMATION PROCESSING

The famous computer pioneer, Professor Harry D. Huskey discusses the origins of the automatic computer from conception to production models, the relationship between memory technology and computer system design, describes the explosive growth of integrated circuits, the development of user languages and architectural trends. A paragraph on otday's situation concludes this contribution which was supported in Munich by rare, unusual photographs, some of which are reproduced here.

Niels BJÜRN-ANDERSEN, Denmark

A CRITICAL VIEW ON THE POSITION OF INFORMATION PROCESSING
Discussant's Contribution

It is by far too narrow to consider information processing as a field driven by technical innovation in hardware and software: organizational and socio-technical innovation requires strong inputs from the social sciences if the technology is to meet societal needs.

Fritz L. BAUER, Germany

RATIOCINATION AND INTUITION IN THE PROGRAMMING PROCESS

Ratiocination, I want to assure those international readers who doubt that this is an English word, can be found in every dictionary and means logical derivation or conclusion. Professor Bauer offers a new treatment of the classic question of whether programming is an art or a scientific discipline. It has features of both - intuition is as necessary as logical reasoning, but intuition without careful rational cross-checking is as misleading as mechanical derivation ignoring context and semantics. At present, he says, the radical forces of 'artificial intelligence' and of 'creative tools' attract too much attention - what the programming community needs is a constructive attitude combining formal mechanisms and intuitive guidance.

Heinz ZEMANEK, Austria

MUST WE DO EVERYTHING WE CAN DO?
Sense and Nonsense in Information Processing

By giving ten different definitions of 'information' and comments to each, sense and nonsense, usefulness and dangers of information processing are pointed out. Whether we must do everything we can do, was certainly not a question in the pioneer's days, when there was much more to be done than the small group of beginners could carry out. Today, questions of restriction and appropriateness have become decisive and need careful investigation. No, we are not allowed to do everything that could be done - but it is difficult to properly define the lines and limitations of reasonable restriction.

Giorgio SACERDOTI, Italia

MUST WE DO EVERYTHING WE CAN DO?
Sense and Nonsense in Information Processing - Discussant's Contribution

All sense and nonsense of information processing depends of proper selection of the meaningful information which exists all around us. The critical aspect is not at all *processing*; once we have the symbols, we can make very sensible rules of processing. But the symbols do not always carry meaningful information. And meaningful information, Giorgio Sacerdoti says, is what reduces the level of incertitude of a system.

Bruce GILCHRIST, USA

COMPUTER TECHNOLOGY - COMPUTER INDUSTRY

Some form of symbiotic relationship exists between technology and industry. It is unnecessary to know which is the chicken and which is the egg and which was first - certainly by 1960 technology and industry were growing in tandem. The important role played by the enterpreneurs and their employees, by salespeople, job-hoppers, user groups, students and meeting goers in spreading ideas is examined. Thus, as countries seek to stimulate the information processing sectors of their economies, they must take into account the diverse ways in which ideas are disseminated.

John DIEBOLD, USA

Discussant's Contribution to the same subject.- The tape which should have been projected at the Symposium did not arrive in time.

The remarks are structured in five specific areas: (1) when studying computer history, it is crucial to differentiate between technology and industry; (2) a useful area of study is in the economic and social conditions for development and evolution; (3) the role of the US-Government-funded research is often badly understood, especially outside the US; (4) studies of the computer's impact should focus on the user; and (5) the role of the university merits deeper attention.

Gene M. AMDAHL, USA

MAINFRAME TECHNOLOGY FOR THE NEXT DECADES

There has been much speculation as to which technology will be employed in mainframe computers in the next decade and as to how much longer the speed of computers can be increased from generation to generation. For the coming one or two decades there appears to be the promise of continued growth, and for the small and intermediate mainframes it can be predicted that CMOS (Complementary Metal Oxide Semiconductor) will occupy the winning position. Chips as produced by Amdahl, IBM and Hitachi are discussed and compared.

Philippe RENARD, France

Discussant's Contribution to the same subject

Mr. Amdahl assumed the heavy burden of predicting the future. But we all know that we most often failed to forecast correctly. Mainly, we were not able to predict the new computer applications from which technological improvements originated. So it is better not to make too risky statements. But a calculation shows the surprising fact that the improvements over the last years *accelerated* instead of decelerating. Will these trends continue? If we analyze all the available forecasts, lots of contradictions will show. So a French writer, A.R. Grillet, is quoted who, when he was attacked by many participants after a conference talk, had as last argument: *there is enough place in the world to allow each of us to be right.*

Harlan D. MILLS, USA

MANAGEMENT AND PERFORMANCE OF SOFTWARE
The paper was read by George Glaser

Software engineering management is on the way from a black art to a science. And if one considers the development times in other areas, it appears that programming is still very young. So there is hope enough that further good ideas will come. To turn program development into an orderly process is easier said than done. The best intentions and diligence will merely create a public chaos if the specifications and the design are lost in a sea of details and terminology. And since there is a sea of details in any sizable software development, they will indeed be swamped unless extraordinary methods and disciplines are evoked. The concepts of structured programming (Dijkstra), program modularity (Parnas) and program verification (McCarthy) are discussed and evaluated.

R. NARASIMHAN, India

IFIP AND THE DEVELOPING COUNTRIES

Informatics is a vital factor in development. IFIP has realized this very early, and had hoped for support from UNESCO and the other members of the UN family. But the problem is difficult and IFIP is very lucky to have Professor Narasimhan as chairman of its 'IFIP Committee Informatics for Development' - he is close to the problems and understands both sides: the developed countries and the developing countries. In this paper he briefly describes those problems, IFIP's initiatives since 1980 and the future needs - which include better visibility of IFIP in the developing countries.

Tosio KITAGAWA, Japan

MAN AND MACHINE VIEWED FROM DIFFERENT CULTURAL BACKGROUNDS

Health reasons inhibited Professor Tosio Kitagawa to come to Munich. The paper was read by R.W. Rector (University of California, Los Angeles), and this was not an easy job. While giving access to a philosophy of computers much cultivated in Japan and considered of big importance for the information processing and social future of Japan, the text is hard to follow - even when read carefully expression by expression. It requires, for instance, many quoted publications for full understanding. Since the author expressed in a letter that he had spent several months to prepare this manuscript, the editor decided to have this paper printed, apart from minor revisions and corrected misprints, exactly as he had received it.

Essentially, biology, civilization and culture are confronted in view of the computer possibilities and their social consequences. Generalized relational ecospheres result in five viewpoints for analysis - cognition, evaluation, communication, control and creation.

José G. SANTESMASES, Spain

MOLECULAR COMPUTERS - A FUTURE POSSIBILITY ?

Professor Santesmases, IFIP representative of Spain from foundation to 1970, picks a controversial question: will the silicon chips in the future be replaced by 'biochips', based on carbon instead of silicon?
The available information is collected and a set of references is offered.

REFLECTIONS AND REMINISCENCES

John M. BENNETT, Australia

IFIP - SOME AUSTRALIAN REFLECTIONS

Professor John Bennett represented Australia from 1961 to 1980 with an intermission from 1964 to 1971 - when he was the TC 3 member of his country. He served as Vice-President and as Trustee; and he played a leading role in the conception, planning and realization of the Japanese-Australian IFIP Congress 80. Australia is far away from - say - Geneva, but when an Australian goes there, almost every place on earth offers a natural stop on the direct way. John's personality reflects this fact. His reflections prove that far distances do not only separate - they interconnect as well.

A. S. DOUGLAS, United Kingdom

IFIP REMINISCENCES : THE SECOND DECADE

Professor A.S. Douglas is as typically British as he is an international person; wherever one goes - there is a chance to find him there involved in some project or acting as an advisor. So IFIP for him is a most colourful texture, the underground threads of which interest him most. I wished his 'reminiscences' would have included more of his (sometimes very subtle) jokes - he could have made his contribution the puzzle corner of this volume. For those, however, who know him and his tales, many sections of his contribution will extend to multiple length by remembering oral events.

P.X. GUO, China

IFIP AND CHINA

China in IFIP! Even at the foundation of IFIP, not so many people - whether one counts the population or the professionals represented - joined IFIP than when Professor Guo took his seat for the first time in the General Assembly in 1980. Only three years later, the Chinese Institute for Electronics hosted an IFIP Council Meeting. It is interesting - in the best sense of this word - to read the Chinese view of this relationship.

Leon LUKASZEWICZ, Poland

A HANDFUL OF RECOLLECTIONS ABOUT IFIP PEOPLE

Poland joined IFIP one year after foundation, otherwise Academician Lukaszewicz would join Academician Dorodnicyn in celebrating a quarter century of IFIP representation. He remembers a 'handful' of people, the presidents, van Wijngaarden and Dov Chevion, and it is a very personal perspective.

Gerd D. van der VEER, South Africa

REMINISCENCES OF IFIP

Very few General Assembly Members made, during their IFIP time, a career like Gerd who is now General Manager of the South African Airlines - while he had been the computation manager of the Railways when he entered IFIP. The country has political problems, the country is a political problem. And politics can easily hurt people (I can well remember the period in which I had been a victim of political hostility even as an unimportant young man). The contribution not only rounds the picture, it is suggested as evening reading before any IFIP decision with a political dimension. It is the people who count, our colleagues, for instance.

Heinz ZEMANEK, Austria

THE ROLE OF PROFESSOR A. van WIJNGAARDEN IN THE HISTORY OF IFIP

This paper, originally read at Professor van Wijngaarden's retirement symposium, Amsterdam 1981, was chosen for reprint because this outstanding IFIP personality would otherwise not have been properly represented in this volume. It is van Wijngaarden History, it is IFIP History, and it is - I admit - some of my history. I wish I could offer each reader of the chapter "Princeton and St. Pierre" a bottle of the "Clairette de Die" (as I did to Aad).

TECHNICAL PAPERS - TECHNICAL COMMITTEES

Ed L. HARDER, USA

FINANCING IFIP

Who - do you think - built the computer which is probably the oldest, certainly one of the oldest still in operation? The IFIP Treasurer 1969 to 1972, Ed Harder, who shaped IFIP's finances. The old computer is an analog machine for electrical power network simulation, called ANACOM, conceived in 1946, completed in 1948 and - extended and partially modernized - still in full use. I saw it working in Pittsburgh in summer 1985, for Westinghouse as well as for customers. Ed Harder did much more - also for IFIP and for AFIPS. His description of the financial philosophy is the right transition to the technical papers and the technical committees.

D. ASPINALL, Chairman TC 10, United Kingdom

THE FIRST TEN YEARS OF TC 10 IN IFIP

Professor Aspinall was there from the very beginning, with Professor Piloty, and he represents TC 10 and its history as a typical IFIP TC example, typical, but yet as unique as all other TC's. (The papers of this section are not ordered by the TC number, but by the family name of the author, an arbitrariness which yields a sequence which pleased the editor.)

Manfred BROY, WG 2.2 Member, Germany

ON MODULARITY IN PROGRAMMING
Discussant's Contribution

This highly technical paper is a specimen for the IFIP scientific language work, it will appear a little abstract and exotic in this context - but it fits into the volume (while, on behalf of IFIP and North Holland and the Chairman of the IFIP Publications Committee I herewith grant permission to reprint it where more specialized readers will encounter it). It is also included as a proof that some IFIP people are working hard while others are celebrating and reflecting.

Richard A. BUCKINGHAM, TC 3 Chairman 1963 - 1973, United Kingdom

TC 3 - THE FIRST TEN YEARS

One of the most devoted IFIP TC chairmen describes the history of IFIP's involvement in education, the generation of the first IFIP World Conference, and the work of TC 3. In his concluding chapter, Professor Buckingham calls his contribution a 'perhaps unexciting description', and he says that the human and the intellectual interactions, the dedication of the individual can not be recorded in such a paper - which is correct. But who ever has worked in a TC or WG or in a similar group can read a lot between the lines.

W.L. van der POEL, WG 2.1 Chairman 1962 - 1969, The Netherlands

SOME NOTES ON THE HISTORY OF ALGOL

This 'anecdotic approach', as Professor van der Poel calls it, was reprinted from "Mathematisch Centrum Tracts No. 37 (they are of limited distribution - we thank the Mathematisch Centrum for the permission) because the history of ALGOL is not yet appropriately written; R.W. Bemer's 'History' is important, but only one of the bricks for the building, and here is another one. The chairman's view certainly is not necessarily representative for the WG members' view (I had something to do with WG 2.1; I know. They had as a rule and as a philosophy more opinions than members). And of course I have my own view of the history of ALGOL and WG 2.1. The 'anecdotic approach' is descriptive and consists of correct pieces, but the pieces are selected, necessarily a personal and incomplete description. Which shows how much historic work remains to be done. "The chairmanship", Professor van der Poel says, "were the longest seven years I ever had". Here we fully agree: it was an intense and fascinating period.

Harold SACKMAN, present TC 9 Chairman, USA

HISTORICAL CRITIQUE OF IFIP TC 9 : COMPUTER RELATIONSHIPS WITH SOCIETY

All IFIP Technical Committees are different, not only in their technical subject, but also in their philosophy, their style and their operation. But TC 9 is a special case in the set - a non-technical Technical Committee, with a long and hard pre-history (since I had been involved, I may quote here my paper in the 'Computer Compacts' Vol. 1, 1983, pp. 184 - 186). The slightly redundant description of IFIP was left in the paper because, as Professor Sackman expressively states, it serves several purposes in this paper.

Alex A. VERRIJN-STUART, TC 8 Chairman 1977 - 1982, The Netherlands

INFORMATION SYSTEMS : THEMES AND TRENDS
From MIS to DSS and Office Systems

Unfortunately, not all TC's have submitted programmatic accounts of their subjects (IMIA, the former TC 4, for instance, has tried hard and could not make it) - TC 8 and TC 5 did, and the editor finds it extremely satisfying to close the set of papers by these two contributions.

Here, Professor Verrijn-Stuart describes the developments from the (centralized) Management Information System (MIS) to a variety of specialized (and decentralized) concepts such as Decision Support Systems (DSS) or Office Systems - a development mirrored by TC 8 and its Working Groups, and also pushed forward by them.

Jacob VLIETSTRA, TC 5 Chairman 1977 - 1983, The Netherlands

AUTOMATION IN TECHNOLOGY
The Case of Computer Aided Design and Manufacture

Industrial applications belong to the methodologically and financially most important computer applications. TC 5 reflects this importance by a spectrum of activities in Computer Aided Design (CAD) and Computer Aided Manufacture (CAM). Present trends, occurring problems and their solutions are treated by Jacob Vlietstra and he makes also observations how to learn to live with some obstacles that can not be removed quickly. He remarks in conclusion that the application of computers in technology has barely begun. This is true for many other fields too.

I would like to read the proceedings of the Golden IFIP Jubilee 2010 now. Because information processing in many respects runs faster into the future than human imagination. IFIP's TC and WG members - totalling nearly a thousand people - who deal with the present have a difficult job and they have before them challenging next 25 years during which they will do, as in the past, the essential work of IFIP.

THE OBITUARIES

Most of the obituaries are full reprints or slightly shortened versions from the IFIP Bulletins. Some have been translated (A. Walther and H. Rutishauser from "Elektronische Rechenanlagen", R. Oldenbourg Verlag, Munich) or condensed from an historic paper (J. Pasta from "Annals of the History of Computing", AFIPS).

THE IFIP SILVER SUMMARY

The papers of this book give an informal account of 25 years of IFIP. The editor felt that a section with more formal information about the federation, about the IFIP people for instance or about the IFIP publications would properly complement the informal part. So he added the IFIP SILVER SUMMARY to the plan, a concept based on some history.

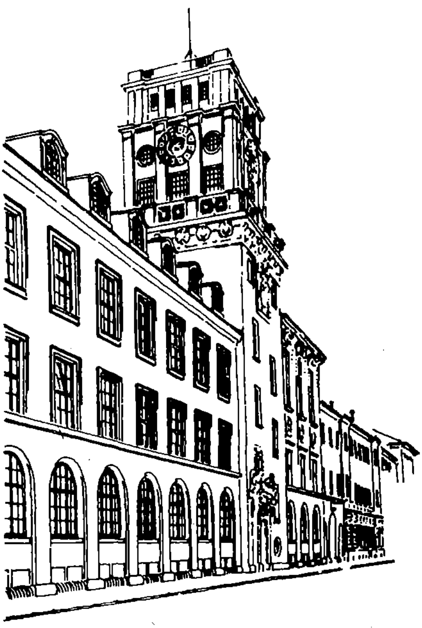
For a number of congresses (1968 through 1977) IFIP had printed small brochures called "IFIP Summary" giving the basic information about the federation, its constituents, its bodies and its publications. In the Eighties, the IFIP Bulletins took over the role of those brochures. But now some of the chapters - the list of publications, for example - have reached a size which is prohibitive in the long run. This volume is an opportunity not only to summarize the history in the form of a collection of information corresponding to the historical summaries, but in addition to serve as a reference source - so that the Bulletins can be restricted to the changes and to new sections of the IFIP standard information.

The reader and user is warned: while IFIP has often been criticized because of its bureaucracy, IFIP does not have enough of it - (the Secretariat is an admirably small entity - to maintain the required files accurately down to the last required detail). There may be errors,wrong dates primarily. Whoever discovers one is invited to communicate the correct information to the secretariat in Geneva (IFIP Secretariat, 3 Rue du Marché, CH-1204 GENEVA, Switzerland).

THE SYMPOSIUM

IFIP

THE FIRST 25 YEARS



A One-Day Symposium
Featuring Top-Experts
From the World of Computing,
to be held in the
Technische Universität München

Munich, March 27, 1985

THE FIRST 25 YEARS
THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS
THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS

F.L. Bauer

Professor M. Paul and Professor Dr. R. Piloty

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING

FOREWORD

When P. Bobillier, then President of IFIP, in Melbourne 1980 approached me to prepare the 25th Anniversary Symposium, I hesitated first. Finally, I agreed for two reasons:

First, I found it challenging to draft a program of more philosophical than technical nature comprising the fundamental issues of informatics. Of course, this turned out to be difficult, several proposals did not work out and I was not completely satisfied with the program that was reached finally. I have to leave it up to the judgement of the public to what extent the program was successful.

Second, I thought I would offer to IFIP, by arranging the Symposium and hosting the Council meeting accompanying it, a farewell present. I have been standing in the second row, behind the unforgotten Alwin Walther, when the Paris 1959 Conference was prepared, and I have been with the Program Committee for the 1962 Congress in Munich. Since then, I have been attached to IFIP in many ways, for a number of years also as German Representative to the General Assembly. I have seen it struggling and growing. This Symposium was my farewell. My younger colleagues will continue to serve IFIP. I can only express my best wishes.

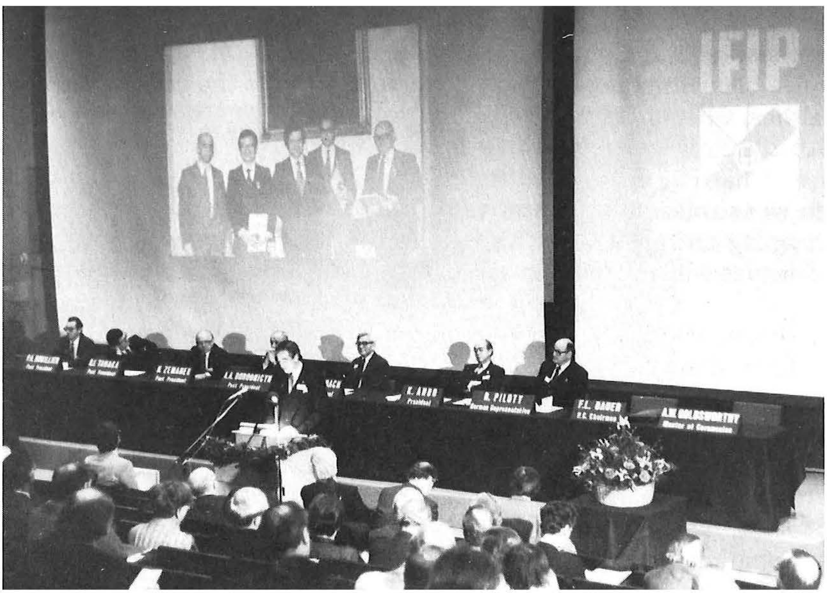
My thanks go to the members of the Program Committee, in particular to Heinz Zemanek who gave me very active support. Moreover, I wish to thank the Past President Mr. P. Bobillier, and the President, Mr. K. Ando, for continuing smooth cooperation. I am extremely grateful to my colleague Professor M. Paul for stepping in with the Local Arrangements Committee when I was ill in summer 1984. Last but not least, may I thank the Lecturers and Discussants for their devoted participation.

F.L. Bauer

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS

Mr. K. Ando - IFIP President



Munich 1985

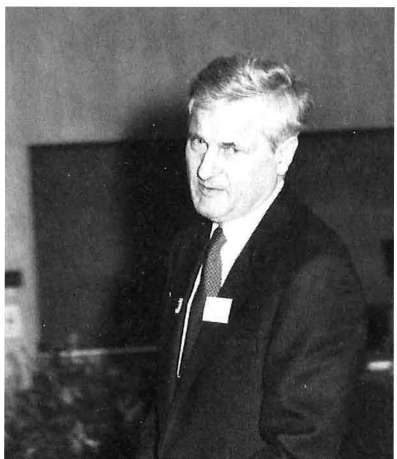
THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS

Professor Dr. M. Thoma
IFAC President

Mr. Kaddouro
UNESCO



Professor Dr. F.R. Güntsch
Federal Government

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS

INTRODUCTION
BY THE DEAN OF FACULTY OF INFORMATICS

During the nineteenth century many fundamental innovations in science and technology necessitated radical changes in teaching and learning. Before then education was a privilege of the upper class, now everyone demanded education on a broad scale. Therefore all over Europe technical schools were established. In the Kingdom of Bavaria, after several failures caused by financial and political difficulties, in 1868 the *Polytechnische Schule München* was founded. Since 1877 it was named officially *Technische Hochschule München*, and in 1970 its name and status were changed to *Technische Universität München.*

In the early fifties, when the rapid development of information processing began, in Munich the PERM computer was conceived and constructed by Hans Piloty, Director of the *Institut für Nachrichtentechnik*, and by Robert Sauer, Director of the *Mathematisches Institut*. Their cooperation was the beginning of computer science at the *Technische Hochschule München.* Substantial contributions to software engineering were made since, e.g. to the analysis of programming languages and to the construction of compilers. As a consequence of the development in this new area of science and technology the *Institut für Informatik* was established in 1975.

Since Munich is a city large enough to host international congresses, and since computer science had a home there already at the time when IFIP was founded, IFIP chose Munich as the venue of its First International Congress in 1962. We feel honoured that IFIP now again has invited computer experts from all over the world to Munich in order to celebrate its 25th anniversary.

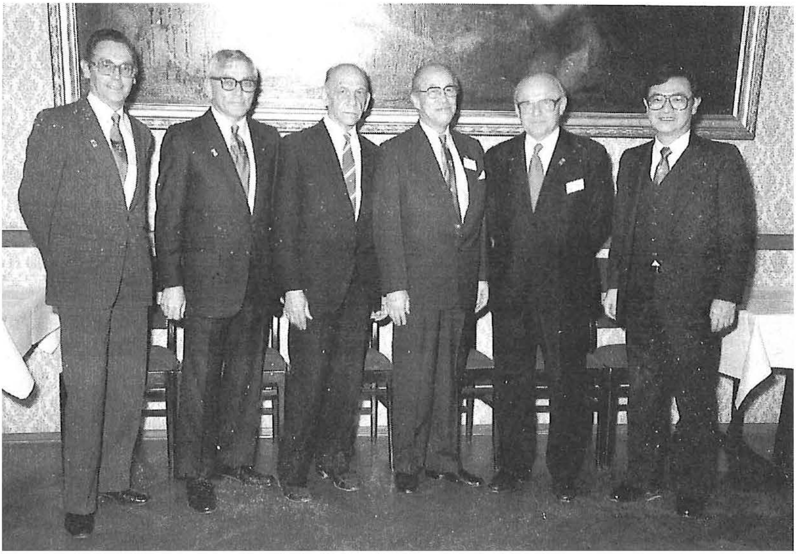
Besides your scientific work for which I wish you great success, I also wish you a pleasant stay in our colorful city and its beautiful surroundings.

M. Paul

IFIP 25th Anniversary — Munich/FRG
SESSIONS' PROGRAMME

March 27, 1985

9.00 a.m.	Opening ceremony
10.00 a.m.	*H.D. Huskey:* An assessment of the conception and the position of information processing (discussant: *N. B.-Andersen*)
10.45 a.m.	Coffee break
11.15 a.m.	*T. Kitagawa:* Man and machine viewed from different cultural backgrounds (discussants: *A Ershov and R.W. Rector*)
12.10 a.m.	End of morning session
	Lunch break
2.30 p.m.	*H. Zemanek:* Must we do everything? Sense and nonsense in information processing (discussant: *G. Sacerdoti*)
3.15 p.m.	*G. Amdahl:* Better performance at lower costs: Are there limits to the evolution of hardware? (discussant: *P. Renard*)
4.00 p.m.	Coffee break
4.30 p.m.	*B. Gilchrist:* Computer technology — Computer industry (discussant: *J. Diebold*)
5.15 p.m.	*H. Mills:* Management and performance of software (discussant: *M. Broy*)
6.00 p.m.	End of afternoon session



The six Presidents present at the celebration
from left to right: P.A. Bobillier, I.L. Auerbach,
A.A. Dorodnicyn, K. Ando, H. Zemanek and R.I. Tanaka

Mr. Junren (from China) hands over a present to President K. Ando.

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING

THE CELEBRATION SYMPOSIUM on March 27,1985 in Munich

Heinz Zemanek

It had been the idea of Dov Chevion, the late IFIP representative of Israel, to celebrate the 20th Anniversary of IFIP, in analogy to the 10th Anniversary, which had been celebrated in Amsterdam in 1970. But the year 1980 was an IFIP congress year, and not a year of a conventional congress: IFIP Congress 80 was the first one organized by two countries instead of one and in two continents at that: a week in Tokyo and the following week in Melbourne. The event, particularly carefully prepared, became a big success, but it absorbed all the power of the federation - no chances for an anniversary celebration; in Melbourne, IFIP decided to have a Silver Jubilee in 1985, and President Bobillier asked Professor Bauer to organize a symposium for the occasion. Bauer hesitated first, but then accepted, he says, for two reasons: he found it challenging to draft a programme of more philosophical than technical nature, and he wanted to offer a farwell present after 25 years of IFIP services.

As it is with international preparations: they need time. Chevion's proposal was made in 1978, the decision to move the event to 1985 in 1980, and in Anaheim in 1981 a programme committee, with Professor Bauer as chairman, was appointed. One year later, in Helsinki a first list of subjects was established, and in 1982 ten lecture titles were proposed to the General Assembly in Rome. At the next one in Paris, candidates for the lecturers were listed, the number of papers was reduced to eight. In the fall of 1984, in Varna, the final set of seven speakers and five or six discussants was accepted. A protocol committee of four vice-presidents was appointed to prepare the ceremony and its protocol, and to finalize the list of invitees. The German member society "Gesellschaft für Informatik" was kindly willing to accept the almost-duty to invite for the Council Meeting to Munich.

The model of the event remained the Amsterdam 10th Birthday of IFIP, celebrated on October 25, 1970 in the big hall of the Amsterdam Tropical Institute. Eight papers - most of them by IFIP presidents or vice-presidents - gave an overview of IFIP and information processing, representatives of UNESCO and UN presented opening addresses. The election of I.L. Auerbach as the first IFIP Honorary Member was officially announced by President A.A. Dorodnicyn. The proceedings of the symposium have been published - they are out of print since years. I accepted again to edit the proceedings, but for the 1985 event I wanted a larger scope for the book. So I proposed - and IFIP agreed - to publish further papers, not read at the symposium, in order to cover more aspects (it would, however, have been difficult to extend the celebration beyond one day).

The ceremony on Wednesday, March 27, 1985, was opened by a performance of Renaissance music. On the stage were seated the IFIP President, Mr. K. Ando (Japan, 1983 - 1986) and the past presidents with the exception of Professor A.P. Speiser (Switzerland, 1965 - 1968) who had been prevented to come:

- I.L. Auerbach (USA, 1961 - 1965),
- A.A. Dorodnicyn (USSR, 1968 - 1971),
- H. Zemanek (Austria, 1971 - 1974),
- R.I. Tanaka (USA, 1974 - 1977),
- P.A. Bobillier (Switzerland, 1977 - 1983).

Vice-President A.W. Goldsworthy (Australia), the Chairman of the Protocol Committee, welcomed the guests and the IFIP participants, and then presented a tribute to the six past presidents, a history of the federation, its achievements and its growth. (See the next paper.)

The following speakers brought congratulation addresses:

- Mr. Kaddouro from UNESCO,
- Professor Dr. F.R. Güntsch from the Federal Government,
- Min.-Direktor H. Kiessling from the Bavarian Government,
- Professor Dr. W. Wild, President of the University of Technology Munich, host of the Symposium,
- Professor Dr. M. Paul (former IFIP TC 2 Chairman), Dean of the Faculty for Mathematics and Informatics,
- Professor Dr. H. Müller-Merbach (IFORS President) from IFORS and
- Professor Dr. M. Thoma (IFAC President) from IFAC.

Rather than bringing all the addresses in ful text, two quotations may indicate the spirit of the wishes. First out of the address by Professor Güntsch from the Federal Ministry for Research and Technology:

Information Processing in today's terms is a very young discipline, even if we have the pleasure to celebrate IFIP's 25th anniversary today. This means that many people all over the world are producing day by day new and fascinating, but not necessarily coherent ideas, theories and products. But there is probably no broad scientific and technical field that, by its very nature, needs more urgently a harmonization, a certain discipline than information processing with all its communication aspects.
Here we find the extraordinary important role of international communication bodies with powerful clearing functions which indeed played and are still playing a predominant role for converting a potentially chaotic process into real progress. There is little risk in stating that the most respectable international body of that kind is IFIP.

And secondly out of the address by Professor Müller-Merbach, IFORS President:

The German philosopher Immanuel Kant (1724 - 1804) once stated that the value of each single science can be determined by its internal content of mathematics. You may agree with this statement or not. However, if you remove mathematics from the single sciences, not much would remain.
Kant's statement is going to have a younger brother, provided by information processing. The statement of the Nineties may read: The effectiveness of each single applied science can be determined by its internal content of information processing.
Three reasons support this statement:

- *The knowledge in each science is well enough structured for automatic information processing.*
- *The amount of knowledge in each science requires support from information processing.*
- *Each advanced science has such a rich methodology that again it can not efficiently be controlled without information processing machinery.*

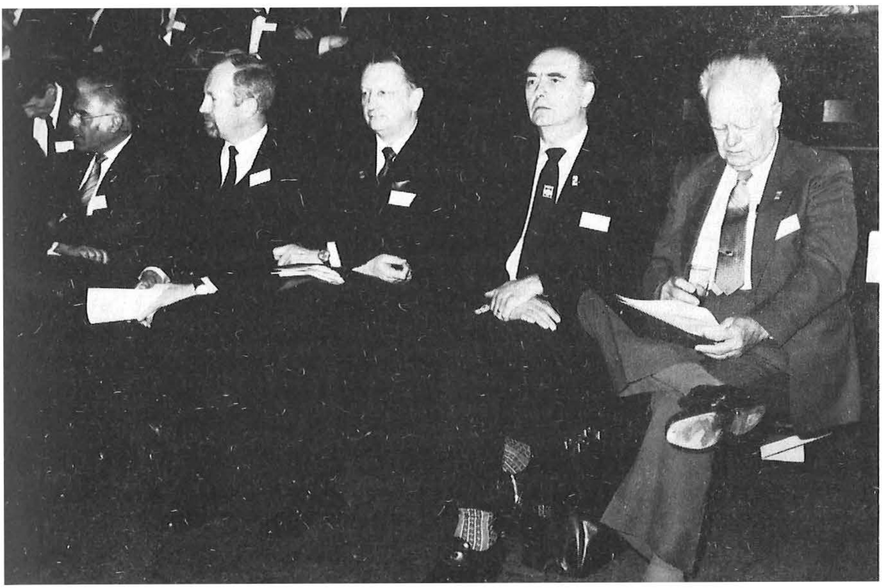
The individuals in any branch of science will become less and less competent in their fields without the support of information processing.

The papers of the Symposium and the discussant's contributions follow in the next sections of this book. The papers are marked by (P) in the contents and the discussant's contributions by (D).

IFIP invited the special guests and the speakers of the Symposium for a lunch in the Munich House of Artists and in the evening, all participants were invited for a banquet at the same location. Banquet speaker was the Honorary Member and Founding President of IFIP, I.L. Auerbach; his talk was very much enjoyed by everyone - he gave a short version of his historic papers in this volume, reminiscences and reflections accompanied by lots of slides.

All the participants of the Celebration and of the Council meeting were invited on Tuesday, 26 to a Bavarian State Reception by the Baviarian State Minister for Economy and Transport, Anton Jaumann, in the 'Black Hall' of the Munich Residence and on Thursday, 28 to a City Reception inthe Munich Town Hall.

On Friday, there was an excursion to the baroque monastery of Benediktbeuren south of Munich followed by an informal dinner reception offered by the Siemens Communication and Information Systems Group in one of the Munich Siemens centers.



25th ANNIVERSARY SYMPOSIUM Munich

from left to right:
M. Paul, H. Müller-Merbach, M. Thoma, L. Kuhn, H.D. Huskey

A.W. Goldsworthy

IFIP - THE FIRST 25 YEARS
A TRIBUTE TO THE SIX PAST PRESIDENTS OF IFIP

Ashley W. Goldsworthy
IFIP President Elect

Fortitude Valley, Australia

The IFIP Presidents from 1960 to 1983 are presented and the achievements during their periods are summarized.

The formation of IFIP brought to fruition work commenced many years before. In January, 1957 Mr. Isaac L. Auerbach submitted a proposal to Unesco on behalf of the National Joint Computer Committee, U.S.A. - the predecessor of the American Federation of Information Processing Societies (AFIPS) - to sponsor an international conference on information processing. In December that year Unesco convened a panel of experts which recommended that Unesco proceed to organize such a conference. It was during the early meetings that representatives from national technical societies discussed the formation of a society of societies rather than an intergovernmental organization. In June, 1959 Unesco held the first International Conference on Information Processing (ICIP) in Paris, a conference which 1800 participants from 37 countries attended. For his contribution to this event, Mr. Auerbach was honoured by the award of the Grand Medal of the City of Paris.

During the conference a meeting of reprentatives of national technical societies was held, and it was agreed to submit the statutes they had worked out to their societies for approval. Two of our distinguished guests were appointed to the Provisional Executive Committee, Mr. Auerbach and Academician Anatol A. Dorodnicyn, as president and vice-president. The first task of the Provisional Executive Committee was to secure approval of the statutes of the proposed federation. It was further agreed that if seven national technical societies approved the statutes and applied for membership before January 1, 1960, the new federation would be brought to existence. Approval and applications for membership were received from 13 national technical societies by end of 1959. Thus was born the first international organisation for the advancement of the science of information processing.

The first council meeting was held in June, 1960 in Rome, with already 15 countries involved: Belgium, Canada, Czechoslovakia, Denmark, Finland, France, Germany, Japan, The Netherlands, Spain, Sweden, Switzerland, Union of Soviet Socialist Republics, United Kingdom and United States of America. Mr. Auerbach was elected president, the late Professor Alwin Walther of Germany vice-president and Dr. Ambrose Speiser of Switzerland, who unfortunately can not be with us this morning, was elected secretary-treasurer.

The second council meeting took place in February, 1961 in Darmstadt. A further two members were admitted - one of which, I am proud to say, was my own country Australia - bringing the total membership to 17. (Poland was the other new member.)

ISAAC AUERBACH

IFIP President 1960 to 1965

Congresses

MUNICH 1962
NEW YORK 1965

At the second IFIP Congress, held in 1962 in Munich, Mr. Auerbach was re-elected as president for a second term through 1965, when the Congress was held in New York. The Congresses were planned by international Programme Committees and national Organising Committees both reporting to the president of IFIP. This method continues for all IFIP Congresses.

Since, at the beginning, IFIP had no treasury of any magnitude, it was necessary to solicit financial guarantees to cover contingencies for losses. Mr. Auerbach was personally responsible for negotiating these guarantees for the first four IFIP Congresses. During his presidency the procedures and methodology for Technical Committees and Working Groups were established, and the following Technical Committees were created:

TC 1 Glossary
TC 2 Programming Languages
TC 3 Education

Mr. Auerbach was deeply involved in TC 1 personally and helped create one of the earliest multilingual glossaries in our industry.

Another of the significant legacies he left was the financial structure and the viability of IFIP. Income included dues, surplusses from congresses and royalties on all publications. Royalties were highly controversial, but a very important issue, and they have proven to be a major source of financial stability to the federation.

Other important procedures that Mr. Auerbach was responsible for were

- basic agreement that political issues were not to be discussed on the floor of a General Assembly or a Council Meeting, and
- the principle that every president had a moral obligation to develop his successor.

IFIP recognised the outstanding contribution of Isaac Auerbach by electing him IFIP's first Honorary Member at the General Assembly in Prague in 1969. He was one of the first recipients of the IFIP Silver Core, which he received in the year of its inception, 1974.

Ladies and Gentlemen - - - the Founder, the first President and the first Honorary Member of IFIP - Mr. Isaac L. Auerbach of the United States of America.

AMBROS SPEISER

IFIP President 1965 to 1968

Congress

EDINBURGH 1968

Professor Dr. Ambros Speiser joined IFIP at its foundation; he represented Switzerland (the Swiss Federation for Automatic Control) from 1960 to 1968. He was appointed Secretary-Treasurer of IFIP at the first Council meeting in June 1960 in Rome, and he had to organise the administration and the finances of IFIP, as well as many of the procedures which subsequently were the basis of the Federation's operation. While IFIP was registered in Belgium, from 1962 to 1967, Mr. Marcel Linsman of Belgium was elected Assistant Secretary to act on matters that had to be done in Brussels, but otherwise Professor Speiser handled all the items like minutes, financial reports and other documentation as well as the files. He submitted the budgets and financial reports, prepared the agenda and mailed the documents. He was re-elected Secretary-Treasurer in 1962 for a one year term and re-elected for a three years term in Gøla, Norway in 1963.

In 1965 the size of the IFIP administrative workload had grown to such an extent that an administrative secretary and a secretariat became necessary. The British Computer Society offered their services, and Mr. G.J. Mackarness, then secretary of the British Computer Society, was in the office as administrative secretary for the first time at the first IFIP General Assembly in 1965 in Nice (before then, all the meetings were called Council meetings).

In 1965 in New York, Dr. Speiser was elected IFIP president until 1968. In 1967 he was elected an Individual Member of IFIP. He wished to introduce his successor, Professor Bobillier, as the Swiss representative in due time, and IFIP had a desire to keep Professor Speiser in the Council as a Past President. Meanwhile, in 1966, Professor Speiser had moved to the newly created post of research director of an electrical company based in Switzerland. Having thus left the field of information processing, he withdrew from IFIP in 1969.

During Dr. Speiser's presidency, IFIP membership increased to 27 from the original 15 founding member societies; another two Technical Committees, TC 4 for Health Care and Biomedical Research, and TC 5 for Computer Applications in Technology, were established.

The IFIP Administrative Data Processing Group (IAG), the first IFIP Special Interest Group, was created. IAG dealt with Applied Information Processing; it was a Partner Organisation, and Partners mainly were computation centers.

Professor Speiser's Congress was the one in Edinburgh in 1968, one of the most successful IFIP events. He was awarded the IFIP Silver Core in 1974.

Ladies and Gentlemen - - - the founding Secretary-Treasurer and second president of IFIP, Professor Dr. Ambros Speiser of Switzerland cannot be with us this morning, but his contributions are recognised as if he were here.

ANATOL A. DORODNICYN

IFIP President 1968 to 1971

Congress

LJUBLJANA 1971

Our next president, who has an unlimited fund of humourous anecdotes, took office at the end of the highly successful Edinburgh Congress of 1968 - Academician Anatol A. Dorodnicyn, representing the Academy of Sciences of U.S.S.R.

He had been involved with IFIP since its foundation. He had been the vice-president of the Provisional Executive Committee which drew up the statutes of the federation. His involvement with IFIP has continued uninterrupted since then. He has been the representative of the Union of Soviet Socialist Republics since U.S.S.R. had signed the application for membership. He was a trustee from 1965 to 1967, from 1973 to 1977, from 1980 to 1984, and he was re-elected again in 1984 for a three years term, a total of 13 years.

He was IFIP president-elect from 1967 to 1968, IFIP president from 1968 to 1971, past president from 1971 to 1972, and subsequently served a term as vice-president from 1977 to 1980.

During his time with IFIP, Academician Dorodnicyn has been a member of many committees, and his congress was in 1971 in Yugoslavia. During his term as president, Technical Committee 5 was launched, and he was instrumental in bringing TC 7 into IFIP. A third vice-president was introduced by 1971 and the office of IFIP Secretary-Treasurer was split into two offices.

Academician Dorodnicyn received the IFIP Silver Core in 1974.

It was also during his presidency that IFIP celebrated its 10th Anniversary during the General Assembly in Amsterdam in 1970. It was at those celebrations that Isaac Auerbach was publicly announced elected first Honorary Member of IFIP.

The first Prolamat Conference in Rome in 1969 marked the entry of IFIP into the industrial application area. During Academician Dorodnicyn's term, the first attempts were made to establish an IFIP secretariat in Geneva.

Academician Dorodnicyn remains today as committed to the ideals of IFIP as he was at its inception.

Ladies and Gentlemen - - - the third president of IFIP - Academician Anatol A. Dorodnicyn of the Union of Soviet Socialist Republics.

HEINZ ZEMANEK

IFIP President 1971 to 1974

Congress

STOCKHOLM 1974

Professor Dr. Heinz Zemanek has participated in all IFIP Congresses, the 1959 ICIP included. He attended almost all of the 50 IFIP Council and General Assembly meetings. Since he first participated in the Darmstadt Council of 1961, he has missed only London in 1977 and in 1979 and Helsinki in 1982.

He was appointed TC 2 Chairman in 1962 and he missed no TC 2 meeting during his chairmanship which lasted untill 1969; he missed no Working Conference of TC 2 and very few of the respective Working Group meetings until 1968. The ALGOL work in IFIP was carried out in that period. He was instrumental in creating TC 4 and he fought against many obstacles until TC 9 on *Relationship between Computers and Society* could be established in 1976. In organising the TC 2 Working Conference on *Formal Language Description Languages* in Baden near Vienna in 1964, he created the IFIP model of Working Conferences and their proceedings. In his capacity as chairman of the IFIP Publications Committee (1975 to 1984) he was able to announce the completion of the 100th North-Holland volume of IFIP Working Conference Proceedings. The IFIP conference policy and the IFIP publications policy were originally designed and written by him.

Austria became an IFIP member as of January 1, 1964, and until 1976 Professor Heinz Zemanek served as the Austrian General Assembly member, representing the Austrian Computer Society. He was IFIP trustee from 1967 to 1968, IFIP vice-president from 1968 to 1971, president from 1971 to 1974 and past president from 1974 to 1975. He was elected IFIP Honorary Member in 1976 and he received the IFIP Silver Core in 1977.

At the Vienna Council meeting in 1972 he tried to introduce a non-administrative session and he organised an "IFIP Technical Day", a kind of Pioneers Day as a experiment, with Professor Herman Goldstine, Professor Maurice Wilkes and Professor Konrad Zuse as speakers, Herb Grosch as discussant. This initiative was not followed.

Professor Zemanek created the IFIP Silver Core and handed out the first 40 plaques at the Stockholm Congress in 1974. Except for the ones presented in Toronto, all the Silver Core plaques were made in Vienna.

During his term, TC 6 on Data Communication and TC 7 on System Modelling and Optimisation became operational. He organised the first conference on Human Choice and Computers in Vienna in 1974 where, internationally for the first time, entrepreneurs and trade union representatives, social scientists and computer scientists came together to discuss common problems. He received a high Austrian distinction for the event, and based on this conference, TC 9 became a reality in 1976.

The concept of the conference IFIP INFOPOL - Information Processing in Poland - was accepted in Stockholm in 1974. The IFIP Public Information Committee was tried again during Professor Zemanek's term, and the IFIP Annual Report was introduced.

Professor Victor Broida and Professor Zemanek undertook efforts to co-ordinate similar federations; they created the Five International Associations Co-ordinating Committee (FIACC) of which Heinz Zemanek was vice-chairman from 1970 to 1973 and chairman from 1973 to 1975.

In order to shorten discussions concerning substructures of IFIP - IAG in particular - he proposed the introduction of the Cognisant Person for IFIP bodies. Together with Professor Bobillier, he built up the fully IFIP 'owned' Geneva Secretariat. He was the Editor of the 10-Years-Anniversary volume - he had contributed a philosophical paper for this event - and he is again the editor of the 25-Years-Anniversary volume.

Professor Zemanek was a member of the Programme Committee for Congress 62, a speaker at Congress 65, vice-chairman of the Programme Committee for Congress 71, where he was also an opening speaker (with a one page manuscript in Slovene, delivered, as the local press confirmed, without any accent). He was responsible for Congress 74, one of the initiators of the double Congress Tokyo-Melbourne in 1980, where he organised a panel and presented the closing paper on the Arab mathematician al-Khorezmi (from whom the term 'algorithm' is derived). Professor Zemanek signed the IFIP Summaries 1971 and 1974.

Ladies and Gentlemen - - - one who is as active today as he has been for many years, the fourth president of IFIP - Professor Heinz Zemanek of Austria.

RICHARD TANAKA

IFIP President 1974 to 1977

Congress

TORONTO 1977

Our next distinguished president in a line of distinguished presidents, and perhaps our most outspoken one is Dr. Richard I. Tanaka. Dr. Tanaka first joined IFIP in 1969 as the delegate from the United States, representing the American Federation of Information Processing Societies (AFIPS), a role which he fulfilled until

1979. He was a trustee from 1970 to 1973, IFIP President from 1974 to 1977, and Past President in 1977-1978. In recognition of his contributions, the General Assembly unanimously elected him Honorary Member of IFIP in 1979.

During his time as trustee, he was chairman of the Statutes and Bylaws Committee and, subsequently, chairman of the newly created Activities Planning Committee. On stepping down from the presidency, he was appointed chairman of the IFIP Committee for International Liaison (ICIL). Dr. Tanaka received the IFIP Silver Core in 1977. While he was chairman of the Statutes and Bylaws Committee, they were completely revised and rewritten. Fundamental changes affecting the conduct of the organisation were incorporated and new concepts were introduced.

Subsequently, APC prepared the first complete Six-Year Plan for IFIP and defined procedures to keep the plan updated. To help change the technical objectives of IFIP, APC, under Dr. Tanaka's guidance, sponsored several meetings to select the technical areas where IFIP should be active. From these discussions, APC established the concept of task groups and prepared a six-year time table for evaluating specific technical areas, resulting in several new Technical Committees.

Also at this time, APC defined the concept of Review Committees to evaluate IFIP's activities, and initiated a review schedule under which all of the Technical Committees were reviewed by the end of five years. The first few of the now-periodic joint meetings of TC chairmen and the Executive Body were also organised by APC.

During Dr. Tanaka's presidency, discussions with the Southeast Asian Computer Confederation (SEARCC) led to IFIP becoming a sponsor of the Southeast Asia Computer Conferences. SEARCC representatives began to attend IFIP General Assembly meetings. Recently, SEARCC became the first regional member of IFIP.

Other major events were the Second World Conference on Computer Education, in Marseilles in 1975, and INFOPOL in Warsaw in 1976.

It was also at this time that the General Assembly made the precedent-breaking decisions that resulted in:

- IFIP Congress 80, a single event held in successive weeks, in Tokyo and in Melbourne, and
- EURO-IFIP 79, the first IFIP Regional Conference.

As part of the ICIL programme, IFIP significantly expanded its activities with developing countries. Continuing contacts with Unesco eventually resulted in some funding for sponsoring meetings, training sessions and conferences. Because of the importance of the activity, a separate committee, IFIP Committee for International Development (ICID) was established, first as an ICIL subcommittee, and eventually as a separate committee.

Dr. Tanaka's term culminated with the staging of IFIP Congress 77 in Toronto, held concurrently with IFIP MEDINFO 77.

Ladies and Gentlemen - - - another past president, still actively involved in IFIP affairs - Dr. Richard I. Tanaka of the United States of America.

PIERRE BOBILLIER

IFIP President 1977 to 1983

Congresses

TOKYO 1980
MELBOURNE 1980
PARIS 1983

Our next president, Professor Pierre A. Bobillier, enjoys, together with Mr. Auerbach, the distinction of serving two terms as president of IFIP: from 1977 to 1980 and 1980 to 1983. Prior to this he was already heavily involved with IFIP as Secretary 1969 to 1975 and as trustee 1975-1976.

During his presidency, Professor Bobillier set himself several objectives:
- increase IFIP membership,
- devote more efforts to developing countries,
- improve the overall efficiency of IFIP and
- tackle new fields of activities when needed.

During his six years as president, the IFIP family was increased by the admission of 10 full members - including the first Regional Member - and 5 Affiliate Members. At the end of 1983, IFIP had 44 Full Members representing 49 countries, and 6 Affiliate Members. This increase is of particular interest since IFIP membership is spreading in all parts of the world including developing countries.

Internally, TC 11 on Security and Protection in Information Processing Systems was established. IFIP had, at the end of 1983, 9 Technical Committees with 32 Working Groups and a Special Interest Group: IMIA. For the first time in IFIP history a Technical Committee had been transformed in 1979 into a Special Interest Group thus receiving more independence and freedom in its structure and development: TC 4 became IMIA - The International Medical Informatics Association.

After the 1978 SPIN Conference, sponsored by UNESCO and IBI, the IFIP Committee on Informatics for Development (ICID) was established. Many activities were then organized, sponsored or suggested in or for developing countries.

In order to improve the overall efficiency of IFIP
- Technical Committees were given more importance and better visibility: budjets were increased for TC activities, reporting and financing were simplified, communications between TC's and IFIP were improved by regular combined meetings; TC's became also more involved in Congresses and World Conferences.
- Council and General Assembly Meetings were restructured or reorganised to increase their efficiency and reduce the time of attendance for observers, in particular TC Chairmen
- Charters were established for all IFIP Committees
- the Activity Planning Committee was reorganised: its charter and compe-

tence were enlarged and it plays now a very important role in the management and administrative functions of IFIP by relieving the Council and the General Assembly of many routine tasks, thus allowing them to devote more time to more important issues.

Publications continued to increase and now reach about 20 volumes per year. Two journals were started by Technical Committees: Computers in Industry by TC 5 in 1979 and Computers and Security by TC 11 in 1983. The Compacts Journal was started in 1982 and a series of State-of-the Art Reports will be created by IFIP's TC's according to a decision taken by the General Assembly in Paris in 1983.

In order to better inform the outside world on IFIP, The Public Information Committee continued the production of the IFIP Information Bulletin and produced several new documents, including

- "What is IFIP", describing in short terms IFIP and its activities,
- Articles on IFIP Technical Committees (6 were published in 1982 and 1983),
- A slide presentation of IFIP was created, and, last but not least,
- the IFIP Newsletter, edited by Jack Rosenfeld and started after the Paris General Assembly in 1983, is being published quarterly.

Many major conferences were held during these 6 years:

- Euro-IFIP, London 1979, as mentioned,
- the IFIP Congress 80, Tokyo-Melbourne, October 1980, which despite its risky and unique character was a great success
- the IFIP Congress 83, Paris, September 1983, the first IFIP Congress in France after the UNESCO Congress in 1959
- MEDINFO 80, in Tokyo, September 1980
- MEDINFO 83, in Amsterdam, August 1983
- the Third World Conference on Computers in Education (WCCE) 81, Lausanne, July 1981
- the First International IFIP Conference on Governmental and Municipal Data Processing, Vienna, February 1983
- CAPE'83, the First IFIP Conference on Computer Applications in Industry, which will be continued by TC 5 as a triennial series
- IFIP/Sec'83, the First International Conference on Computer Security.

Pierre Bobillier received the IFIP Silvercore in 1977.

Ladies and Gentlemen - - - a dedicated worker who was courageous enough - or perhaps foolish enough, to serve two terms as a President,
PROFESSOR PIERRE BOBILLIER of Switzerland.

IFIP

IFIP at the present time comprises
45 Full Members representing 58 countries
6 Affiliate Members
9 Technical Committees
38 Working Groups
1 Special Interest Group
It represents over 500 ooo computer professionals throughout the world from East to West, from North to South. Its success in the short time of 25 years has been due to the dedicated service of thousands of volunteers, organising conferences, congresses, seminars, publishing books, proceedings and so on.

This morning we honour all those who have contributed their time and effort to IFIP by honouring those men who led IFIP during this time.

A particular group of contributors to IFIP are the secretaries and assistants to the presidents as well as the employees of the IFIP secretariat.

They deserve not only mentioning, but also a big

```
HHHHH  H   H    H    H   H  H   H     Z   Z  ZZZ   Z   Z   Z
  H    H   H   H H   HH  H  H  H       Z Z  Z   Z  Z   Z   Z
  H    HHHHH  HHHHH  H H H  HHH         Z   Z   Z  Z   Z   Z
  H    H   H  H   H  H  HH  H  H        Z   Z   Z  Z   Z
  H    H   H  H   H  H   H  H   H       Z    ZZZ    ZZZ    Z
```

Ruth ALMEN	H. Zemanek
Hedy ANGELONI	IFIP Secr 1974
A. BELOZEROV	A.A. Dorodnicyn
Erika BOSSHART	P.A. Bobillier
G. Chroust	H. Zemanek
W. DONAT	H. Zemanek
P. DOUMKOV	L. Iliev
G. KÖGL	H. Zemanek
U.I. KOTCHETKOV	A.A. Dorodnicyn
Ria LUCAS (SC 80)	IAG HQ
J.G. MACKARNESS	IFIP Secr., BCS
Susan PRATO	IFIP Secr 1972
Chantal ROYEZ	IFIP Secr 1973
Vivian SCHIMMEL	H. Zemanek
Jean A. SPENCER	IFIP Secr
N. TEUFELHART	H. Zemanek
R.H. WARDEN	IFIP Secr
Rose M. WARREN	R.I. Tanaka
V.V. ZHURIN	A.A. Dorodnicyn

A TRIBUTE TO ALL THE VOLUNTEERS AND WORKERS OF IFIP

by the seven Presidents of IFIP

The job of a President is to lead. This means more than presiding over meetings. It includes the responsibility of setting objectives, initiating actions and controlling the activities of the Federation.

However, the real work, namely the implementation and execution of activities, is done by others. The tribute by the organizers of the Anniversary celebration, the words and much of the glory, should in fact go to those who have carried out what we may have invented, proposed or approved. These individuals include not only those who are listed in the IFIP Summary and Bulletins, but many more - invisible or visible - who have worked on IFIP events and other projects.

An IFIP Congress, the event in which the work of each President culminates, is perhaps the best example. An IFIP Congress is a giant enterprise, in terms of work, of people, of money - in fact by any measure. The success of the event depends on the contributions of many but sometimes it seems as though only a few, the visible leaders, receive public attention and credit.

We, collectively and individually, thank all those who have made possible that which may be connected to our names.

Particular thanks should go to the IFIP Secretariat and its staff, and to the elected IFIP Secretary and Treasurer, without whom the life of our Federation would be impossible. And here, Ms. Gwyneth Roberts, who recently was promoted to IFIP Administrative Manager, deserves special mention. For ten years, as the Administrative Secretary at the Secretariat, she has handled IFIP matters with devotion, enthusiasm and dedication.

The technical work of IFIP is concentrated in the Technical Committees and their Working Groups. General Assembly Members represent national societies, but the members of the Working Groups have devoted their time and their effort on a personal basis, often without full support from their employers. One might have the impression that, in these times, such volunteer efforts have vanished; in truth, an incredible amount of work is done on a volunteered, altruistic basis. The achievements of our Working Group Members attest to this fact. Our thanks to them, sincerely.

The next 25 years will bring much in the way of challenges and - we trust - much success also for IFIP. We wish the very best to our successors and to all the volunteers and workers of IFIP!

I.L. AUERBACH A.P. SPEISER A.A. DORODNICYN

H. ZEMANEK R.I. TANAKA P.A. BOBILLIER

K. ANDO

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS

IFIP ADMINISTRATIVE MANAGER 1975 - 1985

AND MANY YEARS TO COME !!! SC 80

GWYNETH CERIDWEN R O B E R T S

and her collaborator

Madhu JAIN

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING

THE GOLDEN IFIP MEETING

The Fiftieth Council/General Assembly Meeting

TOKYO, SEPT 3 to 7,1985

Heinz Zemanek

Although held after the Silver Anniversary Celebration, the Council and General Assembly Meeting in Tokyo was still part of the first 25 years of IFIP History, and it happens to be the 50th in the sequence. So it seems appropriate to give a compact report of this event.

It was hosted by the

INFORMATION PROCESSING SOCIETY OF JAPAN

which celebrated its own 25th Anniversary during the week following the General Assembly. Those attending the General Assembly were invited to the international part of the celebration programme on September 9, where IFIP President Dr. K. ANDO - after the opening speech by the President of the Information Processing Society of Japan - gave an extensive report on the relations between this Society and IFIP and two invited speakers of IFIP, Professor Dines Björner, Chairman of the Programme Committee for Congress 86, and Professor Karen Duncan, IFIP Pubications Officer, contributed to the celebration.

At the opening of the IFIP General Assembly Meeting, the participants were welcomed by the President of the Information Processing Society of Japan,

Mr. Masanori OZEKI.

We all are greatful to IPSJ for the excellent arrangements and the events prepared for us.

At the General Assembly Meeting, 29 IFIP member countries and the Regional Group SEARCC were represented by their delegates, five more member countries by proxy. Two IFIP Honorary Members were present.

The work of the General Assembly Meeting is reflected by the Minutes of the meeting: officer's reports, committee reports, affiliate member reports, Congress 86 and WCCE reports, and so on. Newly elected were

IFIP President 1986 - 1989	A.W. GOLDSWORTHY (AUS)
IFIP Vice-President 1985 - 1986	A.A. VERRIJN-STUART (NL)
IFIP Trustee 1985 - 1988	G.J. MORRIS (GB)

and re-elected were

IFIP Vice-President 1985 - 1988	G. GLASER (US)
IFIP Trustee 1985 - 1988	P.X. GUO (PRC)
IFIP Trustee 1985 - 1988	A. MELBYE (DK)

Trustee Mr. James Finch (CDN) reported for the Congress Site Selection Committee that four National Members have expressed interest in holding Congress 92 in their countries: Bulgaria, The Netherlands, the South East Asia Regional Computer Federation (SEARCC), and Spain. The decision will be made by the 1987 General Assembly.

Two reports were presented and voted for concerning the future direction of IFIP - one by the IFIP Task Force on Restructuring and one by the IFIP Long Range Planning Committee. The first report, presented by Vice-President Mr. Graham Morris, essentially resolves to

- establish Specialist Groups to handle new activities, with an individual or committee given resposibility for supporting and managing the Specialist Groups
- establish the Activity Development Board to replace the Activity Planning Committee (APC), but with a different membership, and
- create a fourth Vice-Presidency.

Specialist Groups - It is recommended that the term Specialist Group (SG) be applied to new groups concerned with applications and any other area of interest not effectively incorporated within any Technical Committee. In order to manage the creation and the development of SGs, a Specialist Group Committee (SGC) should be formed which would be roughly equivalent to a TC; it should consist of about 6 GA members with a wide spread of experience and with initiative and dedication. The chairmen of SGs could also become members of the SGC. It is expected that a confirmed SG will have much greater autonomy than a WG. While IFIP will be responsible for its budget and may provide loans or grants, the SG will have freedom to recruit members as it sees fit and the charge membership fees and/or subscriptions to a newsletter.

Activity Development Board - It is recommended to replace the Activity Planning Committee by an Activity Development Board consisting of all TC chairmen, the SGC chairman and the SIG chairmen. Publications and Public Information Committes, Conference Officer and Affiliate Members will also be offered seats. The Board should be chaired by an IFIP Vice-President. Finally, the Boards will be completed by up to 6 GA representatives.

Fourth Vice-President - The workload produced by the allocation of responsibilities to vice-presidents could be excessive, expecially for the vice-president who must be chairman of the ADB. It is recommended, therefore, that a forth vice-president be elected to share these responsibilities.

The report by the Long Range Planning Committee, presented by Honorary Member Dr. Richard Tanaka (USA), says that the technology of information processing is changing rapidly. Generally, the Technical Committees have reacted appropriately to changes within their specialty areas, partly because of the flexibility possible in appointing members of Working Groups. However, the TCs cannot be effective on topics which are outside their scope. It is the responsibility of the GA to establish new TCs or to charter relevant conference themes and, correspondingly, to de-emphasize activities which are no longer relevant. Expanding technical activities by adding more TCs has surface appeal. But proliferating the number of TCs can also create a burden on national members, since a member must supply the resources for it to be represented on a TC. Not having full representation in every TC is not necessarily bad. If there is adequate and well distributed membership in a TC, that TC can still be healthy. However, it would be undesirable if very many of the TCs had limited or unbalanced participation.

Instead of the usual sight-seeing excursion - which has an important purpose, namely to give an opportunity to discuss matters with controversial aspects informally and in small, flexibly changing groups, so that almost all fighting votes can be avoided in IFIP - this time the participants got an opportunity to visit the TSUKUBA Science Exposition, the big technical event of the year. A bus brought us in a one hour ride to the Exposition area and there we were guided to seven paivilions - without the obligatory queuing lines, but with very personal treatment. It was an impressive insight into the progress of our profession and technology in Japan and a demonstration of the confident and optimistic view the Japanese nation cultivates versus information processing.

Fujitsu invited the participants to a reception in the Tokyo Prince Hotel, IPSJ to a Banquet at the famous Chinzanso Palace (it was too late, this time, to visit the admirable gardens there).

The performance was given by the *Gennosuke Matsumoto Group*, named after its leader who has devoted his life to perform (and to attract young people to this art) *Edo Sato Kagura*. The last word means *entertainment for gods* or *sacred music*; *Sato* means the kind of music played on festive occasions of the common people, and *Edo* designates the region, it is the old name for the Tokyo region. The picture shows one (of the two performing) lion, the clownish male *Hyottoko*, the female *Okame* (I got no explanation for the two heads she wears - she reminded me less of the Roman god Janus, but more of

Gennosuke Matsumoto Group

our regional members whose representatives wear the heads of a number of national societies) and the three musicians.

The drum performance we got at the banquet requires hearing - words are too weak to describe its impact. Both presentations of Japanese culture left deep impressions on the participants. And this is very typical for all of the 50 IFIP meetings; apart from the business recorded in the minutes, the country and the meeting place offer so many access roads, yield understanding and create sympathy. The many contacts and friendships, initiated during the meetings and the events, often last life long. within the IFIP crew and beyond International professional cooperation is one of the most powerful instruments of world peace - not by big words but by reality. May the bodies supporting the trips of the IFIP crew enter this truth into their daybooks!

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS

IFIP GOLDEN MEETING - GENERAL ASSEMBLY Tokyo 1985

Welcome by the President of the Information Processing Society of Japan, M. Ozeki.

from left to right:
G. Glaser, A. Goldsworthy, Bl. Sendov, M. Ozeki, I. Goto.

THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING THE FIRST 25 YEARS

HISTORICAL PAPERS AND FUTURE OF IFIP

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

Personal Recollections on
The Origin of IFIP

Isaac L. Auerbach

President, Auerbach Consultants
Chairman, Auerbach Publishers, Inc.
Philadelphia, U.S.A.

As with everything else in life, for IFIP there was a beginning. Generally beginnings are marked by a flash, a spark, a big bang, or some incident that heralds an original idea. Once it happens, we can always remember the time, place, and surroundings when that first flash occurred. So it is for me with the conception of IFIP, the international federation concerned with information processing.

I vividly remember when the original idea for the formation of IFIP came to me. I was attending the Eastern Joint Computer Conference in Boston, Massachusetts, in November of 1955. I was sitting in the lounge of the Copley Plaza Hotel with several colleagues, relaxing and discussing the technical sessions presented earlier in the day, when the flash of an idea for having an international meeting first occurred to me. This was nearly ten years after the development of the first electronic digital computer, the ENIAC, which took place at the University of Pennsylvania in Philadelphia, my home town. For those of you old enough to remember or who have read the history of the electronic computer, the ENIAC was a monstrous machine of 18,000 vacuum tubes that occupied the space of a very large room. Its power supply was large enough to supply the lighting for a small town. The equivalent computer today can be held in the palm of one's hand and be thousands of times more powerful. This revolution of processing information has taken place in about forty years, well within an average lifetime. It is one of the most dramatic explosions of a technology ever known to man.

Technical computer conferences started in the United States in the late forties, and at that time, a meeting of all of the professionals then engaged in the development of computers would not have filled one of the smaller public rooms of a hotel. And in fact, in 1955 we still only filled the ballroom of a modest-size hotel. To satisfy the political and logistic needs of two provincial groups, one on each coast, each with its own easily distinguishable engineering design techniques, we organized two national conferences in the United States each year, one on the East Coast and one on the West Coast. It took years before the migration of engineers from coast to coast caused these two schools of computer design to blur.

National Joint Computer Committee (USA)

It occurred to me that evening at the Copley Plaza that we were talking about the state of the art of computers as if all of the developments were taking place in the United States, while little or nothing was happening elsewhere in the world. I suggested that it would be interesting and potentially very valuable to have an international meeting on information processing at which computer scientists and engineers from many nations of the world might exchange information about the state of the computer art. I expressed the hope that we could benefit from knowledge of what was happening in other parts of the world, and that our European and Japanese colleagues could definitely gain from knowing about developments in the United States. The idea was stongly endorsed, and my colleagues suggested that I present it to the National Joint Computer Committee (NJCC) for their consideration. The NJCC was composed of four representatives from each of the three professional societies: Professional Group on Electronic Computers of the Institute of Radio Engineers (IRE), Committee on Computing Devices of the American Institute of Electrical Engineers (AIEE), and the Association for Computing Machinery (ACM).

The next day, I presented my idea to the NJCC, emphasizing that computer scientists worldwide could greatly benefit from the opportunity to learn about computer developments elsewhere and to enlarge their circle of acquaintances. Such a meeting would certainly stimulate both the demand for and the development of computers internationally and would enhance the potential worldwide marketing opportunities for vendors in the United States.

The computer industry was not much of an industry at that time. In the U.S., there were several dozen university laboratories and possibly an equal number of companies designing and manufacturing computers and peripheral equipment and developing computer programs. The era of the transistor was just aborning, and there were no independent software companies of any significant size.

The chairman of the NJCC appointed me to chair an ad hoc committee to develop the idea and bring it back for subsequent discussion. The committee included Dr. Samuel Alexander of the National Bureau of Standards, representing AIEE, and Dr. Alston Householder of the Oakridge National Laboratory, representing ACM. At that time, I was employed by the Burroughs Research Laboratory and represented IRE.

Each of us spent a few months investigating possible international organizations that might convene an international computer conference on information processing. We wanted an apolitical international organization concerned with education and technology that would be instantly recognized for its world stature. We also wanted to involve people who were concerned not only with the development of technology, but who would also be able to develop new computer applications that would benefit mankind. I was very evangelical and wanted to convince more people to share my belief that the computer had the potential to have a greater impact on mankind than any other technology yet developed. Finally, we concluded that Unesco was our best choice to host such a meeting. I presented this recommendation to the NJCC at the Western Joint Computer Conference in San Francisco in February of 1956, and we were then authorized to develop a formal proposal for submission to Unesco.

Over the following summer, with the help of a temporary research assistant from Bryn Mawr College, I drafted the proposal and tried to capture the excitement, the spirit and the potential that the future of computers held. It was a grand view of the future, and I believed that everything that I wrote about was achievable and realistic. Most people not familiar with our work and even some of those actually engaged in it considered these views to be dreams, but the proposal was approved by the NJCC in December of 1956, and we were authorized to submit it to Unesco. I am sure that few people thought that we would succeed. A copy of the original proposal dated January 1, 1957, may be found in Appendix A. I have extracted portions of it to illustrate its flavor and tone.

The purpose of the conference was "to promote a freer exchange of technical information among leading scientists and engineers of many nations, to review the tremendous strides that have been taken, and especially to stimulate an even greater progress in the field in the years to come." We stressed the future uses of information processing systems: "...in the area of management and management decisions, the volume of data to be presented to management for digestion and decision can now be more efficiently assimilated by information handling systems, thus giving management more time to manage. ...Computers are taking over the routine problems of payroll, inventory, records, subscription fulfillments, and premium billing in some of their most advanced applications. Medicine uses computers in its most progressive research. They are a new and accurate tool in highway design. And for banks, insurance organizations and the like, data processors are the supreme bookkeeper, freeing more and more people from the dreary business of counting numbers. ...Information processors ...can schedule, adjust and keep track of flight patterns to ensure a safe air-traffic control system. ...(and be) used in atomic research and in statistical problems of genetics and population studies."

We also stressed the possible economic impact of information processors: "According to the best estimates there are about 3,000 electronic calculators of all sizes in operation now, and at least four of the first 100 companies in the Unted States are manufacturers of information processors. ...The data processing industry sales are expected to reach $500 million per year by 1960. [*In fact, computer sales in the U.S. reached $1.5 billion in 1960.*] ...No matter how advanced the progress in the United States, real progress for the world cannot be achieved until scientists for all the world work together and exchange their independently gained information."

Thus, we proposed some of the following as subjects of international interest: "machine translation of language, data reduction of International Geophysical Year observations, and library classification and retrieval of knowledge. ... programming and mathematics; systems, including logical design and computer organization; and equipment, including components and circuits. ... scientific calculations, data processing, and real time operations." We stated our belief that such an exchange of information would be a "major contribution to a more stable world", and that the "application of information processing systems is equally as vital to man's survival as the peaceful uses of atomic energy."

Each and every one of those dreams is a reality today, and, in fact, more has been realized than any of us could have imagined. No one at that time even dreamed of the micro or personal computer being produced in millions a year that can now be found in homes and offices throughout the world.

In addition to submitting the proposal to Unesco, we simultaneously sent it to national professional societies and individuals throughout the world, asking them to encourage their government representatives to support the plan. Dr. Alston Householder and I visited Prof. Howard H. Aiken at Harvard University, soliciting his support. Prof. Aiken was responsible for developing the Harvard Mark series of computers and had a worldwide reputation. He had been one of my professors and was a friend of Alston's, and we thought we needed and could get his support. Much to our disappointment, Prof. Aiken did not think that our proposal was feasible, or that Unesco would adopt it. He considered it a "pipedream" and refused to lend his support to our efforts. However, once Unesco agreed to sponsor the conference, he was happy to change his attitude and accepted Unesco's invitation to be our Honorary President and to deliver the keynote address. In it, he graciously acknowledged my role in conceiving the idea and bringing the international conference to fruition.

After months of extensive correspondence and meetings in Washington, D.C., we were able to convince the U.S. government's representative to Unesco to formally propose the idea at a forthcoming Unesco planning conference in India during the summer of 1957. Unesco agreed to include a line item in their two-year program to explore the feasibility of convening an international conference on information processing. This was a major breakthrough.

Unesco

In the fall of 1957, Prof. Pierre Auger, the Director of the Natural Sciences Division of Unesco, extended an invitation to a few countries to send a representative to Unesco House in Paris to advise them on the feasibility and practicality of a conference on information processing. I was formally appointed by our State Department to be the official United States delegate. In due time, I received a formal invitation from Prof. Auger, inviting me to Paris in December of 1957.

The invitation could not have come at a more difficult time for me personally. In June of 1957, I had resigned my position as Director of the Defense and Special Projects Division of Burroughs Research Laboratories to start a new company then known as Auerbach Electronics Corporation. By December, we had seven employees, and I was working seven days a week and most nights. But the opportunity was too great to miss, since it was to be my first trip to Europe, aside from my wartime convoy duty as an officer in the U.S. Navy.

The first Committee of Experts, as we were called, met just before Christmas, and to the best of my recollection, consisted of:

I. L. Auerbach	United States
J. Carteron	France
J. Coales	United Kingdom
S. Comet	Sweden
R. de Possel	France
A. Ghizzetti	Italy
D. Panov	U.S.S.R.
A. van Wijngaarden	Netherlands
H. Yamashita	Japan

Since Mr. J. Coales was primarily in the field of automatic control, he and I suggested to Prof. Auger that Dr. M. Wilkes would be a more appropriate representative from the United Kingdom, and he was invited to join the Committee of Experts thereafter.

The Committee was able to convince Prof. Auger and his associate, Mr. Jean A. Mussard, also of Unesco's Department of Natural Science, that the subject of information processing was important enough for Unesco to convene an international conference as soon as possible. What we did not know at that time was that Prof. Auger had been trying since 1946 to create the International Computer Center in Rome, and that Mr. Mussard was the Executive Secretary of the provisional organization. Our proposal was, therefore, enthusiastically welcomed as a way of creating a greater interest for the Provisional International Computer Center and helping to bring it into existence. Prof. Auger had no difficulty in securing approval from Unesco to fund, organize and convene the First International Conference on Information Processing to be held at the Unesco House in Paris on June 15-20, 1959.

Unesco's International Conference on Information Processing (ICIP)

Under the auspices of the Unesco Secretariat, an expanded Committee of Experts met in Paris on June 23-24, 1958; October 21-22, 1958; and February 3-4, 1959, to organize the International Conference on Information Processing (ICIP). The participants were:

S.N. Alexander (USA)	P. Namiam (France)
I.L. Auerbach (USA)	D. Panov (USSR)
J. Carteron (France)	W.L. van der Poel (Netherlands)
J. Coales (UK)	R. de Possel (France)
S. Comet (Sweden)	R. Rind (France)
Ph. Dreyfus (France)	C.S. Scholten (Netherlands)
E. Durand (France)	K. Steinbuch (German Fed. Rep.)
A. Ghizzetti (Italy)	A. Walther (German Fed. Rep.)
M. Goto (Japan)	A. van Wijngaarden (Netherlands)
A.S. Householder (USA)	M.V. Wilkes (UK)
C. Manneback (Belgium)	H. Yamashita (Japan)

The entire committee was responsible for the scope of the conference, the establishment of the program, and the selection of papers. It may be of interest from an historical perspective to note that the major subjects for the technical program were:

- Methods of digital computing
- Common symbolic language for computers
- Automatic translation of languages
- Pattern recognition and machine learning
- Logical design of computers
- Computer techniques of the future

In addition, symposia were scheduled on the following topics:

- Linear programming
- Methods for solving linear systems
- Automatic programming
- Machine translation
- Switching algebra
- Logical organization of very small computers
- Logical organization of very high speed computers
- Influence of very large memory designs and capabilities on information retrieval
- Relation of analog computation to digital computation
- Error detection and correction
- Collection, storage and retrieval of information

Since the United States was the world leader in the development of computers, I organized and chaired a U.S. Committee for the ICIP to further assist Unesco and to insure the success of the conference. The members of my committee were: Program Committee Chairman Dr. A. Householder, Vice-Chairman Dr. A. A. Cohen; Arrangements Committee Chairman Dr. S. Alexander; Exhibition Chairman Dr. E. M. Grabbe, Vice-Chairman L.D. Whitelock; and Public Relations Chairman E. Herbert. These committees proved to be important to the success of the ICIP, so much so, in fact, that they have continued for every successive IFIP Congress. For the ICIP, the U.S. contributed the vast majority of the papers and participation on panels; the exhibits by U.S. companies were solicited by the U.S. committee, even though for budgetary and logistic reasons, they came from European subsidiaries of the companies; group travel plans and hotel reservations were organized by the Arrangements Committee; and extensive press coverage was arranged by the Public Relations Committee.

The content of the international program generally reflected the influence of the academics who sat on the Committee of Experts. However, the topic of Automatic Translation of Languages and the symposium on Machine Translation were initiated by Unesco. The necessity of translating Unesco documents into many languages had been and continues to be a major expense, and they were very excited by the prospect of a computer's being able to perform this function. One of my countrymen was the proponent of this idea, and during one of our meetings I learned that Unesco was negotiating to purchase a very large multi-million dollar computer to be installed in its basement for the purpose of doing language translation. They had been convinced that automatic translation was a perfected application that was ready for exploitation. I personally intervened in this issue and persuaded Prof. Auger and his superiors that no one had as yet demonstrated a program that would do automatic translation; furthermore, the equipment they were planning to buy did not have adequate memory capacity to handle the necessary dictionaries. Of all of the projects discussed at the conference, automatic translation of languages continues to this day to be the only unsolved application. Computer-assisted translation has been demonstrated, and it has markedly improved the cost of this labor-intense function, but fully automatic translation is not yet possible.

We also recommended that Unesco organize an exhibition of commercial equipment as a part of the conference. We felt that it was important for the participants to see the current state of the art in the design and manufacture of computers, peripheral equipments and components. Computers were not commonplace in 1959, and we believed that the opportunity to learn how they were being made was an essential educational function of the conference. In the U.S., exhibitions had been a part of each NJCC, and were considered essential to their success. We were able to convince Prof. Auger to include an exhibition as a part of the ICIP. However, to comply with certain legal restrictions, we organized the exhibition independently under a separate French corporation called AUTOMATH, headed by a French representative from a computer manufacturer, but with strong support from our U.S. committee.

The exhibition, held in the Grand Palais in Paris, was not only very modest by today's standards, but also took an extraordinary amount of effort due to the necessity of convincing computer manufacturers to participate in this new unscheduled and unbudgeted conference. We overcame considerable difficulties and used all of our connections and influence to have American companies participate through their European subsidiaries. What for us in the U.S. was routine turned out to be a major chore for our French colleagues - creating a false floor in this Baroque building for the cabling in all of the exhibit booths. This may well have been one of the first computer exhibits to be staged on the continent of Europe. Most of the exhibits demonstrated peripheral equipment or new techniques. The only computers per se were analog machines.

A review of the exhibits shows the various stages of development that countries and companies went through in developing reliable and dependable products. The early magnetic drums, until then, did not have adequate provision for adjusting head-to-drum spacing or for ease of maintenance. The Japanese exhibits were exclusively in peripherals and techniques, showing their early interest in that segment of the market. One of these exhibitions was the Oki Chain Printer that was later adopted by IBM. The Japanese also showed a film of the parametron computer they had developed. Some companies showed advanced concepts; for example, NCR exhibited photochemical memory and carbonless copy paper, and IBM demonstrated super conductive computer elements. Table 1 shows a list of exhibitors at AUTOMATH 59.

Table 1:
Exhibitors at AUTOMATH 59

AMPEX International S.A.; USA, Sweden	The National Cash Register Co.; USA
Bell Telephone Manufacturing Co.; Belgium	National Science Foundation; USA
Bendix International; USA	Nippon Electric, Ltd.; Japan
Benson Lehner Corp.; USA	Oki Electric Industry Co., Ltd.; Japan
Bull (Machinery Company); France	Olivetti S.A.M.P.O.; France
Facit Electronic; Sweden	Royal Mc Bee - Mecanalyse; France
Friden, Inc.; USA	Societe d'Electronique et d'Automatisme; France
Hitachi, Ltd.; Japan	Societe Nouvelle d'Electronique; France
IBM France; France	Standard Elektrik Lorenz A.G.; Germany
Intertechnique; France	Standard Telephones and Cable, Ltd.; Great Britain
Le Materiel Telephonique; France	Telemeter Magnetics, Inc.; USA
Logabax Societe Commerciale; France	Tokyo Denki Kagaku Kogyo Co., Ltd.; Japan
Machines Automatiques Modernes; France	Zuse K.G.; Germany
Minnesota Mining and Manufacturing Co.; USA	

Table 2:
Unesco's
International Conference on Information Processing
Paris, June 15-20, 1959
Number of attendees per country

Argentina	3	Czechoslovakia	6	Hungary	3	Netherlands	79	S. Africa	3
Australia	4	Denmark	14	India	3	Norway	5	UAR	1
Austria	10	Finland	6	Indonesia	1	Pakistan	1	UK	164
Belgium	34	France	479	Ireland	1	Poland	18	USA	409
Brazil	2	W.Germany	217	Israel	8	Portugal	3	USSR	38
Bulgaria	3	E.Germany	11	Italy	83	Spain	8	Yugoslavia	6
Canada	5	Ghana	1	Japan	16	Sweden	87	Intl. Org.	20
China	2	Greece	2	Mexico	3	Switzerland	24		

One could sense from the exhibition the tautology that ideas and inventions know no national boundaries. More importantly, the exhibition showed how little we were learning from each other, and that international meetings could help to reduce learning time. What I found fascinating as I walked through the exhibition was how frequently the outside panels of equipments were open, and curious engineers were reviewing and assessing the details of the techniques used by other companies. There was a true exchange of information. As modest as the exhibition was, it was highly successful.

Nearly 1800 participants from thirty-eight countries and thirteen international organizations attended the ICIP. A breakdown of attendance by country can be found in Table 2. It is fascinating to observe the dominance of the United States' participation, considering the distance that everyone had to travel, in comparison to attendance from European countries. Twenty-one of the thirty-eight countries attending had six or fewer participants. What a dramatic change in the distribution of attendees from this 1959 conference to more recent IFIP conferences, where the attendance from most of these countries has greatly increased.

With hindsight, one can observe that the program was controlled by Unesco's obsession with protocol and international politics, and thus was flawed by excessive concern for national distribution of the participants rather than the absolute quality of the papers. Consequently, too many of the papers were out of date and lacked the originality that should have prevailed.

By far the most important success of the conference was the co-mingling of people from all parts of the world, their making new acquaintances, and their willingness to share their knowledge with one another. One could sense the excitement at a breakfast, lunch or dinner, during coffee breaks, or later in the evening at sidewalk cafes, when an idea or explanation was exchanged that solved someone's current problem. In 1959, we were all struggling to design and build reliable computer hardware, and we were searching for better ways to write, document and debug computer software. It was still a period when great struggle and intense hard work went into designing, building and programming a computer. The successes were few and far between. There were so few of us that the discovery of a new colleague who might be able to suggest a new or different way of thinking about a problem was always welcome. People contacts and sharing ideas are still the most important aspects of any conference.

Paris in the springtime, with flowers in full bloom, was invigorating and invited people to establish new relationships. The new Unesco House offered unmatched facilities and was a superb place for a conference. In retrospect, by all measures the ICIP was a smashing success, and Unesco was very pleased with their initiative and accomplishments.

Let me pause for a moment and switch back in time and pick up a parallel stream of events that was going on at the same time.

Organizing Committee for an International Federation

During the very first meeting of the Committee of Experts in December of 1957, Prof. Auger posed the question as to the existence of an international organization in the field of information processing that could convene international conferences in future years. He advised us that Unesco's policy was to initiate such activites, but not to continue them. It was the sense of the Unesco advisors, all of whom were attending in an individual capacity, that an organization to convene international conferences would be highly advantageous. We agreed that we would each confer with our own countries and national professional societies so that we could discuss the organization of a federation when we met again.

At our next meeting in June of 1958 and at subsequent meetings, after completing Unesco business, a group of us would meet regularly in late afternoons and evenings to explore the creation of an organization for convening future information processing conferences. The members of the Organizing Committee were:

I.L. Auerbach, Chairman	USA
J. Carteron	France
S. Comet	Sweden
A. Ghizzetti	Italy
C. Manneback	Belgium
D. Panov	USSR
C.S.Scholten (for A. van Wijngaarden)	Netherlands
M.V. Wilkes	UK
H. Yamashita	Japan

Van Wijngaarden was in a severe automobile accident and was unable to attend a number of these meetings.

One of the first issues to be discussed was whether the organization should consist of governmental or non-governmental bodies. By this time I had become well aware of the ponderous procedures of governmental bureaucracy and also of the negative sentiments in the U.S. towards the organization of another multi-national United Nations type of organization. Without much debate, we agreed to form a non-governmental federation of national professional technical societies, acknowledging that financing such an activity would pose severe hardship as compared to getting grants from governments. In spite of this difficulty, the decision turned out to be superbly correct.

During these sessions, some of the academics on the Organizing Committee questioned the value of an international federation, stating that its sole purpose should be to convene a few international conferences, there being no other activity worthy of international effort. They felt that we should agree in advance that if we were to organize a federation, it should have a maximum life of ten years. They doubted the need for a federation in the field of information processing, since the subject matter was not on-going, like astonomy or geology or a similar science where international cooperation is essential. They were involved in academic pursuits in their own fields and wanted a computer to enable them to solve their particular problems. They perceived the computer as a means to an end, not a field of study unto itself.

My perception of the computer was quite different. For me, it was a universal tool enabling the solution of thousands of problems and could be a way of extending the capacity and ability of our brains just as the Industrial Revolution extended our brawn. I was convinced that the computer would be the most important technical development of the twentieth century, whose impact on society would be boundless. I expressed these sentiments to the Organizing Committee rather strongly; however, the issue continued to be discussed for about a year. Fortunately, the majority of the members of the Organizing Committee supported my position that the federation should be permanent, and we were able to continue with our plans.

In December of 1958, a member of my U.S. committee wrote to me to say that Dr. Wilkes had expressed misgivings about the formation of the federation. This stemmed from an ACM Council meeting he had attended where the idea of a federation had not met with the enthusiasm he had hoped. I had been aware of Dr. Wilkes's feelings about the international conference and IFIP, and found an opportunity to talk with him again in February of 1959. In March of 1959, I received a warm letter from Dr. Wilkes in which he said, "I am now convinced that the countries represented at the meeting really do want an International Federation to be set up, and I will do my best to see that things go smoothly so far as my country [Great Britain] is concerned." From that day on he became a very strong supporter and a very active contributor to the formation of the federation.

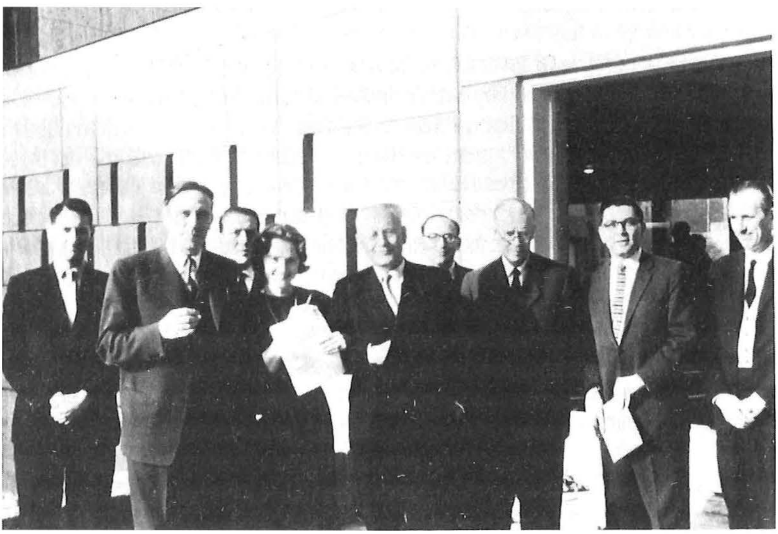
Dr. Harold Chestnut of the United States, the first President of the International Federation of Automatic Control (IFAC), was an excellent source of information and guidance in our proceedings. He had been through the trauma of forming an international federation and could give first-hand advice. In the course of my conversations and correspondence with him, he told me that IFAC was planning their first international conference in Moscow in September, 1960. He further noted that the IFAC constitution contained a sincere effort to include computers as they effected control processes as part of IFAC's area of interest. He made me aware of the feeling in a number of countries that there were too many international federations being formulated, and that the British were particularly reluctant to participate in new international federations. I had extensive correspondence with Dr. Chestnut and other national representatives to IFAC, who all proposed that our computer activity be subsumed by IFAC. He encouraged me to explore with the Organizing Committee the option of becoming a part of IFAC and subsuming our computer activities within IFAC. Unknown to me was a struggle that was going on in the United Kingdom to get computing established in its own right, independent of the automatic control group.

During the meetings of the Organizing Committee in October, 1958, I reported on the very positive response I had received by letter from individuals and national societies not represented on the Organizing Committee to the formation of a federation dealing with information processing. The members of the committee also reported a definite interest in their countries for us to proceed with the formation of our own federation. We then discussed the IFAC proposal, and, recognizing that our field of interest was much broader than IFAC's, we were unwilling to have information processing subsumed under control systems. Thus, we decided to thank them for their generous offer and to proceed independently to form our own federation.

We agreed that the federation would be a society of societies, and would not have individual members so as not to compete with national professional societies. Furthermore, the federation would have only one national technical society per country as a member, and certain Eastern European countries could register their National Academy of Sciences as the representative. The rationale for this decision was that one society for each country would keep the voting balanced and controlled. It should be noted that in the Scandanavian countries, Netherlands, Japan and Italy, no professional technical society dealing specifically with information processing had yet been formed.

UNESCO's International Conference on Information Processing, June 15-20, 1959

From left to right: A. van Wijngaarden, M.V. Wilkes, I.L. Auerbach, J. Dursort (Acting Director-General of Unesco), H. Yamashita, P. Auger (Secretary-General of the Conference) and H.H. Aiken (Honorary Chairman of the Conference)



From left to right: W.L. van der Poel, K. Steinbuch, A. Ghizetti, Mme. C. Philippot, A. Walther, M.V. Wilkes, D. Panov, I.L. Auerbach and S. Comet

Even though these countries had National Academies, each country was triggered by the formation of IFIP to organize its own professional computing society to be its representative in the new federation.

At first, the federation was incorporated in Belgium, which supposedly had the most liberal regulations for a not-for-profit professional society. Later we learned that the laws in Switzerland, and in particular the Canton of Geneva, were more advantageous, and the Federation is currently registered there. The name that we had decided upon for the federation was the International Federation of Information Processing Societies (IFIPS). We proceeded with this name, even though my hand-written notes as of December, 1958, say that the name of the federation should be the International Federation for Information Processing (IFIP). Hereafter, to avoid confusion, I will refer to the federation as IFIP, even though the Council did not change the name until October of 1961.

Mr. Jean Mussard of Unesco and his assistant, Mme. C. Philippot, were very supportive and encouraging throughout our deliberations, and without their help and secretarial support, we would have had much greater difficulty in bringing an international federation into existence. Mr. Mussard furnished me with constitutions of other international federations, summarized our discussions, and was responsible for the first draft of the statutes for the federation. He was truly a tower of strength, and I would like to thank him here for his assistance and support.

It was our goal to create a set of statutes that would provide the federation with a solid foundation for operation and, at the same time, provide the officers with maximum flexibility for adjusting to the needs and unknown contingencies which might arise during the early years. We must have been successful, because the statutes stood for twelve years without major refinement. The statutes contained the aims of the federation to be as follows:

- To organize other international conferences on the subject of information processing.
- To establish international committees to undertake special tasks.
- To advance the interests generally of member societies through international cooperation in the field of information processing.

These basic aims enunciated twenty-seven years ago continue to be the main objectives of IFIP.

During this period, we submitted two successive drafts of our statutes to each national technical society or academy represented in the Organizing Committee for their reactions. Finally, we invited all of the national technical societies or academies worldwide to attend the Organizing Committee meetings during the Unesco-sponsored ICIP in June.

On June 18, 1959, the fourth day of the ICIP, the final meeting of the IFIP Organizing Committee was held, and twenty-eight people from eighteen countries attended. Their names, organizations and countries are listed in Table 3. Many of these people were meeting each other for the first time, which caused the meeting to be somewhat more fractious than any heretofore. Prof. A. Panov, who had represented the U.S.S.R. in all of our prior meetings, was not in attendance, and in fact, has yet to attend any IFIP function.

Table 3
Attendees of the Organizing Committee for IFIPS, Unesco House, Paris, June 18, 1959

Name	Representative (R) Observer (O)	Organization	Country
Isaac L. Auerbach	R	National Joint Computer Committee	U.S.A.
Jouri J. Basilevski	O	Academy of Sciences of the U.S.S.R.	U.S.S.R.
Niels Ivar Bech	R	Danish Academy of Sciences	Denmark
Sergio F. Beltran	R	Mexican Society for Information Processing	Mexico
Stig Comet	R	Swedish Society for Information Processing	Sweden
A.A. Dorodnicyn	O	Academy of Sciences of the U.S.S.R.	U.S.S.R.
H.W. Gearing	O	British Conference on Automation and Computation	United Kingdom
Aldo Ghizzetti	R	Instituto Nacionale per le Applicazioni del Calcolo	Italy
Harry H. Goode	O	National Joint Computer Committee	U.S.A.
C.C. Gotlieb	R	Computing and Data Processing Society of Canada	Canada
Korganoff M. Carteron)	R	l'Association Francaise de Calcul	France
J. Křyže	O	Czechoslovakia Academy of Sciences	Czechoslovakia
Pentti Laasonen	R	Finnish Committee for Information Processing	Finland
Fernando de las Penas	O	Polytechnic Institute of Mexico	Mexico
Leon Lukaszewicz	O	Polish Academy of Sciences	Poland
W.L. van der Poel	O	Dutch Society of Mathematics	Netherlands
Zvi Riesel	O	Weizmann Institute	Israel
M. Sadosky	R	National Commission of Atomic Energy	Argentina
José Garciá Santesmases	R	National Spanish Council of Research	Spain
Paul Szulkin	O	Polish Academy of Sciences	Poland
A. Walther	R	German Computer Society	Germany
A. van Wijngaarden	R	Dutch Society of Mathematics	Netherlands
Maurice V. Wilkes	R	British Computer Society	United Kingdom
Hideo Yamashita	R	Japanese Council of Sciences	Japan
Zdzislaw Pawlak	R	Polish Academy of Sciences	Poland

Attendees representing international organizations

Georges R. Boulanger	International Association of Cybernetics
Jean A. Mussard	Unesco
E.H.E. Pietsch	International Federation of Documentation and the European Organization of Economic Cooperation

I chaired the meeting and, after an introduction and discussion of our purpose, circulated for discussion a copy of the proposed statutes for the formation of IFIP. Two issues of substance were raised for the very first time. The first was a request from the Observer from the Polish Academy of Sciences that the voting rights in the federation's Council be modified to permit a veto right for the representatives from the nations which had similar veto rights in the Council of the United Nations. The second issue was that all national societies of recognized scientific or technical merit should be automatically admitted as members of the federation, independent of a decision by the Council members.

It was during this meeting that I learned the tremendous value of a coffee break to enable people with differing viewpoints to discuss them informally rather than debate them in an open forum. During the coffee break, I met Acad. A.A. Dorodnicyn of the Soviet Union for the first time and was able to explain to his satisfaction that we were not proposing a United Nations type body, but a professional society of societies that would conduct its affairs in a more democratic way. Once he fully understood that the proposed federation was to be a non-governmental organization, we were able to resolve both issues. It was finally agreed that the statutes be presented for ratification to each national professional technical society or Academy of Science.

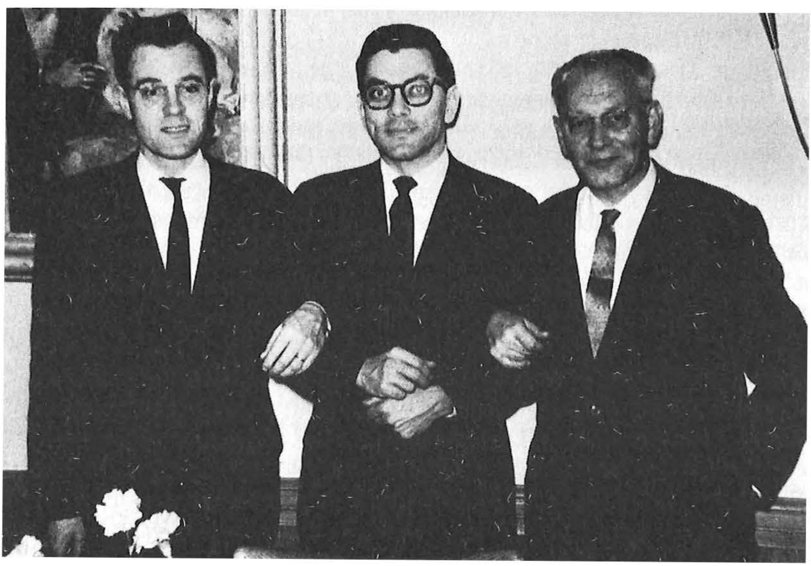
From then on, Acad. Dorodnicyn and I established a mutually cordial and effective working relationship, each respecting the political polarization of our countries, but working together for a common goal. In later years, when I chaired the Nominations Committee for the President of IFIP and discussed with him his willingness to be a candidate for President, he agreed on one proviso. Namely that since his knowledge of finances was so meager, based on his experiences in the Soviet Union, that I must agree to be his advisor on all financial matters during his term of office. I so agreed, and we worked effectively together during his three years in office.

By the conclusion of the meeting of the Organizing Committee, the following decisions had been taken: 1) to create an international federation of information processing societies (IFIPS) if seven or more national technical societies agreed to ratify the statutes before January 1, 1960; 2) to establish a provisional committee consisting of President I. L. Auerbach, Vice Presidents A.A. Dorodnicyn and Dr. A van Wijngaarden, Secretary J.A. Mussard; 3) to authorize the Council to examine the possibility of holding a Second International Conference and Exhibition on Information Processing in 1963; 4) to study the financial arrangements for the Second International Conference and report on it to the Council at its first meeting; 5) to have member societies bear the expenses of their representatives' participation at the first meeting of the Council; 6) to select the place and date of the first meeting of the Council; 7) to publicize the decision to create IFIP and the names of the members of the Provisional Committee.

This was a most auspicious occasion, and all of us who had spent so many hours planning for this meeting were delighted with its results. I was ecstatic and celebrated that evening with Harry Goode, Chairman of the NJCC, his wife and several friends at a fine Parisian restaurant. In three-and-a-half years from the moment of the original concept, I had convinced Unesco to sponsor a most successful international conference, had helped program it, and had simultaneously organized an international federation. I had made many new and worthy acquaintances in countries around the globe, some of whom became close friends. This was indeed a thrilling period in my life.

First IFIP Council Meeting, June 16-17, 1960, Rome

From left to right: A. van Wijngaarden (Holland), B. Langefors (Sweden), M.V. Wilkes (Great Britain), H. Yamashita (Japan), I.L. Auerbach (USA), A.P. Speiser (Switzerland), A. Walther (FRG), J.G. Santesmases (Spain), P. Laasonen (Finland), M. Linsman (Belgium), N.I. Bech (Denmark) and L. Lukaszewicz (Poland).



From left to right: A.P. Speiser (Secretary-Treasurer), I.L. Auerbach (President) and A. Walther (Vice-President).

By January 1, 1960, thirteen national professional technical societies had formally agreed to adhere to the statutes proposed by the Organizing Committee, and IFIP legally came into existence.

Provisional International Computing Center, Rome (PICC)

While I was participating as an advisor to Unesco, Prof. Auger and Mr. Mussard confided to me that, since 1946, they had been trying without success to set up the International Computation Center in Rome. Unesco had agreed to establish such a center as an independent subsidiary provided that ten or more countries agreed to join and ratify its convention. Unfortunately, they were only able to obtain seven or eight signatories, some of these from countries in Africa.

After I had studied the statutes, it was clear to me that the original concept of an international computation center for those countries or government agencies that could not afford a computer had been a reasonable idea in 1946, but that, over a decade later, it was no longer a viable concept. By 1958, computers were not so rare that one had to travel to an international center to find one. There was little or no reason for the developed countries or even many developing countries to join the PICC.

I recommended that they modify the goals and aims of PICC and concentrate predominantly in the field of computer education and training, particularly for the Third World countries. Once the mission of PICC was changed and publicized, Unesco quickly obtained the requisite ten member nations to adhere to the conventions. In 1961, the PICC became ICC, and I continued to serve as an advisor to them for a few more years. In 1969, ICC changed its name to the Intergovernmental Bureau for Informatics (IBI), and it continues as a viable organization serving primarily the Third World countries.

The First Council Meeting of IFIP

The IFIP Council met for the first time in Rome on June 16-17, 1960. We met in the facilities of the PICC in EUR, a suburb just outside of Rome designed and built by Mussolini in the ponderous, heavy architecture of the early 1930's. Ten representatives from the then fifteen societies which had approved the statutes plus many observers assembled. Their names and affiliations are listed in Table 4.

One of the first actions of the Council was to modify the statutes, changing the titles of Chairman and Vice Chairman to President and Vice President, and electing the first President for a three-year rather than two-year term so he would serve through the next IFIP Congress. Later the statutes were modified so that all of the officers were elected for staggered three-year terms. I was elected President, Dr. A. Walther Vice President, Dr. A. Speiser Secretary-Treasurer, and I appointed Mr. J. Mussard as Technical Advisor.

**Table 4:
Attendees of the First Council Meeting,
International Federation on Information Processing Societies
Rome, June 16-17, 1960**

Name	Organization	Country
M. Linsman	Association Belge pour l'Application des Methodes Scientifiques de Gestion	Belgium
N. I. Bech	Akademiet for de Tekniske Videnskaber	Denmark
R. de Possel (for J. Carteron)	Association Francaise de Calcul et de Traitement de l'Information(AFCALTI)	France
A. Walther	Deutsche Arbeitsgemeinschaft fur Rechenanlagen (DARA)	Germany
H. Yamashita	Information Processing Society of Japan (IPSJ)	Japan
J.G. Santesmases	Consejo Superior di Investigaciones Cientificas	SpaiS. Comet
S. Comét	Swedish Society for Information Processing (SSI)	Sweden
A.P. Speiser	Swiss Federation of Automatic Control	Switzerland
M.V. Wilkes	British Computer Society	United Kingdom
I.L. Auerbach	National Joint Computer	United States
Unable to attend		
C.C. Gotlieb	Canadian Computing and Data Processing Society	Canada
J. Křyže	Czechoslovakian Academy of Science	Czechoslovakia
A. van Wijngaarden	Dutch Society of Mathematics	Netherlands
A.A. Dorodnicyn	Academy of Sciences of the U.S.S.R.	U.S.S.R.
P. Laasonen	Finnish National Committee for Information Processing	Finland
Observers		
J.A. Mussard	International Federation of Information Processing Societies	
A. Ghizzetti	Comitato Promotore dell' Associazione Italiana per il Calcolo Automatico	Italy
C.K. Dilwali	Statistics Division, FAO	Rome
F. Bauhofer	Division of Administration and Finance, FAO	Rome
R. Rind	IBM World Trade Corporation	Paris
S. Wurmser	Compagnie des Machines Bull	Paris
S. Arcipiani	Olivetti-Bull	Milan

In the early years, the Council was the only official body of IFIP. However, as the federation grew in size and the Council meetings became unwieldy, we created a General Assembly for all of the representatives to meet once a year and a new, smaller Council consisting of only the officers and six members elected from the General Assembly to meet twice a year. Annually thereafter, two representatives and appropriate officers were elected for a three-year term.

To avoid conflicting dates of international conferences, particularly with IFAC, we agreed to schedule IFIP Congresses every three years, the next to be held in 1962. IFIP was invited to send a delegation to the first IFAC Conference held in Moscow in September of 1960. Because the program was sparse in the area of information processing, and because travel funds were limited, there were no volunteers to attend. I cabled IFAC congratulating them and wishing them every success in their Congress.

Most of the time during the Council meeting was spent discussing the next international congress, our first Congress as IFIP. We solicited invitations from all of the member societies and Academies of Sciences, but received only one written invitation. It was from Prof. A. Walther, Chairman of the Deutsche Arbeitsgemeinschaft fur Rechgenanlagen (DARA) of the Federal Republic of Germany, to convene our Congress in September of 1962 in Germany. Apparently, the information processing societies either did not take us seriously or did not feel confident enough to extend invitations. We accepted Prof. Walther's invitation and agreed that the city would be decided upon at the next Council meeting. After IFIP's First Congress, we rarely received fewer than two invitations and there has been active international competition to host the next Congress.

To continue the international flavor of the Congress, we established a policy that the Chairman of the Program Committee and the Chairman of the Arrangements Committee from the host country would each report directly to the President of IFIP. The Program Committee was appointed by the President to insure its international constituency and its independence from the host country. For our First Congress, we agreed that the Council members would constitute the Program Committee. Thereafter, the Program Committee was selected from international experts with care taken to assure national representation. The Chairman of the Arrangements Committee generally selected the chairmen of the sub-committees, which included Finance, Exhibition, Proceedings, Printing, and Spouse Activities. This structure for organizing IFIP Congresses continues to this day.

For our first Congress, called IFIP Congress 62, I appointed Prof. A. Walther as General Chairman of Arrangements and Niels I. Bech Chairman of the Program Committee. In discussing the technical content of the Congress, the Council members pressed for papers of both higher quality and greater currentness than those presented at the ICIP, with less attention paid to the national distribution of the authors. The Council strongly recommended more symposia and panel discussions to further increase participation and currentness of the program. The Council agreed that its operating language would be English and that Congresses would be conducted in English. Permission was granted to the local Arrangements Committee to provide competent technical interpretation at no cost to IFIP.

To finance the federation, each national technical society was asked to make an annual contribution of $1000, $ 500, or $250 per year. The NJCC from the U.S. and the Academy of Sciences from the U.S.S.R. both agreed to contribute $ 1,000. All of the other professional societies except DARA from the Federal Republic of Germany, who gave $500, selected the $ 250 option. In later years, the Finance Committee insured more equitable distribution of contributions. At the time of our first Council meeting, our treasury held a mere $ 2,758.13 (the odd amount due to the conversion of foreign currencies into U.S. dollars). It was clear from the beginning that we would have to take heroic measures to insure our financial viability. The officers agreed that their companies would underwrite the expenses of their activities and all of the representatives would pay their own expenses to attend the Council meetings. Our first annual budget totalled $2200. The Director General of Unesco generously contributed $5,000 to IFIP to assist us in organizing and defraying the costs of the next

Congress. Indeed, it took tremendous chutzpah to plan an international conference with such a meager treasury. We addressed the problem by arranging to have either the host city or country or local industries agree to underwrite any losses that the IFIP Congress suffered. Based on the successes with our 1962 Congress, I was charged with the responsibility for these negotiations for the next three Congresses. Thereafter, the responsibility fell to other members of the General Assembly.

In retrospect, one of the most amusing items in the minutes of the first Council meeting was a discussion of the fees to be charged for the first Congress. For attendance at the technical sessions, the fee was to be between fifteen and twenty dollars, with students paying only five dollars. The proviso was that "this fee will entitle participants to receive all pre-printed Congress papers, but not the Proceedings". The registration fee for IFIP Congresses continued to be an issue for the first three Congressses. Those familiar with the current registration fees will be aware that the fees are significantly higher and include a copy of the Proceedings.

One of the major legacies I left IFIP was the establishment of sound fiscal policies, creating a positive net worth, that in twenty-five years have never put the federation in financial jeopardy. I attribute this to three factors. First, my working experience was in industry and not academia or government. Second, I was intimately familiar with the finances of the professional societies in the U.S. and in particular with the financing of computer conferences. Each conference had to generate a surplus to provide adequate funds for the other activities of the societies during the intervening years. Third, I showed patience and perserverance during the conduct of these discussions and was willing to devote endless hours enlightening my peers about fiscal management.

Over the next three years, I was able to put into place a set of financial policies that made IFIP one of the few international federations that, after the first contribution from Unesco, never had a major financial problem or had to borrow money to conduct its affairs. The axioms are relatively simple: 1) each Congress has to be financially self-sufficient with registration fees adequate to cover all normal expenses and produce a surplus derived principally from fees charged exhibitors and casual attendees to the exhibition; 2) IFIP must derive a royalty from all of its publications; 3) we conduct the affairs of IFIP in a prudent manner throughout a three-year fiscal cycle.

Of these policies, the only one that caused dissension was that of establishing a royalty on publications. This particular idea was my own. Some representatives from the academic community objected strongly, for they felt the royalty would increase the price of the proceedings and other IFIP publication and make them prohibitively high. This has not been borne out by our historic results. In reviewing the financial statements of IFIP over a quarter of a century, I am happy to report that, even though the royalty percentage has been quite modest, it has generated income which on occasions was equal to or greater than the annual contribution from the member professional societies. In later years, many other professional societies adopted this same practice.

Another noteworthy action of the first Council meeting was the recognition of the need for greater standardization of terminology throughout the industry. Since I was responsible for this activity within the NJCC, it was my intent that IFIP should have a similar technical activity, and I drafted the goals accordingly. The Council authorized the establishment of our first Technical Committee 1-Terminology (TC-1), whose objectives were to establish a terminology of digital computers and data processing devices, and to compile a multilingual glossary for information processing systems and related subjects. We were indeed fortunate to find Geoffrey C. Tootill (U.K.) to serve as its first Chairman and A. R. Wilde (U.K.) to be committee secretary.

To increase the awareness of IFIP within the member societies and in professional circles, the Council authorized the publication of a bulletin. The originial circulation of approximately two hundred was through members of the Council and was supplemented by a page in the PICC Bulletin. This was Mr. Mussard's idea, and further expanded the excellent working relationship and collaboration we enjoyed with the PICC. In later years, after the International Computation Center became a legal entity and took on new leadership, their view of IFIP was more as a competitor rather than a collaborator and needless friction developed between the two organizations.

Our host for the first Council Meeting, PICC, initiated a practice that we continue, providing for an excursion or outing for the entire Council and its guests. The excursions proved to be invaluable, enabling the representatives to mingle informally, to get to know each other better, and to conduct federation business that was formalized during subsequent meetings. The first excursion was a bus tour through the mountain villages leading to Assisi, where we enjoyed a beautiful lunch in an outdoor restaurant.

It is fascinating to recount the professional backgrounds of some of the early people in our industry and in IFIP. Many of us became involved in the development of computers because we had particular problems and saw the computer as a vehicle for solving these problems. Dr. John Mauchly, one of my first bosses and the man who conceived of the ENIAC and was co-conceiver of the UNIVAC, was a physicist studying weather forecasting who became involved in the development of computers to help track weather patterns. Dr. A. van Wijngaarden, a mathematician, was concerned with the development of mathematical models of dikes for his country, and Acad. A. Dorodnicyn was a gas dynamicist involved in the solution of non-linear differential equations. I was originally an electronic engineer, and my purposeful direction was the development and design of computers that would enable us to do computing more effectively.

All of the lofty goals that were set forth in the original proposal to Unesco which began with that first flash of an idea during our conversation in the winter of 1955 were brought to successful fruition. The visionaries among us recognized the significance and importance of the computer and information processing, and how significant an impact it would have on our lives. Eventually, others joined in our vision, and today the computer industry has become the most exciting, dynamic, and rapidly expanding field of the century. Today, as the computer becomes ever more essential to the smooth running of every aspect of our lives, it is difficult to believe how reluctant people were to understand, appreciate and involve themselves in one of the greatest technological developments of all times.

IFIP has had a great impact on bringing together scientists, engineers, mathematicians, academicians, and computer professionals worldwide, providing an opportunity to exchange ideas and enhance the advancement of information processing. Its success has been largely due to the devotion of its national representatives and the members of the Technical Committees and Working Groups, all volunteers who have given freely of their knowledge and time to insure the progress of the federation.

The future of IFIP should be devoted to reaching out to developing nations, holding regional Congresses and conferences in countries in Africa, South America and Southeast Asia, which have been slow to integrate data processing into their societies. We have worked in the past to educate and disseminate knowledge, and we have shown that a meeting of the minds is essential in dealing with the complexities of a technical revolution. With information processing such an integral aspect of every day life around the world, IFIP can continue to be an important force in shaping the future.

APPENDIX A

Proposal

for an

International Conference

on

Information Processing Systems

Submitted

by the

National Joint Computer Committee

United States of America

January 1, 1957

PURPOSE:

It is proposed that the United Nations, under the auspices of UNESCO, sponsor an International Conference on Information Processing Systems to promote a freer exchange of technical information among leading scientists and engineers of many nations, to review the tremendous strides that have been taken, and especially to stimulate an even greater progress in the field in the years to come.

JUSTIFICATION:

One of the most important forces that will raise the world's standard of living is the ability of men to deal competently with the increasing complexities of their existence. Every moment, on every frontier, new opportunities for advancement are discerned that will enhance the scientific, educational and cultural welfare of the world. But man needs a new tool to make possible his exploration into these myriad, yet integrated, fields. A machine which will harness this leviathan of complexity is the electronic computer. During the past ten years electronic data processing systems have done much to enable major breakthroughs in many scientific areas and have opened new vistas in industrial automation.

Information processing systems are revolutionizing industry. It is hoped that complete production and in fact, the entire operation of industry can be greatly improved through the application of computers. Scientists from an oil company built a logical model of a refinery by breaking down the many variables involved in operation into the language of a large digital computer. New ideas on how to improve production efficiency were tried out on the computer, and the answers were derived faster, cheaper and more accurately than any method short of actual refinery tryouts. Optimum combinations for particular products wanted from crude oil have been derived by using a computer, and scientists are hoping for answers to the problems of discovery and production of crude oil. Now mathematical and logical simulation of entire organization operations are envisioned.

The most promising application for data processors in business is in the area of management and management decisions. The volume of data to be presented to management for digestion and decision can now be more efficiently assimilated by information handling systems, thus giving management more time to manage. Branches of an organization can be linked together by high-speed communication systems that not only transfer information, but process it to provide comprehensive information on all organization operations, facilitating more accurate management decisions. Computers are taking over the routine problems of payroll, inventory, records, subscription fulfillments, and premium billing in some of their most advanced applications. Medicine uses computers in its most progressive research. They are a new and accurate tool in highway design. And for banks, insurance organizations and the like, data processors are the supreme bookkeeper, freeing more and more people from the dreary business of counting numbers.

The complications incurred by the air age can be mitigated through the use of information processing systems. The multitude of aircraft from jets to small private planes, with their tremendous differences in speed, make air travel and landing a constant hazard. Decisions frequently must now be made faster than man's reaction time permits. Information processors, however, which respond in microseconds, can schedule, adjust and keep track of flight patterns to ensure a safe air-traffic control system. Flutter calculations and studies of aircraft performance can now be made on a computer, avoiding the trial-and-error method of, for example, wind tunnel models.

Implements developed by man in the struggle to conquer his environment have hitherto amplified only his mechanical abilities. Steam shovels extend his strength, radar extends his sight, loudspeakers extend his voice. But the goal now deemed possible of achievement is the amplification of man's mental capacities.

Linguists, scientists, industrialists, business men, economists all can apply information processors in countless ways. For example, their use in language translations will promote international communications while augmenting our understanding of the process of communication in general. Dr. J. Robert Oppenheimer sees computers used in atomic research and in statistical problems of genetics and population studies. Despite the proliferation of information processors, the consensus of engineers, scientists and industrialists is that present applications of the electronic computer have just begun to scratch the surface of the potential. That the manufacture and design of computers has reached a place of financial eminence in industry is well known. There are almost 400 organizations in the computing field--organizations making, developing, servicing or making components for computers. According to the best estimates there are about 3,000 electronic calculators of all sizes in operation now, and at least four of the first 100 industries in the United States are manufacturers of information processors. One organization alone has computers in plants and on delivery within the next two years that represent an investment of $1 billion. The data processing industry sales are expected to reach $500 million per year by 1960. However, monetary success is not a measure of scientific progress, but a by-product. Yet scientific progress cannot be isolated within national boundaries. No matter how advanced the progress in the United States, real progress for the world cannot be achieved until scientists for all the world work together and exchange their independently gained information. Today, through UNESCO, is the first time in history it is thought practible to make the benefits of civilization available to the whole human race.

Limited communication within and among nations has curtailed progress. People in the United States are, in general, poorly informed about computer developments and the level of interest in computer usage throughout the world. There are approximately fifty technical societies outside the United States which are interested in computing and allied fields. There are many industries building and using computers all over the world. But neither facts nor information on world-wide technical advances have been available or generally known to comparable organizations in the United States.

To solve these mutual problems of communication and the furthering of progress in scientific, educational, cultural and industrial fields, an International Conference on Information Processing Systems is proposed. It is felt that an exchange of information and with it, a concerted approach to advancement in scientific computation, industrial automation, and business applications by leading scientists will be a major contribution to a more stable world. It is sincerely believed that the application of information processing systems is equally as vital to man's survival as the peaceful uses of atomic energy.

PROCEDURE:

The dedication of the United Nations to the international exchange of scientific information is shown by its support of the International Conference on the Peaceful Uses of Atomic Energy, and the International Conferences on Acoustics, to mention only two. Therefore, we of the National Joint Computer Committee, comprised of the Professional Group on Electronic Computers of the Institute of Radio Engineers, the Committee for Computing Devices of the American Institute of Electrical Engineers, and the Association for Computing Machinery, desire to bring the idea of an International Conference on Information Processing Systems to the attention of the United Nations.

Since the United Nations Economic, Social and Cultural Organization (UNESCO) ". . . contributes to peace and security by promoting collaboration among nations through education, science and culture . . ." according to its Charter, it is proposed that they, perhaps through one of their agencies, sponsor such a conference. While the extent to which the National Joint Computer Committee, its constituents, and the other technical societies of the world can assist UNESCO in the organization of the conference is not certain, their full support of the program is assured. If UNESCO initiates the procedures, the technical societies can be relied upon to handle the technical aspects of the program.

It is suggested that the International Conference on Information Processing Systems be held in Paris at the new UNESCO Headquarters in August, 1958. There are a greater number of computer people in the United States than in Europe, but a greater availability of travel funds is believed to be available here. Held in Europe, the conference would be more truly international "in spirit".

Complete simultaneous translation facilities are a necessity for an international conference, to encourage a large and diversified attendance, and to enable men from all over the world to participate and learn equally. It is suggested that Paris, which is the home of UNESCO Headquarters, thus affords these excellent translation services.

(1) Paris affords excellent facilities for meetings (meeting rooms and accomodations), is easily accessible to all transportation, and its general appeal as a city will stimulate participation by the greatest number of nations.

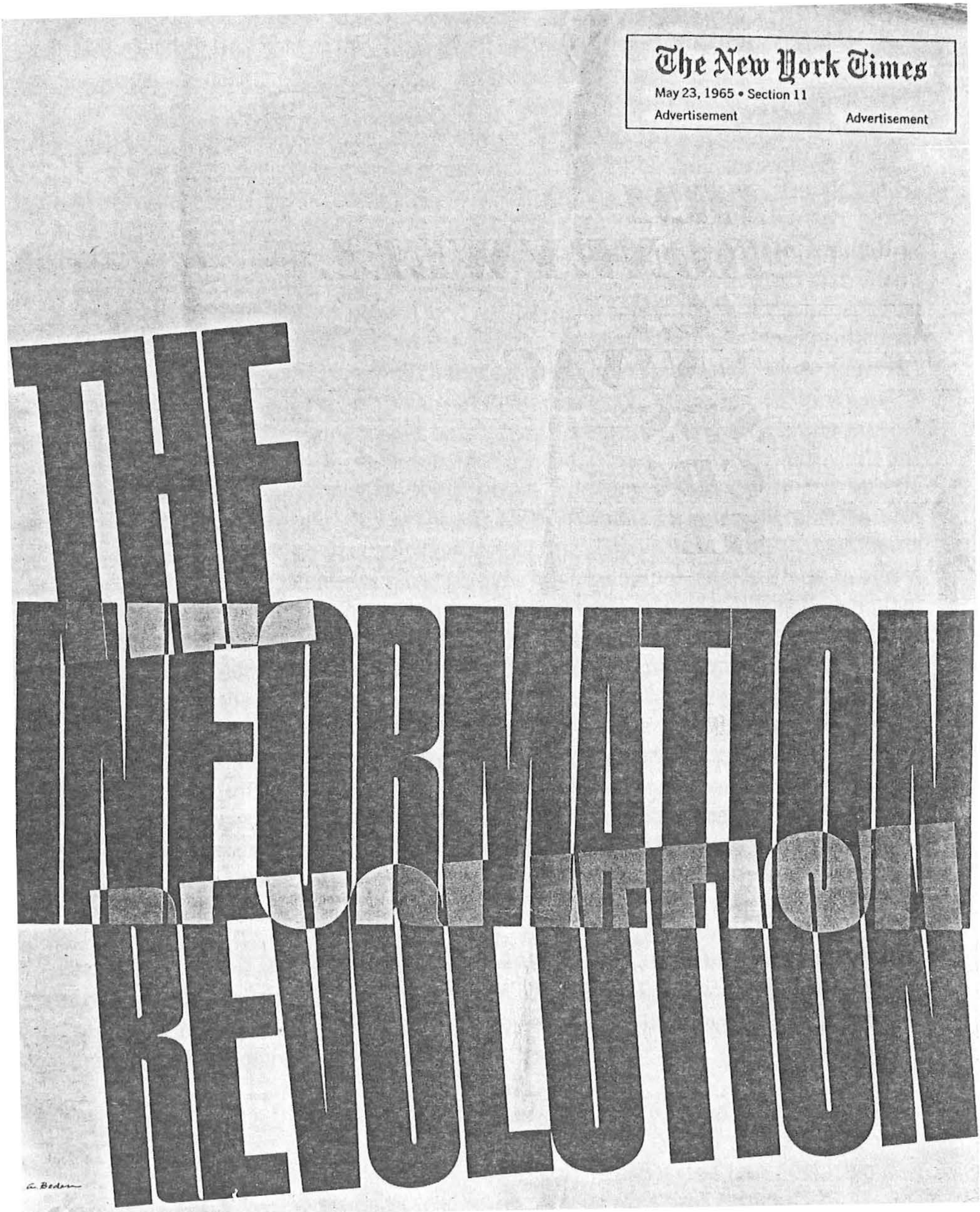
(2) Paris, the headquarters of UNESCO, emphasizes the UNESCO sponsorship. UNESCO sponsorship will avoid political implication, and will indicate that the conference was not called by one nation, but by an association of nations. It will imply world-wide benefits in the areas of science, education, and general welfare.

It is highly recommended that the conference take place during 1958 to take advantage of the International Geophysical Year Program, since information processing systems will play a vital role in the successful launching of earth satellites and in the analysis of the data derived therefrom. The International Geophysical Year Committee could, perhaps, sponsor one of the sessions of the Conference. In addition, if it were held at that time, mathematicians coming to Edinburgh for the International Conference of Mathematicians August 7-14, 1958 could attend both conferences.

It is proposed that the conference be organized around information processing systems and their applications. Subjects of international interest should be especially stressed. Some examples would be: machine translation of language, data reduction of International Geophysical Year observations, and library classification and retrieval of knowledge. Papers, invited and contributed, and discussions should be carried on at the levels of applications, including programming and mathematics; systems, including logical design and computer organization; and equipment, including components and circuits. In connection with the application of computers, it would be appropriate to discuss scientific calculations, data processing, and real time operations.

The conference should include an industrial international exhibit of information processing systems and their components. Exhibits are of particular value to American participants, who seldom see equipment not made in the United States. Displays of the calibre and good taste shown at the Conference on the Peaceful Uses of Atomic Energy would add immeasurably to the interest and dignity of the conference, and would indicate a concrete support by nations and industries of the technical ideas to be discussed.

The importance of information processing systems to the entire world justifies an extensive investigation by UNESCO into all possibilities of the scope of the conference, and it is hoped that a vitally important symposium will result.



For Congress 65, AFIPS prepared a special supplement of 32 pages for the New York Times, written by 14 authors (IFIP authors were I.L. Auerbach, E.L. Harder and R.A. Buckingham; others were e.g. J.C.R. Licklider, J.A. Rajchman and Margaret Mead).

Inaugural session of the International Conference on Information Processing, organized by UNESCO. This opening session took place at the Amphitheathre of the Sorbonne, Paris, France, June 15, 1959.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

IFIP-The Early Years: 1960-1971

Isaac L. Auerbach

President, Auerbach Consultants
Chairman, Auerbach Publishers, Inc.
Philadelphia, U.S.A.

Introduction

On January 1, 1960, the International Federation of Information Processing (IFIP) formally came into existence. Thirteen national professional technical societies ratified the proposed statutes. This was six more than the minimum required by the representatives of eighteen national technical societies who participated in the final Organizing Committee meeting during the Unesco-sponsored International Conference on Information Processing (ICIP) at Unesco House on June 16, 1959.

To join IFIP, which was a federation of societies, each country had to either organize a national technical society, form a society of societies, or have its Academy of Science apply for membership. Hence, IFIP was an important force in stimulating the formation of national professional information processing societies throughout the world.

Although the United States had three existing information processing professional societies in 1959 that had already joined together in a single purpose confederation as the National Joint Computer Committee (NJCC) to organize semi-annual computer conferences, the NJCC was not a legal society that met IFIP requirements. The Association for Computing Machinery (ACM) agreed with the computer oriented portions of the other two societies, the Professional Group on Electronic Computers of the Institute of Radio Engineers (IRE) and the Committee on Computing Devices of the American Institute of Electrical Engineers (AIEE), to form an umbrella organization, the American Federation of Information Processing Societies (AFIPS). AFIPS replaced the NJCC, continued its national conference sponsorship activities, and became the U.S. member of IFIP. Subsequently, other information processing related societies joined AFIPS, which currently has eleven member societies:

- American Society for Information Science (ASIS)
- American Statistical Association (ASA)
- Association for Computational Linguistics (ACL)
- Association for Computing Machinery (ACM)
- Association for Educational Data Systems (AEDS)
- Data Processing Management Association (DPMA)
- IEEE Computer Society (IEEE-CS)
- Instrument Society of America (ISA)

Society for Computer Simulation, Inc. (SCS)
Society for Industrial and Applied Mathematics (SIAM)
Society for Information Display (SID)

The situation was similar in the Netherlands, Italy, Sweden, France and the Federal Republic of Germany. In each case, the desire to affiliate with IFIP was the driving force that stimulated the formation of umbrella organizations or professional technical societies. This resulted in greater national activity in the field of information processing. As the industry grew and users matured, other nations became more aware of the benefits of forming a national professional society on information processing and affiliating with IFIP. In 1985, as IFIP celebrated its 25th Anniversary, there were 45 member societies representing 58 countries, some of whom were affiliated through regional or university groups.

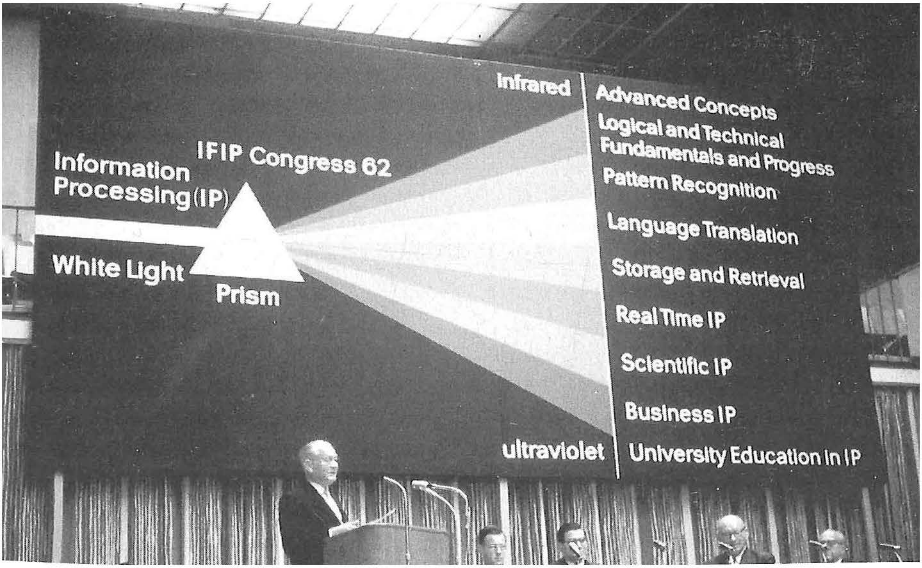
The IFIP Council met for the first time on June 16-17, 1960, at the Unesco-sponsored Provisional International Computation Center (PICC) in EUR, a suburb of Rome. By then, fifteen national societies had joined IFIP, and ten sent representatives. The Council elected I. L. Auerbach (USA) President, A. Walther (West Germany) Vice President , and A. P. Speiser (Switzerland) Secretary-Treasurer.

IFIP Congresses

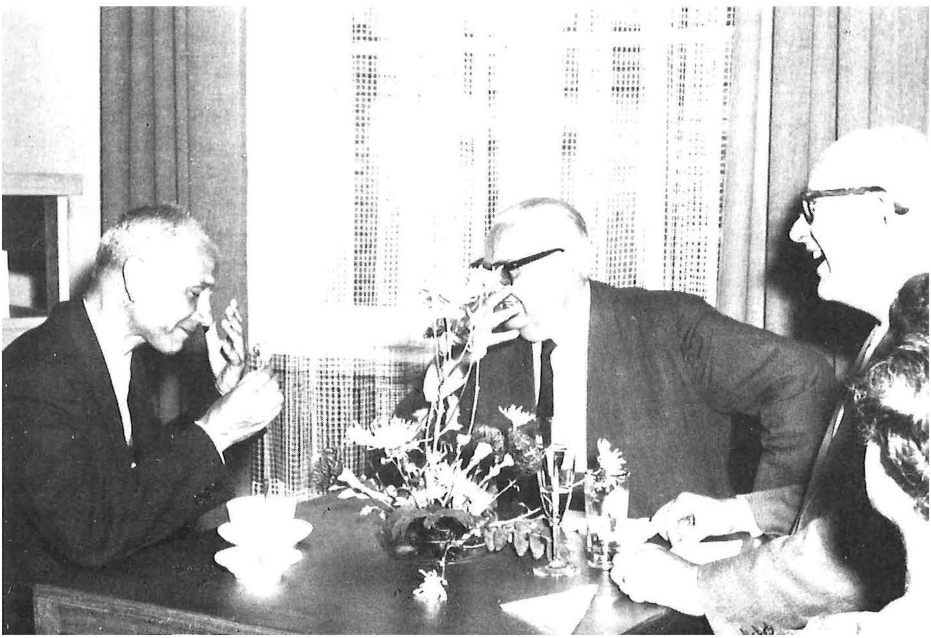
At this Council Meeting, most of the discussion was devoted to the first IFIP Congress. Based on the success of Unesco's ICIP in Paris in 1959 and the more than double the anticipated number of national professional societies that had joined IFIP by the time of the first Council Meeting, there was considerable enthusiasism to proceed with an IFIP Congress which would be the second world-wide international information processing Congress. We decided to convene IFIP Congresses every three years to avoid conflicts with other international professional congresses. This has worked out well for IFIP and the many other professional societies in fields related to information processing. The date of the first congress was set for 1962.

IFIP received only one invitation, from Prof. A. Walther, the representative from DARA of West Germany, and it was accepted. The Council established itself as the Program Committee for the Congress. Niels I. Bech of Denmark was appointed the Chairman of the Program Committee and A. Walther the General Chairman for Local Arrangements.

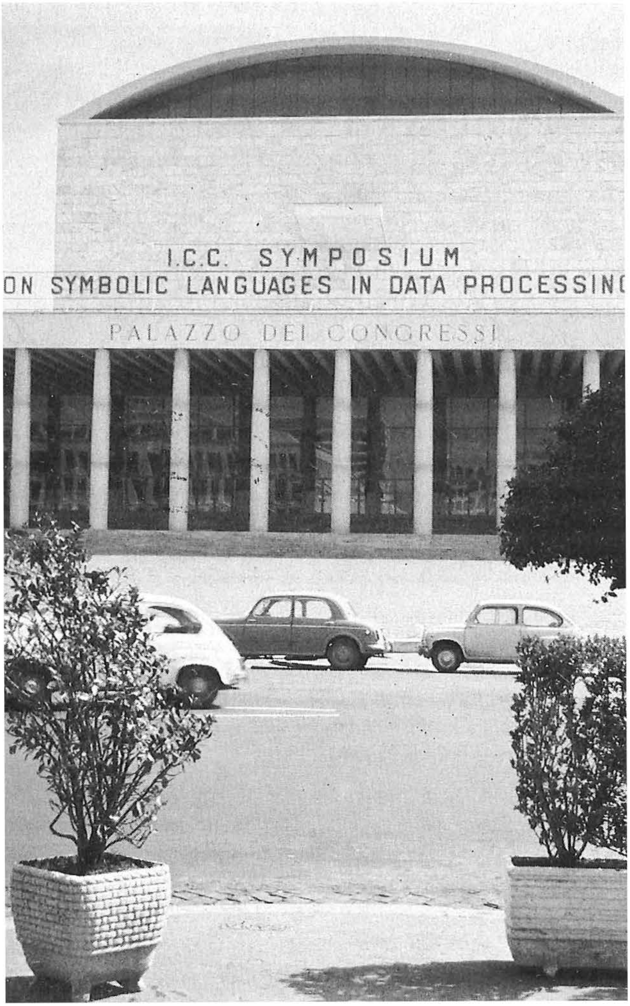
Since I was preparing an article entitled "European Electronic Data Processing-A Report on the Industry and the State-of-the-Art" for the January, 1961, Proceedings of the IRE, I had to visit almost all of the laboratories in Europe that were then developing electronic digital computers. When I visited Munich, I was stunned to discover that none of the principals involved in computer development



Prof. Alwin Walther at the Opening Session of IFIP Congress 62 in Munich shows his view of the spectrum of Information Processing.



A.A. Dorodnicyn telling jokes to Prof. Hans Piloty and Prof. Robert Sauer during IFIP Congress 62 in Munich.



Rome 1962

"Palazzo dei Congressi" in Rome
where the ICC Symposium was held

Discussion at the ICC Symposium on Symbolic Languages in Data Processing

from left to right:
P. Naur, E.W. Dijkstra, Session Chairman, A. van Wijngaarden

knew of the invitation from DARA or that Munich was the city proposed for our first Congress. We later learned that Prof. Walther had acted unilateraly out of personal graciousness and the desire to keep the first Congress in Europe. This contretemps put additional stress on our fledgling organization. However, by obtaining the assistance of senior members of the Technische Hochschule, the Max-Planck-Institute and Siemens, all in Munich, we were able to carry the Congress off successfully.

I vivdly recall that this was the time of the Berlin Crisis and there was great fear that the world might be going into another war. We were deeply concerned that we had obligated IFIP for the rental of exhibit space and the printing of many invitations, and we did not have funds to pay these bills if the Congress were cancelled. We had to secure guarantees from the local companies and municipalities to underwrite any loss that the IFIP Congress might sustain. Fortunately, all worked out well, and the IFIP Congress 62 was technically and financially successful.

Evan Herbert, who was U.S. Chairman of the Public Relations Committee for the IFIP Congress and who conducted the press conferences every afternoon during the Congress in Munich, designed the IFIP logo, which we have used ever since. The same motif was used in the design for the IFIP Silver Core Award some twelve years later.

While planning the Congress program, the tensions Europeans felt in participating with the Germans became apparent. There were several personal confrontations that showed that the scars of World War II had not yet healed. This made my job as President that much more complex, and I developed the ability to sense what people were feeling and concerned about, even though not explicitly stated.

The preparation of the early Congresses and Exhibitions required an immense amount of effort and cooperation by individuals, organizations and nations, but the results were extremely gratifying. Each of the Congresses had their own sets of problems and pleasures, and each Congress presented new and great opportunities to fulfill one of our goals in the creation of IFIP, to encourage the attendees to establish people-to-people relationships, to learn that ideas have no national boundaries and that we can learn from each other in many ways. The technical exchanges at the meetings through technical papers, symposia, panels, and exhibitions has been extremely high. IFIP can take a lot of credit for the international rate of growth of information processing through voluntary technical transfers.

Probably more ideas have been sparked at operas, picnics, theaters, tours, dinners and cocktail parties, where people can meet and test pet ideas strictly "off the record", than at the more formal presentations and sessions. Over the years, many people have established invaluable international personal friendships .

During the planning for IFIP Congress 65 in New York City, I became aware that I was in a situation involving a potential conflict of interest, as I was President of IFIP, the Chairman of the International Committee for AFIPS, and also the AFIPS representative to IFIP. I felt it would be better for everybody concerned if I resigned as the AFIPS representative and let AFIPS appoint a new representative to IFIP. This required that IFIP create a new category of membership, the Individual Member, with no voting power. This enabled me to be elected as an Individual Member and continue as President of IFIP without being the AFIPS representative. Dr. John Pasta replaced me as the AFIPS representative.

In 1966, one year after Ambrose Speiser assumed the Presidency of IFIP, he became Director of Research for Brown-Boveri. Speiser felt that since he was leaving the information processing field, he should also resign as president of IFIP. He asked that I fill out his term of office. I felt that it was in the best interest of IFIP that he continue to hold the post of President, but I agreed to fulfill as many obligations for him as I possibly could, in particular, to coordinate the activities for the IFIP Congress 68 to be held in Edinburgh.

IFIP Congress 71 in Ljubljana, Yugoslavia, during the Presidency of A. A. Dorodnicyn, showed how a smaller city could decorate its entire main street with buntings of IFIP logos and IFIP flags. The opening ceremony was spectacular. At least forty young women, all dressed in uniforms with IFIP logos, paraded in, each carrying a large IFIP flag. Part of the negotiations with the local managers of this Congress was that all of this bunting, flags and uniforms were to be put into boxes and shipped to IFIP in Geneva. Not one single shred of material was ever received .

The Congress in Yugoslavia had been managed by an organization called Magistrat. They spent IFIP money at a rate that we had never experienced. The finances in Ljubljana were eventually resolved by Heinz Zemanek's going there and negotiating with the people for the monies due us.

On the positive side is the stimulation the IFIP Congress 71 had on improving the understanding and importance of information processing to the Yugoslavian technological development and economy. The Congress gave the Office for Science and Technology of the United Nations, represented by Dr. Benjamin Barg, the opportunity to hold informal meetings of attendees from developing countries to discuss his project, "Application of Computer Technology in Developing Countries". The meetings were to standing room crowds and emphasized the need to help people in developing countries to more rapidly assimiliate computer systems into their lives. These sessions also stimulated Unesco, and through them the International Bureau for Informatique, to take a more active role in assisting the developing countries to acquire the necessary knowledge of information processing.

IFIP Congress location	*Program Chairman, Vice-Chairman	*Local Arrangements Chairman, Vice-Chairman	Activities	Attendance #people/ #countries	Exhibits
62 Munich	*N. I. Bech W. L. van der Poel	*R. Sauer A. Gunter	Beer Party Opera Gala Banquet Excursion to Innsbruck (Tyrol)	2800/41	48 exhibitors Films
65 New York	*B. Langefors A. S. Householder	*W. Buchholz W. R. Lonergan	Cocktail Party Theatre, "Hello, Dolly!" Princeton Tour Banquet Sports Night World's Fair Night Tour up the Hudson River	5000/35	82 exhibitors Films. Plant and lab tours 20,000 attend
68 Edinburgh	*F. Genuys A. P. Ershov	*B. B. Swann C. DePaula	Cocktail Party Concert-Scottish singing Garden Party-Lord Provost's Banquet Reception-Secretary of State of Scotland	3,700/47	77 exhibitors 26 films 9000 attend
71 Ljubljana	*V. M. Glushkov C. C. Gotlieb H. Zemanek	*Stane Kavcic Milan Osredkar	Concert Picnic in Kostanjevica Trip to Forma Viva and the Pleterje monastery Reception Banquet	2500/49	78 exhibitors Films

TC-1 Terminology

Our first Council meeting recognized the need for greater standardization of terminology. In those early days of computer development, each group made its own contribution to new terminology and to computer jargon. It was clear that an international federation was the ideal organization to standardize terms in order to reduce misunderstanding and promote accuracy in the exchange of information. The Council authorized the establishment of Technical Committee 1-Terminology (TC-1), whose aim was to promote and coordinate the exchange of information processing terms leading to the compilation of a multilingual glossary for information processing systems.

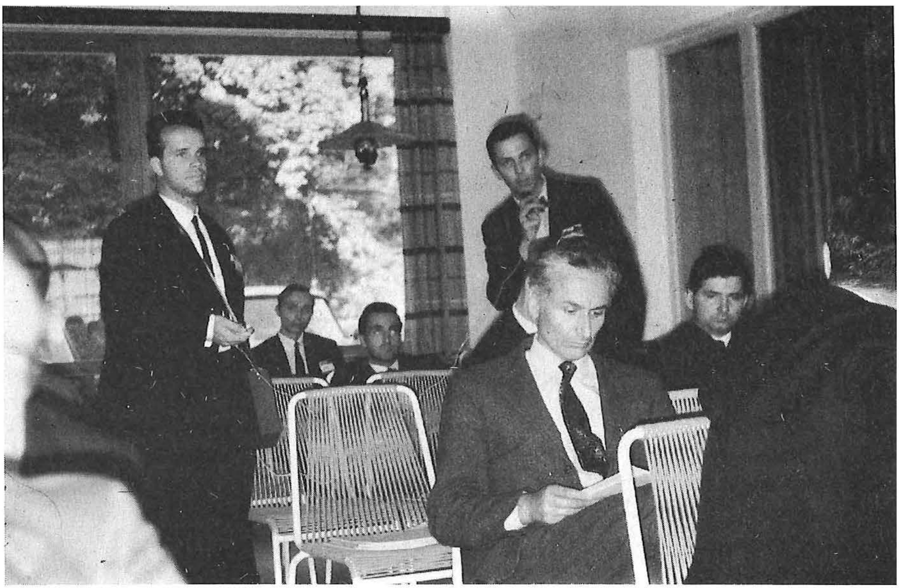
In 1961, the International Computation Center in Rome (ICC) proposed joining IFIP in this standardization effort. The committee name was changed to reflect ICC participation to IFIP/ICC Technical Committee 1-Terminology.

Chairmen: G. Tootill (GB) 1962-1964
A. R. Wilde (GB) 1965-1966
A. van Wijngaarden (NL) 1967-1974
Publications: IFIP/ICC Vocabulary for Information Processing, 1965
Guide to Concepts and Terms in Data Processing, 1971

Thanks to Geoffry Tootill's ingenuity, an unusual approach to the basic concept and structure of the vocabulary was developed. The glossary's construction was based on internationally accepted concepts, rather than terms. Each concept was assigned a unique key or number. Each volume consisted of two parts, the first part containing the explanations of over 1,500 information processing concepts about which there was an international concensus, the assignment of a unique key or number to each concept, and the term or terms that would represent the concept. The second part of the volume consisted of an alphabetical listing of terms. This methodology was unique in its ability to get agreement on a concept, the assignment of a key, then finding a term or terms that conveyed the meaning or the concept. Accurate descriptive terms in any language could then be obtained for a specific concept by referring to the concepts key. Therefore, two monolingual volumes formed a bilingual dictionary, three volumes formed a trilingual dictionary, and so on. Since each volume was to be in a single language, the volumes could be compiled and published separately. National technical organizations could work on the translations, minimizing the difficulties encountered in technical translation work.

The first English language edition of the IFIP/ICC Vocabulary of Information Processing was published in 1965. However, strained interpersonal relations between IFIP and the ICC representatives led to a breach when the ICC objected to the vocabulary and refused to permit translations into other languages as a part of the joint effort. With the provision that all reference to the ICC be eliminated,

First IFIP Working Conference "Formal Language Description Languages"
Baden (near Vienna), September 15-18, 1964
standing: P.Z. Ingerman, turning around: G. Seegmüller



Tom Steel in discussion (right)
and Paul Oliva of IBM Lab. Vienna (left)
sitting in front : C. Boehm

the German edition was published in 1968. Work was also done on translations into Finnish, Dutch, Swedish, Czech, French, Hungarian and Russian, but because of the conflict with ICC, it is unclear if any of these works were published independently of IFIP.

In 1967, I.H. Gould was appointed Chairman of Working Group 1.1 to prepare a second edition of the English vocabulary. In 1971, "Guide to Concepts and Terms in Data Processing" was published. In 1974, TC-1 was dissolved.

TC-2 Programming Languages

In addition to confusion over terminology, the dynamic growth of information processing resulted in a confusing proliferation of programming languages that man used to communicate with the ever increasing variety of computers. Computers had very little communication compatibility with each other, even among those from the same manufacturer. People could not communicate with machines without learning each computer's particular language. The field was too new to allow sensible standardization, even though manufacturers, users' groups, and government organizations preferred to struggle with the problem of devising common languages oriented to users' needs while supporting the NOT INVENTED HERE attitude.

In 1961, the ALGOL authors and/or the sponsoring associations ACM/AFIPS and DARA/GAMM, requested that IFIP undertake the publication and maintenance of the ALGOL language. Finding a Chairman for TC-2 Programming Languages, proved to be a formidable task. There were very deep feelings among the various groups within Europe about ALGOL'S origin and maintenance. To minimize conflict, a Chairman was needed who was not involved as one of the thirteen originators of the language, but who had intimate knowledge of the current evolution of the ALGOL language itself. Fortunately, Dr. Heinz Zemanek was such a man. He was a master diplomat, and for seven years he managed to stimulate significant output from the Technical Committee and Working Groups.

Chairmen: H. Zemanek (Austria) 1962-1969
T. B. Steel, Jr. (USA) 1970-1976

Conferences and Proceedings:
- Formal Language Description Languages, 1964, Vienna
- Symbol Manipulation Languages and Techniques, 1966, Pisa
- Simulation Programming Languages, 1967, Oslo
- ALGOL 68 Implementation, 1970, Munich

Publications:
- Revised Report on ALGOL 60 and related documents, 1963
- Report on ALGOL 68, 1969
- ALGOL Bulletin, 1969-1972

First IFIP Working Conference 1964, Baden near Vienna
Christopher Strachey on the Microphone

F. Duncan

Technical Committee TC-2 Programming Languages was established in 1962. The aims of the committee included:

1) general considerations concerning programming principles and techniques such as concept development, classification and description;

2) the development, investigation and specification of particular programming languages;

3) the identification, development, investigation and specification of additional programming techniques.

The committee invited the authors of ALGOL to become the kernel of Working Group 2.1 ALGOL. Most of them answered favorably, and additional members were appointed under the Chairmanship of W. L. van der Poel who served as Chairman from 1962-1968. He was succeeded by M. Paul, who served from 1969-1974. WG 2.1 was responsible for the continuing support of ALGOL 60 and the promulgation and development of ALGOL 68, as well as the evaluation of new ideas in the field of programming languages, possibly leading to further languages. The Committee organized and amplified certain aspects of ALGOL 60, which became the official IFIP programming language. It was reproduced and maintained as an IFIP document through national technical journals. In 1964, IFIP received a request from the International Standards Organization for proposals for an IFIP Subset ALGOL 60 and to develop Input/Output Procedures for ALGOL 60. WG 2.1 also revived the ALGOL Bulletin with F. Duncan as editor. The committee developed ALGOL 68, publishing its first report on it in 1969, and held a Working Conference on ALGOL 68 Implementation in Munich on July 20-26, 1970. As a result, ALGOL as a language became much more widely accepted and used both in Europe and, to a lesser extent, in the United States.

To promote the development of common programming languages, the committee arranged small working conferences, inviting language specialists to meet to exchange ideas. The Committee published the results of these meetings in book form. The first such conference on Formal Language Description Languages, managed and chaired by H. Zemanek, was held in September 1964 in Vienna. It was the first non-Congress major conference sponsored by IFIP, creating a pattern that endured for the next two decades. The outcome of this conference was the formation of Working Group 2.2, Formal Description of Programming Concepts, which was established to evaluate and develop methodologies, both formal and informal, for the syntactic and semantic description of programming languages. T. B. Steel, Jr. served as Chairman from 1965-1971.

The second conference, chaired by A. Caracciolo, on Symbol Manipulation Languages and Techniques, was held in September, 1966, in Pisa. The third, chaired by O. J. Dahl, on Simulation Programming Languages, was held in Oslo in May of 1967. F. L. Bauer was Chairman of the conference on Algol 68 Implementation held in Munich in 1970.

Under the Chairmanship of M. Woodger (1969-1976), Working Group 2.3 on Programming Methodology was formed in 1969 to work toward increasing programmers' ability to compose programs, and to provide an international forum for the discussion of programming methodology. The problems addressed were:

- Identification of sources of difficulties encountered in programming.
- Intellectual disciplines and problem-solving techniques which can aid programmers.
- Achieving program reliability.
- Requirements for program adaptability.
- Provability of program correctness.
- Guidelines for partitioning large programming tasks and defining the interfaces.

TC-3 Education

Until IFIP formed TC-3 on Education in 1962, there was no world-wide central clearing house for educational material about the information sciences. The aims of the committee were:

- To establish the guidelines for comprehensive training programs and curricula in the science of information processing with special consideration for the needs of developing countries and to encourage the implementation of these programs.
- To generate material to acquaint the general public with the computer and its impact on the various aspects of society.
- To serve as a central clearing house for all educational material pertaining to the science of information processing.

One of TC-3's earliest major projects was a series of six-month courses for teachers from developing countries. The first course was held in Rome in 1965-66 in conjunction with the ICC, and was attended by 19 people from 12 countries. It was so successful that a second six-month course was held in London in 1967. Twenty-five participants from 15 countries enrolled. They attended classes, did practical work with various organizations, and concluded with a four-week discussion of applications of case studies. Similar courses were later held in Hungary in 1969 and Paris in 1970.

Chairmen:	N. I. Bech (DK)	1962-1963
	R. A. Buckingham (GB)	1963-1972

Conferences and Proceedings:

First IFIP World Conference on Computer Education, 1970, Amsterdam

Seminar on Administrative Data Processing, London, 1967

Publications: Computer Education in Secondary Schools; an Outline Guide for Teachers 1970, revised 1971
Computers and Education, a bibliography 1970
Aims and Objectives of Teacher Training, 1972
Information and Information Processing, 1974
Analysis and Algorithms, 1974

Teachers' Seminars: Rome 1965/66
London 1967
Hungary 1969
Paris 1970

Through its membership and contacts and the formation of national committees, TC-3 encouraged the most industrialized countries to establish courses in the computer sciences as part of their university curricula, at both graduate and undergraduate levels, and proposed preliminary curricula.

Working Group 3.1, Informatics Education at the Secondary Education Level, established in 1966, with D. Chevion as Chairman (1966-1968) and later W. F. Atchison (1969-1977), had the task of studying and encouraging the development of information processing education in secondary schools. It also addressed the problem of teacher training, making top level administrators aware of the impact of computers on secondary school education. In an effort to promote computer utilization in schools, an information package was prepared for secondary school teachers. Though we no longer need to convince educators that computers belong in the curriculum, this committee is still active in assisting teachers on how to use the computer in the classroom.

R.A. Buckingham became the Chairman of Working Group 3.2, Advanced Curriculum Projects in Information Processing, formed in 1968. Its aims were to develop and supervise international seminars in areas of special importance in information processing. This Working Group also studied existing curricula with the goal of offering recommendations for revision and extension.

The First IFIP World Conference on Computer Education, held in Amsterdam in 1970 and chaired by J. Hebenstreit, resulted in several publications, including a comprehensive bibliography on computer education and an outline guide for teachers, "Computer Education in Secondary Schools". In addition to plenary sessions and small meetings on various subject matters of the conference, there was an exhibition of equipment for computer education as well as a display of some 2,000 publications. 866 people representing 40 countries attended, making this a highly successful first effort.

TC-4 Medicine

The value of information processing to the medical profession led to the formation of TC-4 Medicine in 1967. The committee was concerned with three main areas of study:

- Identification and detailed investigation of the problems that arise in medical data processing, e.g. computer-assisted diagnostic methods, resource allocation in hospitals, utilization of mathematical models in medicine.
- Means of obtaining information concerning medical data processing within member countries.
- Extension of medical, paramedical and administrative staff's education in the field of data processing.

This third aim became the province of WG 4.1, Education of Medical and Paramedical Personnel, set up to define the different needs of knowledge for each category of personnel, and the best ways to provide such knowledge. Chaired by T. Husak (1968-1970), this group worked closely with TC-3.

TC-4 became an active and productive committee, with four Working Groups which went on to hold numerous working conferences and produced many valuable publications. In 1974, TC-4 evolved into an IFIP Special Interest Group called the International Medical Informatics Association (IMIA), which includes national societies not affiliated with IFIP. This reflects the fact that the interaction between computers and medicine is organized differently in different countries.

Chairman:	F. Gremy (France)	1967-1973
Secretary:	J. M. Forsythe (GB)	1967-1971
Conferences:	Information Processing of Medical Records, 1970, Lyon	
	Computer Application on ECG and VCG Analysis, 1971, Hanover	
	World Congress on Medical Informatics (MEDINFO), 1974, 1977	

TC-5 Computer Applications in Technology

From IFIP's very beginnings, a close relationship existed with the International Federation of Automatic Control (IFAC) because of the rapidly emerging technology of the use of computers to effect the control of all types of vehicles, machines and even complete industrial plants. At first this cooperation was expressed as an IFIP cosponsorship of a growing set of IFAC initiated international conferences in this field as follows:

1. IFAC/IFIP Conference, Digital Computer Applications to Process Control, Stockholm, 1964

2. IFAC/IFIP Conference, Microminiaturization in Automatic Control Equipment and in Digital Computers, Munich, 1965
3. IFAC/IFIP Conference, Digital Computer Applications to Process Control, Menton, 1967
4. IFAC/IFIP Conference, Digital Control of Large Industrial Systems, Toronto, 1968
5. IFAC/IFIP Conference, Numeric Control Programming Languages (Prolomat I), Rome, 1969
6. IFAC/IFIP Conference, Use of Digital Computers for Traffic Control and Regulation, Versailles, 1970
7. IFAC/IFIP Conference, Digital Computer Applications to Process Control, Helsinki, 1971

In 1969 IFIP's management, through the efforts of E. L. Harder (USA), decided that IFIP should also have a technical committee in this area leading to the formation of Technical Committee TC-5 Computer Applications in Technology, including research, design, manufacture, operation and control of products and physical systems, as well as the related programming methods. T. J. Williams (USA) was the first Chairman serving from 1970-1977. He was succeeded by Jacob Vlietstra (NL) in 1978.

TC-5 vastly expanded the International Conference offering in the digital computer based automatic control area while retaining the cooperation with IFAC, but with lead sponsorship now shared alternately by the two organizations. This has resulted in 26 separate Conference and Workshop Proceedings published by North Holland through June 1984.

IFIP Administrative Data Processing Group - IAG

In 1965, IFIP became aware of an activity in Europe to organize a business or administrative data processing group with participation and membership from many western European organizations. The focal point of this activity was the Studiecentrum, an organization headquartered in Amsterdam. Through the good offices of Niels I. Bech, who was then Chairman of that group, it was agreed that IFIP would sponsor a conference on data processing centers to be organized by S. Duyverman. Rather than see the Administrative Data Processing group independent and in competition with IFIP, it seemed preferable to have the group affiliated with IFIP. In order to permit a functional membership group to operate within the structure of IFIP, it was necessary to modify IFIP by-laws. This took a great deal of discussion and two years of negotiation, as the ADP group often disagreed with the IFIP General Assembly regarding its role, membership criteria and finances. In 1967, IFIP formed its first Special Interest Group (SIG), the IFIP Administrative Data Processing Group (IAG) as a constituent part of IFIP.

Chairman: S. Duyverman (NL) 1968-1976

The aim of IAG was to promote research, education and the exchange of experience in the field of information processing as applied to problems in public and business administration. It was based on the concept of member institutions in each country being partners, each concerned with the use of computers, together forming a national membership organization with a representative to the General Conference. The partners paid an annual contribution to the IAG Headquarters, and a Board of Directors was responsible for the formulation of IAG's policies and activities. The Chairman, S. Duyverman, was an Associate Member of the IFIP General Assembly. IAG never grew to fulfill its founders' aspirations or to meet the needs of the user community. In addition, IAG proved to be a drain on IFIP's resources, and in 1981 it was dissolved.

Tenth Anniversary Celebration of IFIP

The General Assembly meeting held in Amsterdam in October of 1970 was the occasion of the Tenth Anniversary Celebration. A. van Wijngaarden was the Chairman of the event, and the proceedings are chronicled in "The Skyline of Information Processing", edited by H. Zemanek and published in 1972.

Administrative Secretaries

In the late 1960's, it became obvious that the activities of the Federation put too heavy a burden on the unpaid part-time Secretary or Treasurer. The British Computer Society volunteered to handle the administrative aspects of IFIP, and the Administrative Secretary was then the same individual within the British Computer Society, J. Mackarness. The IFIP General Assembly did not like this arrangement and instead employed an outside organization to handle administrative business. After one year, IFIP set up a permanent administrative office in Geneva, and in 1971 a full-time head of the Secretariat was employed. Gwyneth Roberts, our present Administrative Manager, took the office in 1974.

Finances

Originally IFIP had meager financial resources. When IFIP Congress 62 was being planned, the treasury held less than $3,000. To insure against possible severe debt, IFIP arranged for the host city or country or local industries to underwrite any losses the the Congress might suffer. As a fiscal policy evolved, it was decided that:

- IFIP Congresses should be financially self-sufficient and produce a surplus from the exhibitions;
- IFIP must derive a royalty from all publications;
- financial affairs would be conducted in a three-year cycle.

Since the initial $5000 contribution from Unesco to support IFIP Congress 62, IFIP has never had to accept money or to request funds from guarantors or anyone to conduct its affairs. In 1970, IFIP's net worth was over 500,000 Swiss francs, making it one of the most financially stable professional technical federations.

Summary

While IFIP struggled financially for the first several years of its existence, from the beginning its activities were a success, reflecting the need for an international organization devoted to information processing. That success was largely due to the unflagging energies of the early IFIP representatives and officers and their successors, all of whom had the foresight to recognize IFIP's importance and the dedication to devote countless hours to its concerns.

Carefully drafted statutes and by-laws, and a sound fiscal policy, also contributed to IFIP's success. The statutes provided the federation with a solid foundation for operation while allowing flexibility for adjusting to the changes of the early years. The statutes stood for twelve years without major refinement, and the basic aims of the federation have not changed significantly since they were first set down twenty-seven years ago. The Technical Committees and Working Groups have proved to be extremely well-conceived and a most productive arm of IFIP's organizational structure.

An international organization of any kind is always in danger of becoming a political forum. Aware that politics can often get in the way of science and technology, IFIP established from the very beginning that the General Assembly meetings were to be apolitical. People of vastly different cultural and political backgrounds have come together at IFIP General Assembly meetings, Congresses, and Conferences, and there has never been a major outburst or rift due to national or political differences.

IFIP grew because its founders foresaw the future of the computer industry and realized the need for international standardization, organization, and education to prevent the industry from being hampered by confusion. In twelve years, IFIP organized four major Congresses, five Technical Committees, a comprehensive vocabulary, a standardization of a major programming language, ten joint IFIP/IFAC conferences, a world conference on education, eight working conferences, and the beginnings of a major publishing program. That was an impressive achievement for a group which began with a handful of people who had a vision of the future importance of computer technology. IFIP has grown and prospered with the industry, and its flexibility has kept it a viable organization which continues to have a beneficial impact on the progress of information processing.

IFIP COUNCIL MEETING 1967 Madrid

from left to right: (facing camera, in front)
V.M. Glushkov, H. Zemanek

IFIP - General Assembly Meeting
International hotel, Prague October 27 - 31, 1969

IFIP GENERAL ASSEMBLY 1969 Prague

D. Chevion, A.A. Dorodnicyn, H. Zemanek, J. Carteron

A. Svoboda and A.A. Dorodnicyn in the
Institute for Mathematical Machines in Prague

IFIP COUNCIL MEETING 1969 Prague

left table: A.P. Speiser, A.A. Dorodnicyn, H. Zemanek, J. Carteron
background: W. Donat, ?.
head table: M. Linsman, J.N.P. Hume. I. Plander
right table: B. Langefors, ?, ?, S.D. Duyvermann, E.L. Harder, T.B. Steel Jr., R.A. Buckingham, F. Grémy

IFIP 1971 Summary

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

IFIP RECENT HISTORY

Pierre-A. Bobillier

IBM Geneva
and
Swiss Federal Institute of Technology, Lausanne
Switzerland

When, in view of the 25th Anniversary of IFIP, I was asked to write the IFIP recent history, I hesitated for a short time then thought it would be both an interesting exercise and also a pleasure to look back at the past 15 years during which I was very closely associated to the IFIP life. Having been Secretary for 6 years and President for 6 years, I not only witnessed many developments, events, reorganizations but also actively contributed to them and worked hard to continue what my predecessors had done during the previous period.

I will cover the period 1970 to 1984, i.e. the 15 years following the IFIP 10th Anniversary.

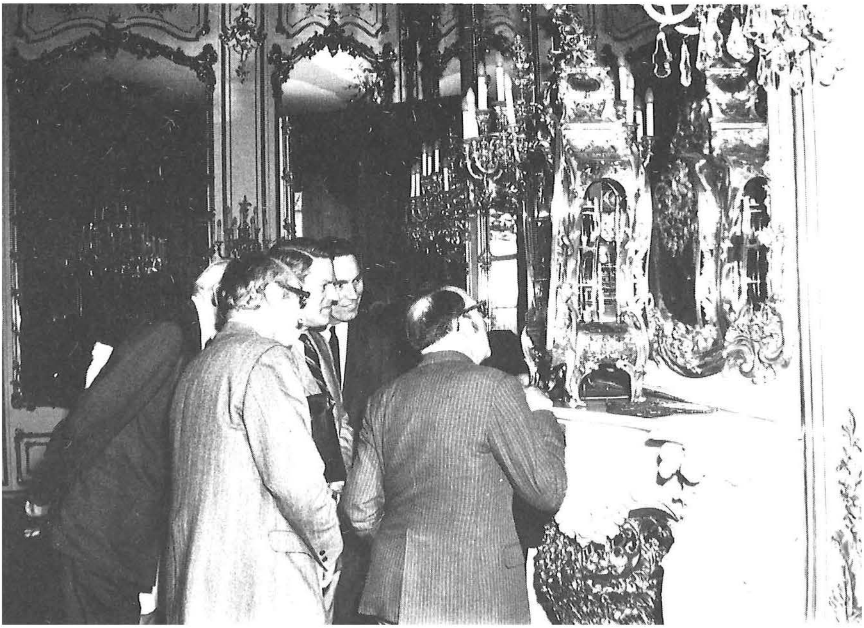
I will not mention the names of all officers and council members who served during those fifteen years: they can be found - as well as their period of office - in the table showing as well the history of the Council, General Assembly meetings and Congresses. The admission of new full members is not mentioned either as this information is displayed in a tabular form in this book.

In order to describe an international federation like IFIP, many aspects can be considered. I will concentrate on a few of them in order to illustrate the development of IFIP during this period.

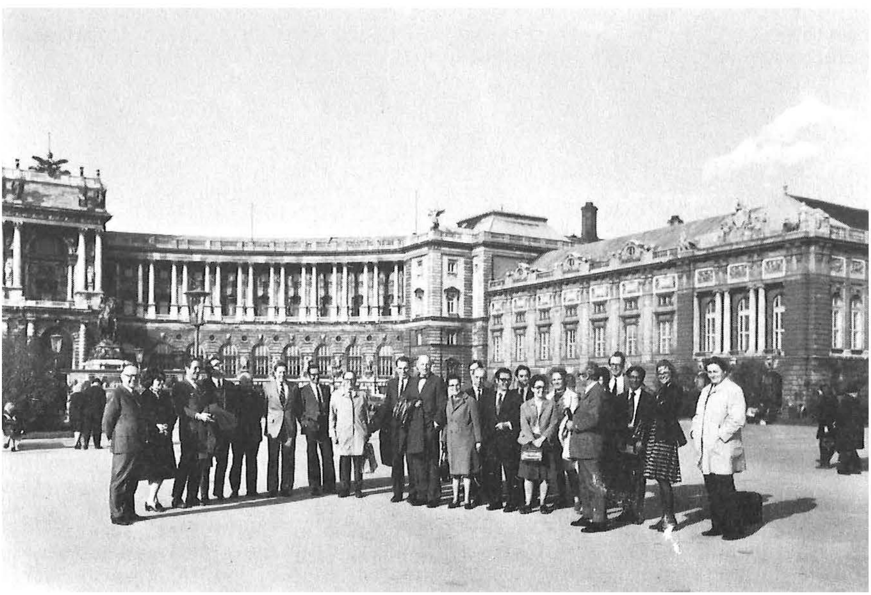
IFIP IN 1970

In 1970, IFIP, under the Presidency of Academician A.A. Dorodnicyn (1968 - 1971), had 29 full members (national association representing the informatics interests and activities in a country). The technical and scientific activities were organized within 5 IFIP Technical Committees (counting 7 Working Groups): TC 1 Terminology, TC 2 Programming, TC 3 Education, TC 4 Medical Data Processing, TC 5 Computer Applications in Technology, and one Special Interest Group: IAG (IFIP Administrative Data Processing Group).

The yearly expenditures accounted in the IFIP books were about 75 KFrs., covered by the income which was roughly divided into: 40 % from the dues of the members, 25 % from the royalties on publications and 35 % from the bank interests produced by the IFIP fortune. The net worth of IFIP, end of 1970, was 515 KFrs. It must be noted that, at this time, very little money was allocated to IFIP activities, either technical activities or work performed by the standing or ad-hoc committees. The rule was that all participants in such activities should pay their expenses. Only in very exceptional cases would funds be made available, for travelling for instance. For example, the 75 KFrs. spent in 1970 were allocated roughly as follows: 1/3 for the IFIP Administrative Secretariat; 1/3 for Technical Committee activities, including some grants towards Working Conferences; 1/3 for other committees and the Executive Body. (One half of this

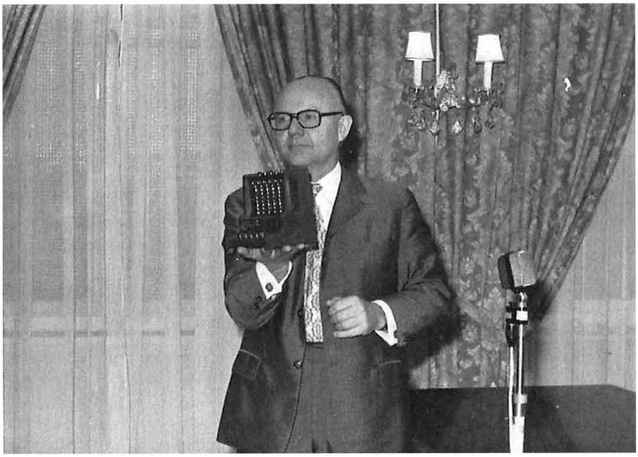


Technical Day Vienna 1972
IFIP delegates look at the "Knights Fight Clock" by L. Knaus (first third of 18th Century) in the Vienna Hofburg. From left to right: M.V. Wilkes, T.J. Williams, H. Freeman, F.L. Bauer and E.L. Harder.



IFIP COUNCIL MEETING 1972 Vienna
IFIP delegates standing in front of the New Hofburg, Vienna

IFIP COUNCIL MEETING 1972 Vienna



Already in 1972, IFIP organized a Pioneers Day at the Council Meeting in Vienna, with the following speakers: M.V. Wilkes, H.H. Goldstine, K. Zuse

H. Zemanek, IFIP President and Opening Speaker, shows a model of the SCHICKARD Calculator of 1637. His opening remarks were on Otto Schäffler, Austrian punch card pioneer (1838-1928).

M.V. Wilkes:
"Some personal recollections"

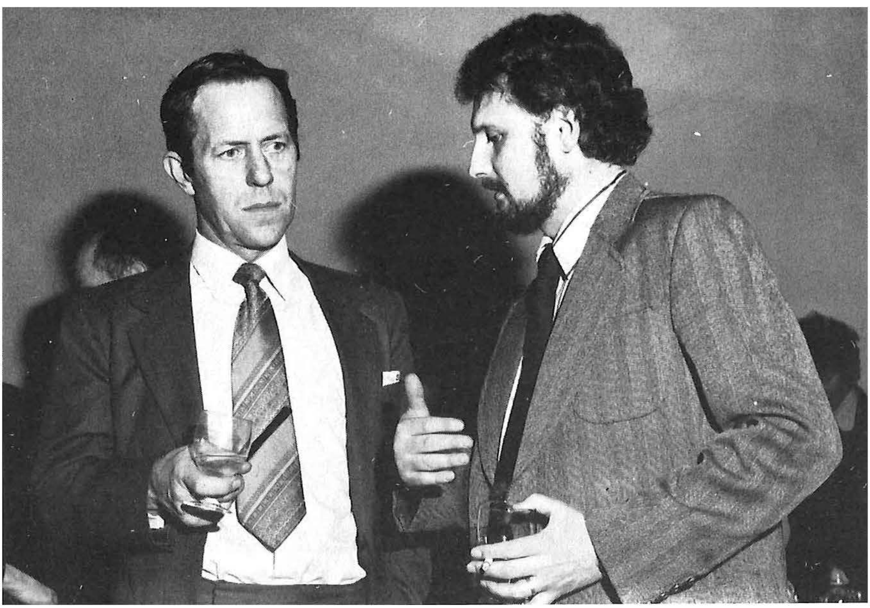
H.H. Goldstine: "Selected figures out of computer history"

K. Zuse spoke about "the Computer, my life".

Finally H.C.R. Grosch gave a longer comment

TECHNICAL DAY VIENNA 1972

From left to right: A.S. Douglas, Dr. Bandat, Mr. Helmreich (IBM Austria), J.G. MacKarness, H.C.R. Grosch and Ph. Renard.
Background: P. Lucas, H.J. Stetter, Mrs. Zemanek, E.L. Harder and N. Teufelhart.



S. Sem Sandberg and E. Fredriksson.

line was for contingency conferences and emergency travel to be allocated by the responsible officers upon TC Chairmen requests). Typically, a Technical Committee could count on an average of 7'000.- Sfr. to cover its yearly activities.

To illustrate the level of IFIP activities: during the year 1970 five conferences took place (Working Conferences, Seminars or Workshops directly organized by IFIP, i.e. excluding events where IFIP was acting as a co-sponsor. During the same year, 4 books were published.

Although there is no specific time when it can be said there was a formal transition in IFIP, it is clear that the last years of the period 1969 - 1970 (which marked its 10th anniversary) was a period when many people active in IFIP started to think about the Federation, its organization, its purpose and general objectives. They started reconsidering many of its aspects and giving a lot of thoughts to possible ways of improvements.

One very important aspect of IFIP is the fact that all engaged people are volunteers. For everyone, IFIP duties come on top of one's main job which usually is already more than a full-time job! It is, therefore, obvious that even being extremely active in IFIP and motivated to do the best possible job, those engaged in the Executive Body could only spend a limited amount of time in administering the Federation. This situation led to a first series of decisions whose objectives were to set the base for a more formal administration of IFIP (the need of which was more and more clearly felt) and to help the Executive Body and the Council in discharging their duties.

In 1969, IFIP had decided: to split the job of Secretary/Treasurer in two separate jobs, to establish a permanent Secretariat in Geneva, to establish an Activity Planning Committee (under the chairmanship of H. Zemanek), and to change the voting system in the General Assembly: every member has since then one vote each (independently of the importance of the country represented or the annual dues for instance).

The more recognized acute needs were: coordination and better planning of activities, better communications in IFIP, an active Secretariat which would execute all administrative duties and be the contact with the outside world, a clearing place for the list of all people active in IFIP with their addresses, etc.

The measures decided in 1969 were addressing these problems and were the first of a long series which took place progressively during the following years.

As already mentioned, IFIP's growing importance (measured in terms of national members, Technical Committees, Working Groups, Special Interest Groups and their activities, international relations with governmental and professional organizations, etc.) was calling for a more efficient organization and also improved communications within IFIP and between IFIP and the outside world. These needs were expressed very often either explicitly or implicitly as well as the urgency for IFIP to present itself to the outside or, in other words, to better inform on what IFIP is, its objectives and activities.

The then IFIP Presidents: Prof. H. Zemanek (1971-1974), Dr. R.I. Tanaka (1974-1977) and Prof. P.A. Bobillier (1977-1983) worked consistently to develop in IFIP better and more formal management methods and tools to respond to the well recognized requirements mentioned above. One motivation being obviously that there is no reason not to apply to IFIP the same management rules and methods in force in private organizations.

IFIP Programme Committee Meeting in Kiev, September 1969

from left to right: K. Samelson, Th. Herborg-Nielsen, F. Genuys, H. Zemanek, C.C. Gotlieb (missing: V.M. Glushkov, V.A. Kovalevsky, Bl. Sendov).

IFIP 10 Years Celebration, Amsterdam 1970

President A.A. Dorodnicyn hands over to I.L. Auerbach the Honorary Member Plaque

IFIP COUNCIL MEETING

MAY 9, 1970

ATLANTIC CITY, U.S.A.

seated in front : S.D. Duyverman

In 1970, IFIP requested the Secretary to study the possible transfer of the IFIP seat from Liège to Geneva. The transfer was then made in 1971 and brought several advantages: possibility for the General Assembly to organize ballots by correspondence when needed, no obligation to have a Swiss representative in the Executive Body; the Swiss authorities confirmed IFIP would be tax free and, as a member of the FIIG (Federation of International Non-governmental Institutions in Geneva) not submitted to the restrictions relating to foreign labour.

The Administrative Secretariat was temporarily assumed by P.A. Bobillier, with the support of his employer in Geneva, until it was subcontracted to a private organization which established itself in Geneva for this purpose. This solution did not satisfy IFIP and the General Assembly decided in 1971 to establish its own Secretariat with a full-time IFIP employee. This was extended in 1974 by an additional half-time headcount. Several personnel changes occurred during the period 1971-74 until the situation settled in January 1975 when Mrs. Gwyneth Roberts took over the Secretariat. Since this time, Gwyneth Roberts has given an outstanding service to IFIP, organized and continuously improved the services of the Secretariat. She was appointed in 1978 as IFIP Administrative Manager by the General Assembly and was granted the IFIP Silver Core award in 1980 in recognition of her outstanding services.

In addition to being the 10th Anniversary of IFIP, 1970 was also the year of the first World Conference on Computers in Education, organized in Amsterdam by TC 3 and IAG.

FIACC (the Five International Associations Coordinating Committee) was established and met for the first time the same year. This Committee, which was the result of the efforts by Prof. V. Broida of IFAC and Prof. H. Zemanek, then IFIP Vice-President, was gathering officers from its 5 members, AICA, IFAC, IFIP, IFORS and IMEKO. It has as essential objective the coordination of the activities of the associations involved and is a forum for discussion of all aspects of common interest. (AICA, the Association Internationale de Calcul Analogique, was renamed some years later as IMACS: International Association for Mathematics and Computers in Simulation). The President of FIACC is appointed for a period of two years and is chosen successively from the 5 member federations. H. Zemanek served as Vice-Chairman from 1970 to 1973 under the chairmanship of Prof. V. Broida who was Chairman from 1973 to 1975. According to the turnus rule, the chairmanship came back to IFIP in 1983 and K. Ando, the today's IFIP President, is the FIACC Chairman for the term 1983-85.

In parallel to the overall development, IFIP members were increasing, thus "covering" more and more the surface of the globe. Acquisition of new members was a constant preoccupation of the Presidents and their Council. This is quite natural for a federation which wants to be truly international. Significant efforts were made by many individuals who, during their travels, always multiplied personal contacts and tried to inform on IFIP, its objectives, the advantages brought through membership to country organizations, etc. As a result, new members were progressively joining the General Assembly as illustrated in the table printed in this book which shows IFIP membership since its creation. This had several effects, one of the most important and positive one being that, through active membership in the General Assembly, Council and Technical Committees, they requested a better spread of activities from the geographical point of view.

The answer to this pressure was that Council and General Assembly increased their efforts to organize their meetings in various parts of the world. The Council and General Assembly meeting locations can be found in the table printed in this volume. Several Technical Committees did the same so that many countries which had had little opportunities to be closely associated with the IFIP life and activities could host such meetings. In most cases they were organized

IFIP CONGRESS 1971 Lubljiana Reception in the Townhall

among the group:
M. Osredkar (3rd from left), D. Dular, H. Zemanek,
...A.A. Dorodnicyn, Mrs. Osredkar, I.L. Auerbach, ?.

from left to right:
D. Dular, P. Zeleznikar, H. Zemanek, I.L. Auerbach, A.A. Dorodnicyn

adjacent to local events like national society annual computer conferences, or, in certain cases, regional conferences organized by several countries. IFIP could then cooperate by providing speakers and panelists. All these activities contributed to improve communications and to a progressively growing understanding of IFIP in these countries.

The value of such IFIP events to "remote" countries can be measured by the fact that in several cases, the local organizers were able to raise funds to support those IFIP participants who needed it. In most cases, the feedback was that informatics or computer science activities were significantly stimulated after such IFIP events.

Such a cooperation between the "host" and the IFIP "guests" is a good example of what an international federation like IFIP can accomplish, even with limited financial resources.

Other examples will be mentioned later on.

1971 was the Congress year. IFIP Congress 71 took place in Ljubljana in September 1971 and was a success from the participation point of view (2'500 participants from 49 countries) as well as from its technical contents (29 invited speakers from 11 countries and 214 submitted papers from 35 countries). It was also stressed after the Congress that the presence of IFIP in Ljubljana during two weeks (IFIP internal meetings and the Congress week) had substantially contributed to stimulate and further the development of informatics in Yugoslavia, and resulted in a better understanding of IFIP.

Following the recommendation of the ad-hoc committee on Design of National and International Data Networks, the General Assembly approved the establishment of the Technical Committee 6 on Data Communications. The chairman was appointed during the next year General Assembly meeting in the person of A. Curran. It also approved the active participation of TC 6 in the appropriate study groups of the CCITT, the CEPT and the ISO.

Three Working Groups were also approved: WG 3.3 Instructional Uses of Computers, WG 3.4 Post-secondary Education and Vocational Training and WG 4.2 Requirements for Interface for Input and Output procedures in Medical Computers Applications (the latter being established definitively in 1972).

In 1971, several decisions were made along the same lines as the previous measures:

- IFIP National Correspondents were introduced. The objective was to establish an additional line of communication between IFIP and its national members and to assist the General Assembly member in discharging his duties. One mission of these correspondents is for example to advertise the IFIP Congress, to stimulate the submission of papers and the attendance to the Congress, etc.
- The existing committees were reinforced and a separate committee established: the Public Information Committee.
- The two former committees CLIPO (Committee for Liaison with International Professional Organizations) and CLIGO (Committee for Liaison with International Governmental Organizations) were merged into ICIL (IFIP Committee for International Liaison) which became the interface to all other international organizations, especially UNESCO.
- IFIP signed in 1971 a first contract with UNESCO for the preparation of a "Survey of high education requirements". This contract was followed during the subsequent years by several others in various fields, in particular relating to developing countries.

The same year the General Assembly decided to double the member dues to provide a more stable source of income for IFIP essential services. A third Vice-President was added to the Executive Body, thus allowing a better work distribution and also a better representation of the various parts of the world in the Executive Body.

The new IFIP President, Prof. H. Zemanek, took his office at the end of the IFIP Congress 71 from A.A. Dorodnicyn.

During the next years, the efforts continued in the same line. Two areas should be mentioned. The first one is the Activity Planning, the other Policies and Procedures.

The Activity Planning Committee, chaired by H. Zemanek (1969-70) then by R.I. Tanaka (1970-74), gathered several times for several days working sessions and produced an extensive report covering the APC charter, formalizing the six-years plan of activities, establishing the Technical Committee review mechanism, the Task Groups in charge of investigating new fields of activities where IFIP was not involved and making recommendations to the General Assembly on what to do in those areas. (such areas as software engineering, computer architecture, social sciences applications, government applications, data bases, computer aided design, etc. were analyzed), and formalizing rules for conducting IFIP activities. Since this period, the APC has continued to play an increasingly important role in IFIP.

In the area of Policies and Procedures, the Statutes and By-laws Committe (SBC), chaired by R.I. Tanaka, (1971 - 1973) organized the set of IFIP rules in a series of hierarchical documents: Statutes and By-laws, Standing Orders and Guidelines which were progressively approved by the General Assembly, printed and distributed in 1973 to all concerned. These documents are not only very useful but necessary to every one in IFIP as reference working documents, especially for those responsible for activities, within TC's, WG's and SIG's for instance. The SBC continued its mission, updating the Statutes and By-laws on a regular basis under Prof. N.J. Lehmann, its chairman since 1973.

In 1972, a new Technical Committee on Optimization, TC 7, was established by the Council to which the 1971 General Assembly had delegated the authority to approve its Aims and Scope. Under the chairmanship of Prof. A.V. Balakrishnan, TC 7 was charged of studying computational aspects of optimization problems arising in all areas. The Council approved in the same way the establishment of WG 5.1 Transportation Systems.

The General Assembly, during its meeting in Sofia, October 1972, established 4 new Working Groups: WG 5.2 Computer-Aided Design, WG 5.3 Discrete Manufacturing, WG 5.4 Common and/or Standardized Hardware/Software Techniques and WG 7.1 Modelling and Simulation. With the creation of 4 Working Groups in the same year, TC 5 was developing very rapidly and organized many events, some of them now well established as a series, for instance PROLAMAT and Ship Operation Automation.

The same year, IFIP was admitted in official relations with WHO (World Health Organization), Geneva. These relations continued to develop since this date at the satisfaction of both sides (TC 4 at the start and now IMIA).

This was also the implementation year of the IFIP Annual Report. This report was established with, as main purposes, to have a reference annual document on IFIP activities and also to increase the efficiency of General Assembly meetings. TC, IAG, Committee Chairmen and Officers were invited to submit their contribution to the Annual Report in time so that it could be distributed to all General Assembly participants several weeks before the General Assembly meeting. This was a very significant step in assisting Council and General Assembly members who could study it and be better prepared to the meetings. An additional motivation was the need to have a document available for outside people and organizations interested in IFIP activities. As H. Zemanek stated in the President's section of the next Annual Report (1972-73) he wanted to "move IFIP from an informal to a partially formalized organization."

In 1973 IFIP established an IFIP Foundation in Amsterdam after its charter was approved by the General Assembly. Its main purpose was to be the base for the Secretariat of the IAG Special Interest Group. The Foundation developed during the following years and served various IFIP functions including: Programme Committee for the Congress 77, for EURO-IFIP 79, for Congress 80, for MEDINFO 80, Secretariat for IMIA and some outside professional organizations such as ACM Europe. When IAG was wound up in 1980, and after a careful analysis of the foundation financial operations and perspectives, IFIP decided to close it.

During its meeting in Toronto, October 1973, the General Assembly approved new Working Groups: WG 2.4 Machine-oriented Higher Level Languages (its title was changed in June 1977 to System Implementation Languages), WG 4.3 Guidelines for Testing and Validating ECG-Analysis Programs, WG 6.1 International Packet Switching for Computer Sharing, WG 7.2 Computational Techniques in Distributed Systems and WG 7.3 Computer System Modelling.

Congress 74 took place in Stockholm in 1974 and was, again, a great success. It was visited by over 4'300 participants from 55 countries. The Technical Programme consisted of 41 invited papers, 174 submitted papers from 34 countries and 17 panel sessions. In addition to this success and thanks to a very careful professional management, it was also a success financially and brought to IFIP a surplus of about 190 KSfr. As mentioned already, congress surpluses are necessary to IFIP to maintain the activities to an acceptable level, the other sources of income - dues, royalties and interests being insufficient to bring the necessary resources. The second edition of the IFIP Summary was distributed at this occasion.

In parallel to the Congress and during the same week, TC 4 organized the first international conference on Medical Informatics: MEDINFO 74. The conference was quite successful and was attended by 930 participants from 33 countries. 350 papers were submitted to the ordinary sessions of which 147 were selected for oral presentation and 28 others for inclusion in the proceedings. MEDINFO 74 was the first of a series which has established itself since as the triennial World Medical Informatics Conference. The following ones took place in Toronto (1977), Tokyo (1980) and Amsterdam (1983). The next one is scheduled for October 1986 in Washington.

For the first time, the IFIP Silver Core Award was presented by President Zemanek to the 40 people who had qualified for it. The Silver Core Award was established in 1973 as a way to recognize those who had served for a period of six years and made valuable contributions to IFIP.

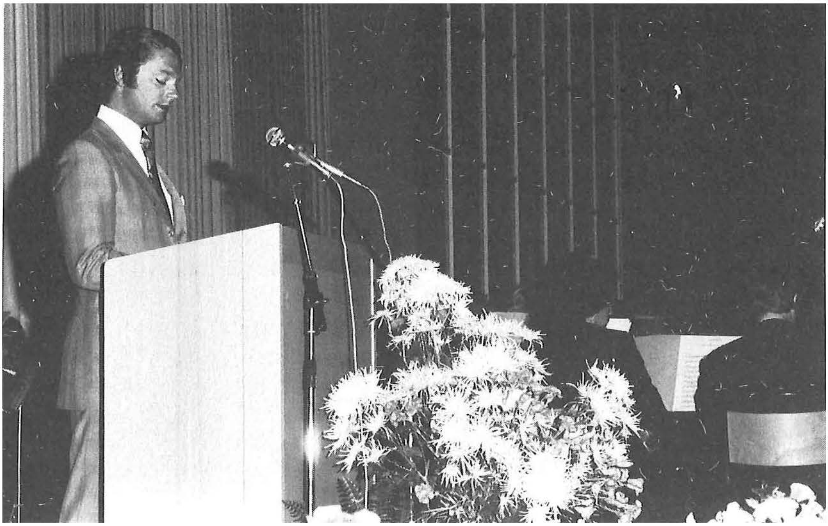
IFIP the same year was accepted as a member of CCITT on a mutual basis in the field of data communications. This cooperation has continued since then, especially through the IFIP TC 6. UNESCO through its UNISIST project agreed to support TC 6, more specifically to establish a new Working Group on International Information Networks.

Five new Working Groups were established by the General Assembly in 1973: WG 2.5 Numerical Software, WG 2.6 Data Bases, WG 5.5 Continuous Process Manufacturing, WG 5.6 Maritime Industries and WG 6.2 International Information Networks.

First Conference on "Human Choice and Computers"
Vienna 1974 - Opening Ceremony

from left to right:
H. Sackman, F. Gallouedec-Genuys, H. Zemanek,
E. Mumford, A. Dallinger, Bl. Sendov

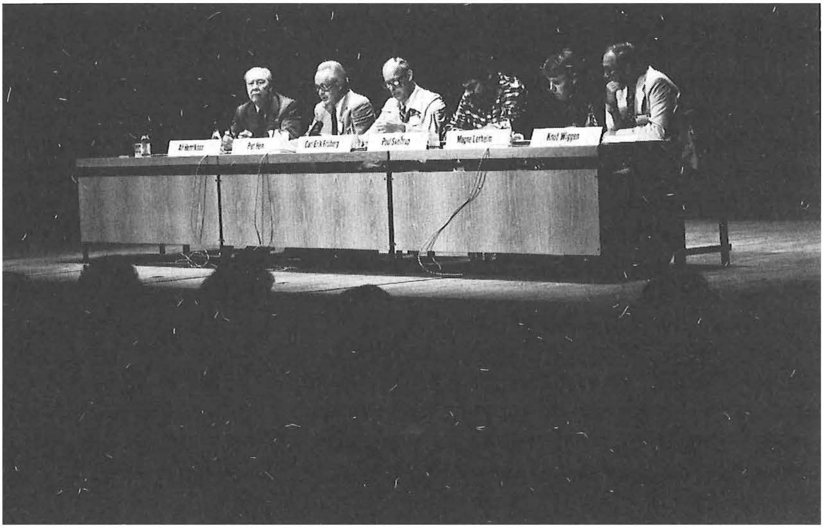
IFIP CONGRESS 74 Stockholm



H.M. King Karl XVI Gustaf opens the Congress

First row during the Opening Ceremony

from left to right: H. Freeman, H. Zemanek,A. Myrdal (Nobel Prize Winner 1982), H.M. King Karl XVI Gustaf of Sweden, S. Sem Sandberg



IFIP CONGRESS 74 Stockholm Panel Discussion

IFIP Congress 74 Programme Committee

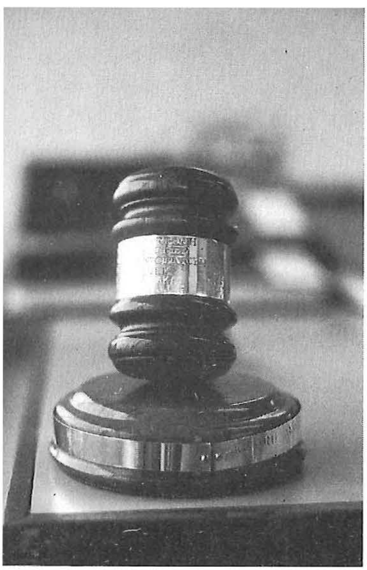
from left to right:
C.C. Gotlieb, Y. Shmyglevski, H. Freeman (Chm), M.V. Wilkes, J.L. Rosenfeld, W. M. Turski, J. Hebenstreit, T. Sakai, H. Zemanek (IFIP President).

IFIP CONGRESS 1974 Stockholm

Closing Ceremony

from left to right:
H. Zemanek, N.J. Lehman, K. Samelson, L. Gvosdjak,
L. Dadda, J.M. Bennett, H. Keilhau, L. Lukaszewicz.

H. Zemanek passes the President's gavel
to his successor R.I. Tanaka



President's gavel

The General Assembly made several decisions relating to its internal administration; the most important one was to convert all accounting information from US$ to Swiss Francs. There were many reasons for this change, among which the fact that a significant part of the expenses were, and still are, spent in Geneva. The conversion was made end of 1974 at the conversion rate of 1 US$ = 3,23 SFr. Since that date the IFIP books including the member dues have been kept in SFr. The General Assembly also adopted the Standing Orders which were subsequently printed and distributed to all functions. They contain useful information on rules and procedures which are not included in the Statutes and By-laws.

Upon invitation by the APC, a meeting took place in London, February 1974 gathering the Executive Body, the APC, the TC and IAG chairmen. This "combined" meeting, an old idea of H. Zemanek, proved to be very successful. For the first time the IFIP technical power came together with the other committees and several suggestions were discussed to improve the communications and the operations of the various groups. This meeting contributed to a better understanding of the six-years plan of activities and the need for a precise schedule for its establishment. A second meeting was held in November 1974 in Amsterdam. Such meetings were not continued thereafter until 1978, when it was re-established by the then President, P.A. Bobillier. Combined meetings took then place twice a year, adjacent to Council or General Assembly meetings, with only a few exceptions, for instance in 1980, where Council and General Assembly meetings added to the two congress weeks in Tokyo and Melbourne made it impossible for practical reasons.

1974 saw also the first International Conference on Human Choice and Computers. This conference was the result of several years of efforts, in particular by H. Zemanek who strongly believed that IFIP had to play an important role in this field on the international scene. The conference took place in February 1974 in Vienna and its success resulted in a proposal that a new Technical Committee be established to become a forum to study the impact of computers on the society. The proposed title was "Relationship between Computers and Society". The General Assembly agreed to it in principle and asked the Task Group to make a final proposal to the next General Assembly meeting. TC 9 was established in 1975, chaired by Prof. C.C. Gotlieb. Its scope included the influence of the applications of computers to individuals, groups, institutions and society. It was specified that TC 9 would not concern itself with strictly technical developments dealt with by other IFIP TC's. The TC 9 establishment was very significant for IFIP since for the first time, it recognized the importance of this field and the fact that being the umbrella for informatics and its applications, it could no longer stay away from these aspects. The Austrian government expressed its appreciation for the HCC Conference success by awarding to Heinz Zemanek one of the highest Austrian government distinction. A second conference "Human Choice and Computers" was organized in June 1979 in Baden, Austria, with the same success as the first one and the Proceedings were published by North-Holland as well as in 1979. The third such conference is scheduled for September 85 in Stockholm.

At the end of the IFIP Congress 74, President Zemanek passed the gavel to his successor Dr. R.I. Tanaka who took his office for the period 1974-1977.

The Council, during its March 1975 meeting in Tokyo, approved the establishment of TC 8 Information Systems which had been proposed in 1974. The objectives of this newly established TC 8, under the chairmanship of Prof. B. Langefors, were to study all aspects of Information Systems, including concepts and theory, methods for their design, implementation and maintenance as well as their influence upon organizations and society.

IFIP GENERAL ASSEMBLY 1976 Tashkent

From left to right:
Sh. Tulyaganov (Tashkent),N.J. Lehmann, Th. Herborg-Nielsen, J.E.D. Navez,
G. Roberts, H. Keilhau, Ph. Renard, R.I. Tanaka, J. Tuori, L. Iliev,

The most important event in 1975 was the second World Conference on Computers in Education which took place in Marseille in September 1975 and was attended by over 1'000 participants from 57 countries. Thereafter WCCE became a well established international conference; the third took place in 1981 in Lausanne, Switzerland, and the fourth one is scheduled for end of July 1985 in Norfolk, USA.

In 1975 for the first time, IFIP during its General Assembly meeting in Rio de Janeiro, admitted an Affiliate Member: IAPR - The International Association for Pattern Recognition. This decision was welcomed on both sides as IFIP had no direct activity in this field, although it was considered as very important, and IAPR had, during its three years of existence, organized two International Joint Conferences on Pattern Recognition and was planning to continue such activity every two years. It did indeed: the 7th conference was held in 1984 in Montreal and the 8th is scheduled for 1986 in Paris.

The 1975 General Assembly approved the establishment of WG 2.7 Operating System Interfaces and WG 6.3 Human Computer Communications.

During the same meeting, the General Assembly accepted the joint invitation from the Australian Computer Society and the Information Processing Society of Japan to hold the IFIP Congress 80 in both Japan an Australia. This joint proposal came in 1975 as a result of various discussions during the 1974 General Assembly meeting in Stockholm where both Japan and Australia were bidding for hosting IFIP Congress 80. All IFIP Congresses so far had been held either in Europe or in North America. Moreover, Japan's invitation to host Congress 74 and Australia's one for Congress 77 had been turned down. It was the general opinion that Congress 80 should take place in Asia or Australia. It was also obvious that accepting one of the two invitations would mean that an IFIP Congress would not go to the other continent before many years. Consequently, the suggestion was made to the bidding societies: why not stop competing, join the efforts and come with a common proposal? What was done at the Rio General Assembly meeting. The decision to hold Congress 80 as a Japan-Australia split Congress proved later on to be the best decision IFIP could have taken: both Japan and Australia got the benefits of hosting an IFIP Congress, and it was very successful.

In 1976, following a recommendation of the Task Group on Computer Systems Architecture, the General Assembly, meeting in Tashkent, approved the establishment of the TC 10: Digital Systems Design under the chairmanship of Prof. D. Aspinall. Interestingly enough, it is only 16 years after its foundation that IFIP formalized technical activities in hardware by establishing TC 10 although this field had been a technical area in the programme of all Congresses. The objectives of the Committee are the promotion and coordination of information exchange on concepts, methodologies and tools in the design of digital systems: concept, architecture and organization, logical design, performance evaluation, specification and design methodology, microprogramming.

General Assembly also approved the change of the title of TC 4 to Information Processing in Health Care and Biomedical Research and authorized the establishment of WG 4.4 Data Protection in Health Information Systems and WG 8.1 Design and Evaluation of Information Systems.

General Assembly also approved the termination of WG 6.2 International Information Networks. This Working Group has been created for the specific purpose of making a study for UNESCO. The report in Information Networks for On-line Bibliography Retrieval had been completed and favourably received by UNESCO, which completed the mission of WG 6.2.

The same year, the General Assembly decided to increase the number of trustees from 6 to 8. At the same time it decided that a trustee not attending two consecutive Council meetings would be deemed to have resigned from the Council; these measures, again, were taken in order to ensure a better distribution of the workload, allow for a better geographical representation in the Council of all parts of the world and increase Council efficiency.

Although not directly related to IFIP at this time, the first SEARC Conference (South East Asia Regional Computer Conference) took place in Singapore in 1976. IFIP sponsorship had been approved by the General Assembly in 1975. IFIP wanted in this way to demonstrate its interest in informatics developments in South East Asia and its desire to strengthen the contacts with the computer societies of this region. SEARCC got also some UNESCO support, in particular through negotiations of the ICIL Committee. SEARCC'76 was followed by several such conferences in 1978 (Manila), 1980 (Jakarta), 1982 (Kuala Lumpur) and 1984 (Hong Kong). The good relations established during the 70's between the members of SEARCC and IFIP resulted in a request by the General Assembly to the Committees Activity Planning and Statutes and By-laws to find a solution allowing the members of the newly formed federation SEARCC (The South East Asia Regional Computer Confederation), established in February 1978, to be associated to IFIP. This was done in 1980; the General Assembly approved two new categories of membership: Regional Members and Corresponding Members with the objective of easing the participation to IFIP activities of groups of countries or computer societies too small to afford a full membership. SEARCC applied for membership and was admitted as a Regional Member by the General Assembly in September 1982. This event was very significant for the expansion of IFIP since the South East Asia Regional Computer Confederation was grouping seven countries: Hong Kong, India, Indonesia, Malaysia, Philippines, Singapore and Thailand. India was already a full member so that, through this admission, six new countries joined IFIP. In September 1984, a new society , the Computer Society of Pakistan, joined SEARCC and is, therefore, now also represented in IFIP.

During its meeting of March 1977 in London, the Council approved the establishment of WG 8.2 The Interaction of Information Systems and the Organization.

1977 was the year of the Congress. Organized by the Canadian member of IFIP, it took place in Toronto in August 77 and was attended by over 3'500 participants from 49 countries. This number includes 866 dual registrants to MEDINFO '77 which took place during the same week in Toronto and had over 1'000 participants. This conference was the second international conference on medical informatics and the series continues now every three years as the most important international event in this field.

IFIP Congress 77 was a great success from the technical contents point of view: 97 sessions with 165 papers including 24 invited ones, 29 panels and 4 symposia. An effort had been made by the Programme Committee to respond to past critiques of Congress participants: to be less theoretical and academic and give a larger part to practical applications and new fields of interest to practitioners. The result was a programme which was more slanted towards popular expectations, dealing with more subjects of interest to practitioners, slightly less academic. Opinions of participants were mixed as can be expected. However, it was noted that large audiences were drawn by sessions on Data Management and Data Bases, general topics in Software and Computer Networks; such subjects as Hardware and Computer Aided Design saw a normal audience, whereas those on Numerical Methods and Process Control were neglected. The panels were generally considered as a success as being an excellent way to bring together specialists with very different positions on a given subject and allowing interactions between participants and panelists.

The financial success matched the technical success since the surplus was slightly over 200 KSfr. As stated already, such surpluses are necessary to IFIP to pursue its overall programme of activities.

For the second time the IFIP Silver Core Award was presented by President Tanaka during the closing ceremony to the 21 recipients who had qualified thanks to their contributions to IFIP over the last six years.

In addition, the General Assembly elected Prof. H. Zemanek as IFIP Honorary Member as tribute to his deep devotion and dedication to IFIP. H. Zemanek received also in June 1978 for his scientific contributions the Johann Josef Ritter von Prechtl Medal from the Technical University of Vienna, a very rare and high distinction. We will come back later on to other activities performed by H. Zemanek, in particular for the IFIP Publications.

The third IFIP Summary was published in 1977 and distributed to all Congress participants. Its usefulness was not only confirmed by IFIP people and Congress participants but from other outside sources as well.

The same year, the Working Groups 9.1 Computers and Work and 9.2 Social Accountability were established. The establishment of these two WG's was an important step for TC 9 whose members had decided to start working groups in these two areas, very controversial by nature.

During the closing Ceremony of the Congress, President Tanaka passed the gavel to his successor Prof. P.A. Bobillier who took office for the period 1977 - 1980.

In February 1978, the Council met in Bombay, India, first official IFIP meeting in South East Asia. This was an opportunity to meet the members of the Computer Society of India and for several Council members the occasion to participate in its Annual Convention in Calcutta and to discuss matters of common interest with the CSI Board.

After the initiative of the Public Information Committee, chaired by G.J. Morris since 1977, the first issue of the IFIP News was published in April 1978. This publication was intended to improve communications between IFIP and the general public. IFIP members were encouraged to contribute articles for publications and also to reprint its contents, in their local journals, for instance.

The General Assembly, during its Oslo 1978 meeting in September 1978 admitted IASC (International Association for Statistical Computing) as second Affiliate Member. Dov Chevion (former delegate of the Information Processing Association of Israel) was elected Individual Member for 3 years.

It also approved the establishment of the following Working Groups: 5.7 Automation of Production Planning and Control, 10.1 System Concepts and Characteristics, 10.2 Digital Systems Descriptions and Design Tools and 10.3 Software/Hardware Interrelation. The creation of these three working groups within TC 10 was a significant step in TC 10 technical activities which continued since then to develop in those as well as other important areas.

The increasing number of working groups was obviously reflected in the number of technical activities, especially working conferences whose proceedings were published by North-Holland. During the period July 1977 to June 1978 12 books were published. This number continued to grow and IFIP publishes now over 20 books per year.

An ad-hoc committee, the Future Policy Committee, was established, chaired by Prof. R. Narasimhan. It was the general feeling of the Council that IFIP had grown to a point where it was necessary to take a critical look at the Federation. The committee was established to look into the IFIP aims and scope, structure and activities and to make recommendations to the General Assembly for a possible restructuring of IFIP. During the March 1980 Council meeting in Sofia

IFIP COUNCIL MEETING 1980 Sofia

From left to right: Kenderov, K. Ando, H. Zemanek, G. van der Veer, G. Boyd, R.I. Tanaka.
Other side of table: A. Eskenazi, M. Ozeki, ?, P.A. Bobilllier.

Acad. Iliev hands over to H. Zemanek the Marin Drimov medal of the Bulgarian Academy of Sciences

IFIP COUNCIL MEETING 1980 Sofia

from left to right:
Ph. Renard, P.A. Bobillier, G. van der Veer,
R. Narasimhan, A. Solvberg, H. Zemanek

a combined meeting of the FPC, APC and Executive Body took place with the objective of reflecting on what IFIP should be and do for the next ten years. A report summarizing the discussions of this brain storming session was distributed in May 1980 to all General Assembly members, TC, WG and SIG chairmen for their reflections. It contained, among other things, recommendations to develop activities in applications, spend more energy and resources to developing countries, establish corresponding and regional membership and review the plans for congresses and regional conferences. This important report laid the base for further discussions and plans.

IFIP was invited to participate to the SPIN Conference - UNESCO-IBI Conference on Strategies and Policies in Informatics, in Torremolinos in August/September 1978. During this conference, the UNESCO-IFIP cooperation was discussed and, in particular, the possible UNESCO support to IFIP activities relating to developing countries. A recommendation was adopted by SPIN asking UNESCO to provide encouragement and support to the activities of IFIP and other international non-governmental organizations in relation to developing countries; for instance, holding of country seminars and meetings in cooperation with local groups, support of developing countries delegates to technical meetings, support to technical experts to work with local groups in organizing educational programme meeting local needs, etc.

IFIP responded to the conclusions of this important conference by the creation of the IFIP Committee Informatics for Development (ICID) whose members were in majority from developing countries. The first ICID meeting took place in Paris, UNESCO House, in June 1979. As part of that meeting the following activities were discussed and plans initiated for their implementation during the coming years: identify the needs of developing countries, organize training courses and seminars in those identified areas, help participants to attend IFIP activities by finding subsidies from various sources, plan IFIP events in developing countries, assure the flow of information between IFIP and the countries. The initial programme was quite ambitious and could start only on a limited basis. For instance in 1980, IFIP was considering 10 activities for which a UNESCO support in the amount of 90 K$ was necessary. Because of budget constraints UNESCO could support six of these events and in a very partial way only: the total contribution to these events for 1980 was 20 K$. These six events took place in Bombay, Madras, Ankara, Ibadan and South East Asia, in addition to the IFIP Congress 80, Tokyo and Melbourne. ICID and its activities will be discussed in more details in the final section of this paper.

In September 1978, a combined meeting gathering TC, IAG and Working Group chairmen together with the Executive Body and APC members took place in Oslo before the General Assembly meeting. It gave the opportunity to the participants to exchange their experiences and ideas about many aspects of IFIP operations and activities. It was recommended to organize such a meeting on a regular basis. This was done: during the following years one or two such meetings took place every year with the exception of 1980 where no convenient date could be found.

1979 was the year of EURO-IFIP 79, the first IFIP European Conference on Applied Information Technology. The decision to organize EURO-IFIP 79 had been taken in principle by the General Assembly in 1976 in Tashkent and finally approved by the Council in 1977. The basic reason for having an European event in 1979 was the fact that, after the decisions to hold Congress 77 in Toronto and Congress 80 in Tokyo/Melbourne, there would be at least 9 years after the Stockholm Congress 74 before a new congress could take place in Europe. EURO-IFIP 79 took place in September 1979 in London, organized by the British Computer Society. It was a 4-days conference with 26 invited and 77 submitted papers and 11 panel discussions. The programme was very well received by the 975 participants coming from 42 countries, half of them from the United Kingdom. The conference closed with a small surplus.

IFIP GENERAL ASSEMBLY 1978, OSLO, NORWAY

Members and observers to the IFIP Council and General Assembly meetings assembled during the excursion on September 14th, 1978, outside the Najaden Restaurant at the Bygdøy peninsula after the luncheon.

The sailing ship in the background is GJØA, the vessel used by Roald Amundsen of Norway in doscovering the North West Passage in 1903-1906, sailing from the Atlantic Ocean south of Greenland, then north of Canada to the Bering Sea.

It was also the year of the transformation of the TC 4 Health Care and Biomedical Research into an IFIP Special Interest Group: IMIA (International Medical Informatics Association). This transformation had been approved by the General Assembly in September 1978 in Oslo and became effective in 1979, after the IMIA inaugural meeting of 10-11 May 1979 in Paris.

1979 saw also the first meeting of ICID mentioned earlier, and the publication of the first issue of Computers and Industry, the TC 5 journal, published quarterly by North-Holland.

During its London meeting, the General Assembly approved the establishment of two Working Groups: WG 6.4 Local Computer Networks and WG 6.5 International Computer message Systems. It also accepted the invitation by AFCET to hold the IFIP Congress 83 in Paris.

The General Assembly elected Dr. R.I. Tanaka, former AFIPS representative to the IFIP General Assembly and Past-President (1974-77) as IFIP Honorary Member in recognition of his numerous accomplishments towards the IFIP objectives during the past years.

P.A. Bobillier was re-elected as President for a second term (1980-1983).

During the March 80 Council meeting in Sofia, Academician B. Sendov, Vice-President of the Academy of Sciences of Bulgaria, presented its Marin Drinov Gold Medal to Messrs. A.A. Dorodnicyn, H. Zemanek, R.I. Tanaka and P.A. Bobillier for their outstanding contributions to informatics and the international scientific cooperation in their IFIP activities.

A first meeting of APC (Activity Planning) and FPC (Future Policy) committees took place before the Council meeting and discussed the results of the questionnaire sent to all General Assembly members at the end of 1979 soliciting opinions on specific items and suggestions regarding the directions IFIP should be heading for in the 80's. It was decided to distribute the results of the meeting discussions to all General Assembly members and TC and WG chairmen. Important aspects were addressed such as: scope of IFIP, membership, activities, organization and structure, publications and communications.

IFIP CONGRESS ON TWO CONTINENTS

For the first time in 1980, IFIP held its congress on two continents: Asia and Australia. It was also the first one taking place in this part of the world. Thanks to the excellent cooperation of the Organization Committees of the Information Processing Society of Japan and the Australian Computer Society and in spite of its potential difficulties IFIP Congress 80, the 8th World Computer Congress was extremely successful by the quality of the programme as well as by the total attendance. It was organized on two consecutive weeks: Tokyo, 6-9 October 1980 and Melbourne 14-17 October 1980. The technical programme planning was especially challenging as it had to be attractive and as complete as possible for those participants deciding to visit one site only. The total programme consisted of 36 invited papers, 114 submitted papers and 32 panels. Prof. F.H. Sumner, chairman of the Programme Committee, succeeded in having the 36 invited speakers to present their paper at both locations. 17 panels were presented at Tokyo and 18 at Melbourne. Because there were 5, respectively 6 parallel sessions in Tokyo and Melbourne, those participants visiting the two locations (about 420) could follow a completely different series of presentations.

The total attendance was 3'662 from 53 countries; 2'300 in Tokyo and 1'800 in Melbourne. The associated computer exhibition saw a record number of visitors:

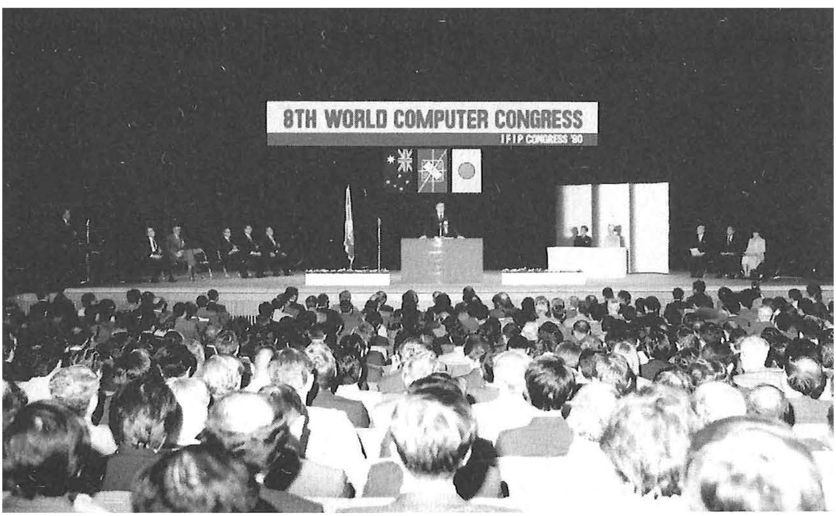
IFIP COUNCIL MEETING 1979 Bratislava

from left to right:
interpreter, H. Zemanek, K. Ando, J. Bennett, J. Tuori (covered),
Ph. Renard, ?, A.W. Goldsworthy, ?, Gene Tanaka, G. Boyd, R.E. Kalman,
R.I. Tanaka, G. Morris, O. Zich, T. Sakai, Gwyneth Roberts, P.A. Bobillier,
S. Passman, N.J. Lehmann, Mrs. Sakai, ? (covered), Mrs. Zemanek, L. Gvosdjak

Demonstration of the status of the Compact Journal (Programming done in Holland, Host Computer in Germany, Demonstration in Japan), at IFIP Congress 1980.

IFIP CONGRESS 1980 Tokyo

Arrival of Crown Princess and Prince



Opening Ceremony

120'000 in Tokyo and 55'000 in Melbourne. The financial results of the Congress were excellent since IFIP received a total surplus of about 350 KFrs.

The Silver Core Award was presented by President Bobillier to 32 persons for their services rendered to IFIP during the last six years.

MEDINFO 80, the 3rd World Conference on Medical Informatics, and the first one organized by IMIA, took place in Tokyo during the same week as the Congress and was attended by about 1'000 participants. Its technical programme consisted of 336 papers distributed in 28 sessions and 8 workshops.

A commemorative stamp was issued by the Japanese PTT's for Congress 80 and Medinfo 80, see page 137.

During its meeting in Melbourne, October 1980, the General Assembly established the Working Group WG 10.4 Reliable Computing and Fault-Tolerance. It introduced two new categories of membership: Regional members for groups of four or more countries and Corresponding members for small societies which cannot afford full membership.

IAG was wound up in September 1980 after a careful analysis had been performed by the IAG Board and the Review Committee which had been appointed by the General Assembly in 1979. As mentioned earlier, this had an impact on the IFIP Foundation whose main purpose was to support IAG; this lead to the closing of the Foundation in 1981.

The 3rd World Conference on Computers in Education took place in July 1981 in Lausanne, attended by 1'300 participants representing 63 countries. Thanks to the involvement of the Organizing Committee and the Programme Committee, it was a great success from both the programme point of view as well as from the financial one. An exhibition with 21 exhibitors from 6 countries, as well as the World Youth Programming Tournament whose winners were invited to the event were complementing this successful conference.

1980 was the 20th anniversary of IFIP. During the previous years, discussions were held on the opportunity to celebrate this 20th birthday. Many people were of the opinion that an event associated to an IFIP birthday should preferably be organized in Europe. As Congress 80 was scheduled in Japan/Australia and because it mobilized many IFIP volunteers, it was decided not to celebrate the 20th anniversary but instead, to organize an event at the occasion of the 25th anniversary in 1985.

In its meeting in Dublin, September 1981, the General Assembly admitted two new Affiliate Members: ICCC (International Council for Computer Communications) and EUROMICRO (European Association for Microprocessing and Microprogramming). General Assembly decided to hold Congress 86 in Dublin in October 1986. It established 2 Working Groups: WG 8.3 Decision Support Systems and WG 10.5 Very Large Scale Integration. It approved a proposal by the Public Information Committee (chairman G.J. Morris) to ask a professional journalist to write articles on the various activities of IFIP. The Council, in March 82, approved the choice of the PIC in the person of Mr. Kenneth Owen, former Technology Editor of the Times.

Within APC, task forces were established to study new areas of activities. It is interesting to note that at this point six such groups were investigating the following areas: Governmental and Municipal Data Processing, EDP Security, Office Automation, Computer Automation and Data Entry Processing, Economic Aspects of Standardization. As APC continued to develop and play a more and more important role, we will come back to it at the end of this paper.

In February 1981, the IFIP Information Bulletin no. 15 was published. It is worth mentioning this first special issue since it was replacing the IFIP Summary and was therefore giving, in addition to the usual information, all IFIP reference information such as: Council, General Assembly, Technical Committees and Working Groups, IMIA, aims, scopes and membership, IFIP Committees, National Correspondents, IFIP affiliations, etc. Reactions after this issue were very positive as measured, for instance, by the numerous requests received by the Secretariat for mailing further copies.

In 1982 during its Rome meeting, the General Assembly admitted its first Regional Member: SEARCC (South East Asia Regional Computer Confederation) as mentioned earlier. Six new countries were joining IFIP, thus contributing to strengthening IFIP relations with the informatics community in Asia. WG 6.1 was renamed to Architecture and Protocols for Computer Networks.

The General Assembly elected Dr. K. Ando, Vice-President and representative of the Information Processing Society of Japan, as President-elect, i.e. as IFIP President for the 1983-86 term.

Charters of several committees were approved by the General Assembly: Activity Planning, Admission, Finance, Publications, Public Information, Statutes and By-laws as well as those of the Conference Officer and the Publication Officer, responsible for advising editors and checking publications against policy, and the Conference Officer, responsible for monitoring IFIP activities in terms of authorizations, dates, places and publication of proceedings and updating the six-years plan of IFIP.

The first three articles by K. Owen, sponsored by the Public Information Committee, were published this year on the work and activities of TC 3: Informatics and Education - IFIP's new Initiatives, TC 6: Data Communications - IFIP International Network of experts and TC 10: Very Large Scale Complexity - the Challenge of Systems Design. They were very well received and published by a number of member societies in their journals, some of them after translation, and appeared also in professional and commercial journals.

1983 was a very important year. In addition to being the congress year, significant events took place as well as internal decisions regarding IFIP itself.

The first IFIP International Conference on Governmental and Municipal Data Processing took place in February 1983 in Vienna. Attended by 280 participants from 21 countries, it evidenced the need for more in depth investigations of this important field. It was thereafter decided to plan a second conference and to establish a task group to work out a recommendation as to what IFIP should do in the field of Public Sector.

CAPE'83, the first International Conference on Applications in Production and Engineering was organized in April 1983 in Amsterdam, by TC 5 with FACE and IFORS. Attendance was over 500 from 29 countries. It lasted 4 days, included 87 papers and 6 panels. TC 5 then decided to establish CAPE as a regular conference, the next one being scheduled for 1986.

IFIP/SEC'83, the first IFIP Security Conference took place in Stockholm in May 1983, attracting 325 registrants from 20 countries. It resulted in a proposal to the General Assembly to create a new TC on Security.

MEDINFO 83, the 4th International Conference on Medical Informatics, took place in Amsterdam in August 1983, organized by IMIA. More then 1'800 participants attended this event and an associated programme of seminars. A total of 400 papers were presented during the six days conference.

BACK TO PARIS

The IFIP Congress 83 took place in Paris, 19-23 September 1983. It was the first IFIP Congress in Paris, although the second world Informatics Congress, as the first such conference took place in 1959, before the creation of IFIP, sponsored by UNESCO. The technical programme consisted of 40 invited papers, 31 panels and 96 submitted papers with typically, 7 sessions in parallel. It included addresses by the French Prime Minister and UNESCO Director General during the opening session and by the IBI Director General during the closing session. Congress 83 was visited by 2'320 registrants from 31 countries. This attendance, especially the 850 local attendants, surprised the organizers as being much lower than the number of about 3'200 expected during the planning phase of the Congress.

The outcome of Congress 83 generated several in depth discussions within the IFIP Council and General Assembly, especially regarding the structure of the technical programme of future congresses. An ad-hoc committee had already been established by the Council in March 1983 with the task of rethinking the nature and the contents of the programme. This committee made recommendations to the IFIP Congress 86 Programme Committee which had already taken concrete measures towards restructuring of the programme. This programme with the theme AWARENESS will consist of 45 invited speakers, 90 contributed papers (of which half of them are expected to be solicited) and 30 invited panels with three to four panelists each. The Congress will favour presentations which will be oriented towards applicable results from science, application design, new possibilities in consumer applications, challenges and problems faced by edp consumers and management, aspirations and problems in developing countries, etc. In brief, a major emphasis to relevance to the today's preoccupations of our society. It is hoped, with this redirection of the Congress Programme, to better match potential participants' expectations and, therefore, attract more attendants, especially informatics practitioners, while maintaining the scientific level of the highly technical sessions.

Three new articles were published by K. Owen within the Public Information Committee covering the activities of TC 8: Formal Methods in an Informal World, IMIA: Health Informatics - the Vital Work of IMIA and TC 2: The Art and Science of Programming. These articles have been well received, as the previous ones.

During its Paris meeting, in September 1983, the General Assembly approved the establishment of TC 11: Security. Its creation was recommended by the Task Force appointed in 1981 to look into the subject of EDP Security & Privacy and extended in 1982 with the organizers of IFIP/Sec'83. The establishment of TC 11 was the result of the increasing worldwide awareness of the great importance of matters of computer security. TC 11's Aims and Scope were approved at the Cape Town Council meeting, March 1984, and include the promotion of security and protection as essential parts of information processing systems. A new title was proposed in 1984: Security and Protection in Information Processing Systems and was approved by the General Assembly. It also established two Working Groups: WG 3.5 Informatics in Primary/Elementary Education and WG 5.8 Product Specification and Product Documentation.

Two new Affiliate members were admitted: FACE (the Federation of Associations of Computer Users in Engineering, Architecture and Related Fields) and IJCAII (the International Joint Conferences on Artificial Intelligence, Inc.) bringing the number of such affiliates to six.

R. Narasimhan (outgoing General Assembly representative for India) was elected as Individual Member and appointed as chairman of the ICID Committee. His long experience in this field as well as his many contacts with International Organizations were considered by the General Assembly as the best base for continuing developing IFIP activities for and with developing countries.

IFIP CONGRESS 83 Paris

P.A. Bobillier speaking at the Reception in the Town Hall.

IFIP CONGRESSES

IFIP Congress Location	PC Chm PC VChm	Local Arr. Chm	Activities	Attendance people/countries	Exhibits
74 Stockholm	H. Freeman	P. Svenonius	COMP CHESS MEDINFO 74 Viking Day	4300 / 55	St. Eriks Mässan
77 Toronto	W.M. Turski E.G. Manning	J.N. Finch	COMP CHESS MEDINFO 77	3500 / 49	Exhib 77 Sheraton Ctr
80 Tokyo	F.H. Sumner A.P. Ershov	M. Ozeki	COMP CHESS COMP ARTS COMP MUSIC MEDINFO 80 Kabuki Theater Austral. Day	2300 / 53	Joint Exhib Int Trade Ctr 120 000 visit
Melbourne	same	A.W. Goldsworthy		1800	
83 Paris	D.C. Tsichritzis	J. Carteron	Paris Today	2320 / 31	SICOB at CNIT La Défense
86 Dublin	D. Björner	D.J. Dolan			

Several other important decisions were taken in view, again, of improving communications and internal operations: The IFIP Newsletter was created with Dr. Jack Rosenfeld as Newsletter Editor. The Newsletter's purpose is to keep those affiliated with IFIP informed of important IFIP events, to let national societies know what IFIP is doing and to publicise the work of IFIP as broadly as possible. The IFIP Newsletter is published quarterly by North-Holland. The first issue was published in November 1983 and 6 issues were published so far.

A Task Group on Restructuring was appointed following a proposal by the APC based on the need to review and reassess the operational structure of IFIP. This task group should investigate if the current structure (TC's, WG's, SIG's and Affiliate Members) is the most appropriate to the current environment and make recommendations to the General Assembly on how to adapt.

It was also decided formally to produce State of the Art Reports. This decision followed various suggestions and proposals which had been made by the Publications Committee during the last few years. It was hoped to see about six such reports per year, the editors being the Working Groups and the target audience practitioners and researchers in computer science. This series will be published with Springer Verlag.

During the period covered by the reports presented to the Paris meeting, TC chairmen and affiliate member representatives presented their Annual Reports detailing 42 conferences and workshops sponsored by IFIP. 20 books were published by North-Holland, each representing the proceedings of a Working Conference. Task Groups were working on the following subjects: Public Sector, Office Automation, History, Human Computer Interaction in addition to those mentioned above.

At the end of the IFIP Congress and following the tradition, President Bobillier presented 35 IFIP Silver Core Awards to honour those people who had rendered outstanding service to IFIP and turned over the gavel to the incoming President, Dr. K. Ando, for the 1983-86 term.

Special honours were received from IFIP people in their home country during the period 1982 - 1983:

A.W. Goldsworthy, Trustee and APC chairman, was awarded the Order of the British Empire (O.B.E.) in Her Majesty the Queen Honour's List. R.I. Tanaka received the AFIPS Distinguished Service Award. H. Zemanek received the Honorary Doctorate in Technical Sciences by the Johannes-Kepler University of Linz, Austria. In addition, in May 1984 he was elected member of the Austrian Academy of Sciences and received the same year the Leonardo da Vinci medal of the Société Européenne pour la Formation des Ingénieurs.

In 1984 IFIP completed its 25th year of existence. This year the number of members reached 45 with 58 countries represented in IFIP. These numbers were reached when the General Assembly, in its meeting of September 1984 in Varna, admitted CLEI (Centro Latinoamericano de Estudios en Informatica) as second regional member. CLEI is a grouping of ten countries: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela. As two of them, Argentina and Brazil, were already members of IFIP, CLEI brought therefore 8 new countries in IFIP. In addition, as mentioned earlier, the Computer Society of Pakistan had joined SEARCC in September 1984 and, therefore, joined the IFIP family.

The General Assembly decided that the IFIP Congress 89 will take place in San Francisco. It further decided to change the guidelines for the Congress Site Selection Committee; in the future the site selection will be made five years before the Congress. It approved the new name of TC 11: Security and Protection in Information Processing Systems.

The Publication Committee indicated that the 100th Working Conference Proceedings was in print by North-Holland. This is a measure of the work accomplished by the Technical Committees since these proceedings are the most visible output of their activities.

The General Assembly approved several recommendations made by the APC. In particular in the areas of structure and operation of Review Committees for TC's, the preparation of the six-years plan of activities now implemented on a Personal Computer by the Conference Officer.

It also approved the programme of the IFIP 25th Anniversary scheduled to take place in Munich on 27 March 1985 at the occasion of the Council meeting.

A new article by K. Owen appeared in December 1984: Computers in Industry - From the Design Office to Shop-floor, the work of IFIP's TC 5.

Interact'84, the first IFIP Conference on Human-Computer Interaction was held in London in September 1984, organized by the Task Group of the same name. About 600 participants heard 153 papers. Results should be presented to the General Assembly in 1985, including recommendations on if and how to continue activities in this field.

IFIP AFTER 25 YEARS

After 25 years of existence, it is interesting to stop for a while and make some reflections on the today's role and status of IFIP, its size, its organization as well as its reputation within the society.

When preparing the celebration of the 25th Anniversary in Munich, March 1985, significant efforts were made to address these aspects, especially around the Task Group on Restructuring. Instead of listing all of them, we have chosen to discuss some of the today's active committees which we consider as very important for the IFIP operation and its future existence.

Let us first describe briefly the Federation at the end of its 25th year and compare it to what it was in 1970.

The member of countries represented in IFIP increased from 29 to 58. From 5 Technical Committees with 7 Working Groups and one Special Interest Group, IFIP developed into 9 Technical Committees with 38 Working Groups and one Special Interest Group (IMIA) with 10 Working Groups. It has now 6 Affiliate Members.

IFIP is in official relations with the following international organizations:

- ICSU (International Council of Scientific Unions): IFIP has been a scientific affiliate since 1969.
- UNESCO: IFIP is a non-governmental organization member, category B ("able to advise in a particular field").
- FIIG (Fédération des Institutions Internationales semi-officielles et privées établies à Genève): IFIP is a member since 1971.
- WHO (World Health Organization): official relations were established in 1972. They continue now through IMIA.
- CCITT (International Telegraph and Telephone Consultative Committee of the International Telecommunication Union): IFIP is a member on a mutual basis.
- ISO (International Standardization Organization): IFIP (especially TC 2 and TC 6) contributes as technical adviser in the fields of Information Processing (ISO-TC97 in particular).
- IBI (Intergovernmental Bureau for Informatics): mutual observer relations.

- IFAC, IFORS, IMACS and IMEKO within the FIACC (Five International Associations Coordinating Committee).

IFIP net worth went from 515 KFrs. in 1970 to 1.09 MFrs. in 1984. The expenses went from 75 KFrs. to 328 KFrs. They were allocated roughly as follows: Administrative Secretariat: 66 %, Technical Committees: 19 %, Other Committees: 10 %. 5 % were spent for the final closing of the IFIP Foundation accounts in Amsterdam. Under Secretariat are included all expenses relating to the production and distribution of the IFIP Publications such as the Information Bulletin and the Annual Reports. The TC percentage does not compare to that one of 1970 since it does not include the various loans to conferences outstanding end of 1984 which represents a total of 118 KFrs. This important amount results from a recent decision by the General Assembly to allocate loans rather than grants to TC Conferences. Taking this amount in consideration, the percentages look as follows: Secretariat: 49 %, TC's: 40 %, other Committees: 7 %, which gives a better idea of how the funds are allocated. It also shows one of the results of reorganization measures taken during the last few years. The income went from 75 KFrs. to 314 KFrs. to which was added 121 KFrs. representing the surplus of Congress 83 transferred in 1984 to the IFIP account. The 314 KFrs. are composed of: Dues 51 %, Royalties 36 %, Interests 5 %, Activities surplus 8 %. Roughly speaking, the fix expenses are covered by the dues and the TC activities and loans by the royalties and interests. This was one of the long range objectives of IFIP management.

The events organized or co-sponsored by IFIP have also considerably increased in numbers and, therefore, in areas covered as well as in the number of individuals participating in them. 1984, for example, saw 43 events, most of them working conferences or symposia organized by TC's and IMIA and the proceedings of which were or will be published by North-Holland. In addition, 4 events were co-sponsored with IFAC and IFORS.

These numbers are self-speaking if we remember that, in 1970, a total of five events were organized by IFIP.

In addition to the IFIP Congress, scheduled every 3 years, IFIP has now a series of regular, well established and well-known international conferences and symposia:

- MEDINFO: World Congress on Medical Informatics, organized every three years by IMIA. The next one is planned in Washington, October 1986.
- WCCE: World Conference on Computers in Education, organized by TC 3. The fourth one is scheduled in Norfolk, July-August 1985.
- System Modelling and Optimization, organized by TC 7 every two years, the twelfth one being scheduled for September 1985 in Budapest.
- PROLAMAT, organized by TC 5 every three years on advanced subjects in Manufacturing Technology. The 6th conference of the series is scheduled for June 1985 in Paris.
- Computer Applications in the Automation of Shipyard Operation and Ship Building, and
- Ship Operation Automation. These two symposia series take place every two years, organized by TC 5 in cooperation with IFAC. The fifth ones are scheduled for September 1985 in Trieste and June 1985 in Trondheim.
- CAPE: Conference on Computer Applications in Production and Engineering organized every 3 years by TC 5, the second one to take place in Copenhagen in August 1986.
- Human Choice and Computers, organized by TC 9. The third one will take place in September 1985 in Stockholm.
- IFIP/Sec: IFIP Security Conference organized yearly by TC 11, the third one scheduled for August 1985 in Dublin.

- TC 10 is setting up a regular pattern of annual or biennial conferences on Computer Hardware Description Languages, Fault Tolerant Computing and VLSI, based upon the success of previous such conferences.

To be mentioned as well:

- SEARCC: South East Asia Regional Computer Conferences, organized by the South East Asia Regional Computer Confederation every two years, which have been sponsored by IFIP since the first one in 1976.

IFIP moreover acts as co-sponsor to many events organized by other international federations. For instance congresses of the FIACC members (IFAC, IFORS, IMEKO, IMACS), or conferences or symposia organized by these federations or IFIP Affiliate members such as: International Conferences on Pattern Recognition, Symposia on Microprocessing and Microprogramming, Digital Application to Process Control, etc.

Let us now discuss IFIP publications. In 1984, 16 Working Conference Proceedings were printed. Since five years, the number of such books produced was between 15 and 20 yearly. As already mentioned, the 100th one was printed recently.

Counting all IFIP books, published mostly by North-Holland but also by Springer Verlag (Lecture Notes) and other publishers, as well as those which resulted from joint symposia or conferences which IFIP co-sponsored, we reach a total of about 220, an impressive number indeed, which is the most visible measure of IFIP technical activities.

The collection of IFIP books is considered as a very prestigious one and can be found in every professional or technical library. If the IFIP Library has such a good reputation, it is in particular thanks to the efforts of the Publications Committee, and most especially, to Heinz Zemanek who not only chaired the Committee between 1975 and 1984, but always insisted, and succeeded, to maintain a very high standard for the IFIP books and a uniform pattern for their hard cover. He recommended this pattern very early, when the first volumes were published. This is well illustrated by the picture "The IFIP Library" printed in this book and showing the IFIP books published so far with North-Holland. It must be stressed that the editing and publishing process has been so improved that most of the conference proceedings are now available a few months only after the event.

Heinz Zemanek kept making innovative proposals to the General Assembly. Three publications resulted from his personal efforts and hard work:

- The IFIP Summary, published three times in 1971, 74 and 77 and, as discussed already, replaced in 1981 by a new format of the IFIP Information Bulletin containing the same standard information on IFIP and all its committees.
- Computer Compacts, to provide quick access to computer-related information in a compact form. Originally planned to be an electronic, on-line system, it was first produced in a paper form in 1983 and is now progressively offered on-line through various computer networks in Europe, USA and Japan. The purpose of Computer Compacts is to store and release what is going on in informatics. The input is taken form conference files, articles, abstracts of not-yet-published volumes, etc. and an input increase was planned to reach 3'000 items by end of 1984 and 7'000 by end of 1985.
- The State of the Art Reports, to be published by Springer Verlag and which will be reference reports to further disseminate IFIP's expertise in information processing.

He also proposed to establish the functions of Publication Officer (approved by General Assembly in 1974) and Conference Officer (approved by the General Assembly in Rome in 1982).

H. Zemanek passed the Publications Committee chair to his successor, H.R. Schuchmann in 1984, after having organized the IFIP publications in an outstanding way and leaving behind him a well running organization.

In addition to the books mentioned above, IFIP publishes now two quarterly journals: Computers and Industry by TC 5 and Computer and Security by TC 11. Other journals published as well as by North-Holland as by IFIP Affiliate Members should also be mentioned: Microprocessing and Microprogramming (Euromicro), Computer Networks (ICCC) and Pattern Recognition Letters (IAPR). Finally Information and Management published by IAG until it was wound up and continued on its own merit thereafter.

Information on IFIP as a federation is published regularly in various documents which result from the initiative and the activities of the Public Information Committee chaired since 1977 by G.J. Morris with the active participation of the Secretariat. Although discussed earlier, let us mention them again:

- IFIP Information Bulletin, published once a year, containing IFIP reference information, such as IFIP membership, Technical Committee, Working Groups and Special Interest Group Aims and Scopes and membership, list of publications, future events, etc. News from IFIP member societies, TC's or WG's, past and planned events, etc.
- IFIP Newsletter, edited by J.L. Rosenfeld, published quarterly since 1983, with the threefold purpose of informing quickly those affiliated with IFIP of important IFIP events, letting national societies know what IFIP is doing and publicizing the work of IFIP as widely as possible.
- The occasional articles by K. Owen on TC's and IMIA and their activities. This series will continue until all aspects of IFIP activities have been covered.
- What is IFIP, a small leaflet produced for general publicity purposes and describing IFIP in general terms.

In addition, G.J. Morris prepared a slide presentation on IFIP which he introduced during the Rome General Assembly meeting in 1982. Every IFIP member has a copy available for presenting IFIP, its structure, membership, TC's, activities, finances, etc.

All these activities contribute to improve one of the crucial problems of IFIP: the communication with and from the end users, i.e. the members of the national societies.

Activities in relation to the developing countries are a very important segment of IFIP activities and will have to develop if IFIP wants to fulfil its mission in this very important area. ICID (IFIP Committee Informatics for Development) is in charge of recommending to the General Assembly programs to best assist the developing countries. Created in 1979, it was first chaired by R.E. Kalman until 1983, then by R. Narasimhan who was elected Individual Member by the General Assembly. As mentioned earlier, great hopes were put in the possible activities sponsored by ICID. Because of the lack of adequate external financial support, these activities had to be limited in scope and number. However, since 1980 ICID could sponsor or co-sponsor with some limited support five to six events yearly; some of them took place in Asia, South America, Middle-East and Africa. Some support was also received from UNESCO and IBI for participants from developing countries to Congress 80 in Tokyo and Melbourne, WCCE 81 in Lausanne and Congress 83 in Paris.

ICID should continue looking at the geographical spread of IFIP activities. The tendency which started some years ago, and which is almost a policy for certain TC's - to gather and organize activities in all parts of the world - should continue and be further developed.

ICID was restructured and restaffed in 1983. Efforts are going on to enlarge the scope of interaction with UNESCO and to investigate possibilities of cooperation with other organizations like UNIDO in Vienna. These efforts are reported by R. Narasimhan in his paper on Developing Countries.

Planning of activities has now become an essential function in IFIP. The Activity Planning Committee has addressed this issue very seriously since several years and has gone through several transformations and restructurations, accompanied by growing responsibilities within IFIP.

APC, created in 1969, was chaired successively by H. Zemanek (1969-70), R.I. Tanaka (1970-74), Ph. Renard (1974-78), G. Van der Veer (1978-81) and A.W. Goldsworthy (since 1981). As mentioned earlier, the first efforts of APC went into establishing the 6-years plan of activities, including the financial planning and budgeting and the coordination of international organization activities, a review mechanism for TC's and SIG's, task groups to investigate new field of activities and formalizing rules for running IFIP activities. During the last few years, under A.W. Goldsworthy's chairmanship, APC has made many recommendations in view of improving IFIP operations, management and overall efficiency. The APC authority was enlarged in order to relieve the General Assembly of non-policy type decisions and to promote the role of APC as being a source within IFIP of action and innovation. APC has now the authority to approve activities proposed by TC's, WG's or other IFIP bodies; this includes the authority to loan up to SFr. 20'000.- for such activities and up to SFr. 200'000.- for all activities in each fiscal year. This new system has proven to be very effective and has the advantage of enabling TC chairmen and others to go ahead without waiting until Council or General Assembly meetings to obtain decisions; it also eases TC chairmen work and provides more time at General Assembly meetings to discuss important TC issues. A Developing Fund was approved in 1983 and an amount of 15 KFrs. allocated to it. It is used by APC to support new initiatives and to stimulate existing projects. Disbursement of money is at the discretion of the APC chairman at the request of TC chairmen, Task Groups and other relevant groups. The same amount was allocated in 1984 and 25 KFrs. for 1985. APC has also recommended a more formal and closer involvement of the TC chairmen to its activities. In fact, all of them should be members of the committee. This need was well evidenced during the regular combined meetings gathering TC and WG chairmen, APC and Executive Body members and which will be superfluous when all TC chairmen are member of APC.

APC has now structured itself and delegated to its members areas such as: new initiatives, TC's, WG's and SIG's, reviews, affiliates and sponsorship, and conference officer.

The APC has recommended the establishment of the Task Group on Restructuring, under the chairmanship of G.J. Morris, which will make suggestions to the General Assembly on what IFIP should be doing in the future and how it should be structured to best fulfil its mission in the today's society. Interesting suggestions have already been made in the committee's preliminary report to the Varna General Assembly meeting in September 1984. For example, in order to improve the visibility of IFIP in member countries, it was suggested to have IFIP Conferences on a continental basis and structured to suit local needs and conditions. It was also suggested to study the desirability to re-establish TC 4 which would concentrate on areas of interest not covered by IMIA. One important point which will have to be discussed in depth is the relationship between the theoretical and applied aspects of information processing and how this should be best addressed by the future IFIP structure. An other very important area is the structure of the congress programme and its necessary evolution so that to meet the needs of the today's environment. In the past, many critiques were made towards congress programmes. For instance, it was considered as too theoretical, addressed to specialists rather than to end users and practitioners, not giving enough attention to applications, etc. As discussed earlier, this problem was addressed by the Programme Committee of the previous congresses and changes in the programmes were already introduced including panels where subjects relevant to our society were discussed. The Congress 86 programme reflects these preoccupations and will mark the most significant change in the congress offerings since many congresses. More details on the programme structure are given after the discussion of Congress 83. Both APC and the Restructuring Committee will obviously follow carefully the results of these changes and recommend to the General Assembly, if appropriate, further modifications for the next congresses.

Other active Task Groups at the end of 1984 were working on Review Procedures, Public Sector Data Processing, Terminology, Human Computer Interaction, Office Automation and History of Information Processing. This evidences the willingness of IFIP to continuously question and review the type and level of its activities.

IFIP PERSPECTIVE

Before closing those remarks on the IFIP recent history I would like to submit some reflections on aspects which, I believe, are fundamental if IFIP wants to continue playing its role in our fast changing society. These aspects were mentioned several times in this paper. Let me, however, restate them.

IFIP is today a well running organization, mobilizing thousands of volunteers, coordinating many informatics activities around the world. The overall level of activities is very high and, in a way astonishing if compared with its available resources.

In highly developed countries, informatics activities are well organized and would not really need IFIP. This is not the case of less developed countries where most of the work is still to be done. IFIP's mission is to do whatever is possible to help them develop, to be a bridge before the first and second ones. This means, of course, making sure that information flows from IFIP to the member societies and, of course, to their members, the end users, as well as in the opposite direction, from the members to IFIP.

More generally, IFIP has to continuously make sure that the members receive what they expect from IFIP and that, in return, IFIP gets information on what is going on in the member societies. IFIP is no doubt an excellent example of the "give and take" organization.

IFIP is now well organized from this point of view. Information vectors are the various documents which have been used since several years and which were discussed already, and the people. Those who are responsible for these communications are firstly the General Assembly members. Within the current structure, a lot, if not everything goes via the General Assembly member and, therefore, the success of IFIP in the country depends directly on him, on his activities and initiative and his overall involvement. Although there is no formal "job description" for the General Assembly member, hereunder are mentioned some activities which should be considered as a minimum base for an active involvement of a member in IFIP:

- Regular reviews of TC's and WG's representation. Are the delegates active? Do they contribute? Do they serve the computer community in their country?
- Active participation in promoting IFIP events: Congresses, World Conferences (MEDINFO, WCCE). This is directly measurable by the number of attendees to such events, and also by the number of submitted papers. What actions are taken when signs show that the attendance will be too low, what efforts are made to secure the showing up of speakers?

- Active dissemination of IFIP publications: books, technical journals, TC newsletters, Information Bulletin, IFIP Newsletter, etc. What real effort is made in the country to improve? IFIP needs to sell its books, first to get the royalties and, of course, to be better known everywhere through its scientific publications.
- Participation in IFIP life through committees. This is the ideal way for a General Assembly member and, therefore, for his society, to be closely associated to interesting aspects of the IFIP life: APC, ICIL, ICID, Publications, Public Information, Statutes and By-laws, etc.

It is obvious that a country association benefits from IFIP depend directly on the General Assembly member. This means that the General Assembly member must invest a significant part of his time to this important function. And it is simply a matter of good citizenship to regularly ask oneself if one has enough time and motivation to do the job well. If not, the General Assembly member should take the measures necessary to improve the situation by delegating the activities in his society for instance, or, in the extreme case, by making his position available to a more active person. Here I would like to quote H. Zemanek who, several years ago, wrote to all General Assembly members "It is better to resign from an office than to remain inactive".

During the past years, several measures were taken to assist the General Assembly member: appointment of IFIP correspondents (it is up to the General Assembly member to appoint him, IFIP just offered the framework to do it), systematic distribution of documents to the President and the Secretariat of the member associations, in addition to the General Assembly member. In some countries, this works, in some it does not. Again, only the General Assembly member can remedy an unsatisfactory situation.

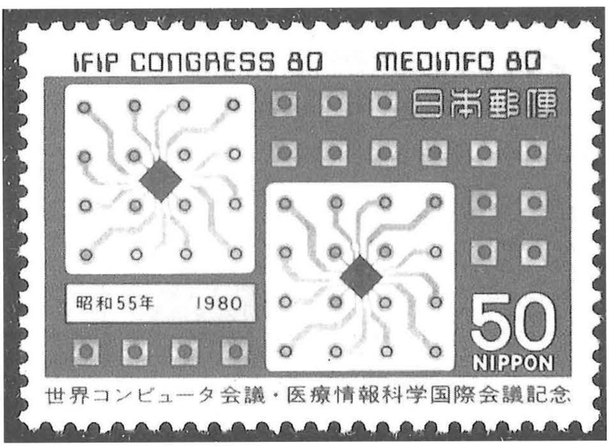
With the growth of IFIP, the work is steadily growing, There is, however, a tendency to concentrate this work on a small number of people, almost always the same (either in TC's, WG's or in the General Assembly). This starts at the President's level: there is a need for more delegation. Some steps were already taken by appointing cognizant officers: this should continue with, however, an even greater involvement of the cognizant persons. Thanks to APC initiatives and following its proposal, several things have now been delegated to the APC. It is hoped that such measures will help the TC's and the Executive Body and result in a better distribution of the workload. As discussed earlier, APC, for the same reasons, has structured itself by formally distributing the responsibilities among its members.

However, at the level of the General Assembly, it is necessary to have more General Assembly members personally involved in specific activities; not only in Standing and Ad-hoc Committees but also in IFIP management, i.e. Council and Executive Body. The Council is composed of the Executive Body (President, 3 Vice-Presidents, Secretary and Treasurer) and 8 Trustees. Its members should ideally be chosen so that to have in the Council a worldwide representation. They obviously must as well be very active persons. Accepting to be nominated on the Council means accepting to work hard for the entire term of office.

Some remarks are appropriate at this point regarding the continuity (or lack of continuity) in the General Assembly. Some countries maintain their General Assembly representative for long periods of time, some change him every year. I believe these two extremes are far from being optimal for both IFIP and the members. Changing every year means almost surely an extremely loose connection: it is a practical observation that any person needs at least to participate to one General Assembly meeting to understand what is going on and be able to contribute. Not changing at all presents the danger of falling in the rut and more importantly closing the way to younger, more active people, i.e. preventing the injection of new blood in the General Assembly. What is the ideal term of office? The answer depends entirely on the objectives of the member society. Suppose it wants to give IFIP a potential IFIP President. The "normal" path would be one to two years as General Assembly member, one or two years on the Council, three years or more on the Executive Body and five years for the Presidency (one year as President-elect, 3 years as President and one year as Past-President); therefore a total of ten to twelve years! It is reasonable to assume that, after such a period of active involvement in IFIP, the retiring President has given most of what he could and will want to make room for a younger, fresher representative! If the member society wants to minimize the term of office of its General Assembly members while maintaining the necessary level of continuity to benefit from IFIP membership, the period should be three years minimum: one year to get acquainted with the IFIP organization and two years of active involvement. Five to six years would, of course, be better. After some time in the General Assembly he will be a better ambassador for his country, especially when presenting specific requirements.

The strength of IFIP lies in its members, the member societies, in the expertise represented by its Technical Committees but, above all, in the individuals, all volunteers, who spend their time and efforts on IFIP jobs. After 25 years of existence, IFIP is a well running federation which has in itself all the necessary resources to adapt itself and face the challenges of the next 25 years.

Good luck, IFIP, for the next 25 years !



First stamp in Japan for a technical conference.
The only IFIP stamp in 25 years.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

IFIP, SOME LOOKS IN PAST AND FUTURE

A.A. Dorodnicyn
Academy of Sciences of the USSR
Computing Centre
Moscow
USSR

IFIP was formally founded in the very beginning of 1960, but the first proposals for its foundation were discussed in the middle of 1959 during the Paris congress on information processing. In the history of computer technology that was the time of transition from the first generation computers (based on electronic tubes) to the second one (based on transistors).

This very important improvement in computer technology created "great jump" in computer applications. The first computers were used for complicated calculations in mechanics and physics connected with practical need of designing new technical objects. The use of computational methods in these branches of science was traditional and here electronic computers gave the possibility for solving many difficult problems, what was impracticable with the old means of computing technics.

A little later computers began to penetrate into the field of business, but again at first for traditional business calculations.

Since 1960 the scale and, I would say, the picture of computer applications changed quite essentially. First of all we note a fast extention of the field of applications. From the traditional for the quantitative analysis branches of science computers penetrated into all others: biology, geology, medicine, economics, sociology, linguistics etc. They began to be used for control of technological processes, for information services, in administration up to governmental scale.

Deep changes occured in the character of the methods used. The computation in the direct sence of the word became only one particular case in using computers. More and more "noncomputational" procedures found practical application, i.e. computers were used as a general mean of information processing, but not only as powerful "arithmometers".

The history of IFIP reflects properly the history of computers and their applications. Though the greatest IFIP event is three-annual world congress, the main and permanent work of IFIP is carried through Technical committees and Special interests groups. The first TC's (TC-1 - terminological, TC-2 - programming, TC-3 - education in informatics) were organized for, so to say, internal needs of computer science, but then one after another application TC's and SIG arouse in the frames of IFIP: TC-4 - biomedical applications, TC-5 - technological, TC-7 - modelling and optimization (methods used in problems of science and technology), TC-8 - information systems, IAG - economic and administrative data processing.

Now we can say, that the activity of IFIP together with some affiliate member organizations cover all important domains of computer applications.No surprising therefore in the fact that 58 countries belong now to IFIP community and, what is worth noticing, the population of these countries constitutes about 80% of the total earth population.

The universility of computers application puts the question: what belongs to the computer science, to the informatics and what to the concreat domain of application? The answer to this question is very important for planning the future IFIP activity.

Informatics stands on three whales: **hardware, software and** brainware: technical, programming and algorithmic means. In all these parts the problem of boundaries between the informatics and the domain of application arises. It is clear, for instance, that construction of microcomputer for control of a particular machine tool does not belong to the informatics, but general methodology of microcomputers construction for the process control is the subject of informatics.

Writing of a program for solving some particular problem in physics belongs to physics, but methodology of programming is a part of informatics.

The same situation is for algorithms: some algorithm for solution of a particular problem, let us say, in mechanics belongs to mechanics, but general approach for construction of algorithms, in other words, algorithm for construction algorithms is the problem of informatics.

From above consideration we can conclude that it would be unreasonable for IFIP to organize TC's and even WG's for each particular computer application. The criterion for foundation of TC in IFIP has to be the generality of methods for sufficiently wide field of application.

Up to now the scopes of IFIP TC's corresponds to such approach, but the "pressure from the outside" compels IFIP to found new TC's and WG's. There is just the time therefore to work out definite strategy in the policy of organization new TC's and WG's. IFIP has to be the federation on computer science, but not a mixed salad of accidental ingredients.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

IFIP: THE NEXT DECADE

Richard I. Tanaka

President and Chief Executive Officer
Systonetics, Inc.
Fullerton, California
U.S.A.

IFIP been active in many areas of technology through its Conferences, Technical Committee activities, publications and events jointly organized with other organizations. However, the field of information processing has advanced rapidly, and many new technical topics of interest have developed. This paper lists some of the technical areas into which IFIP might redirect its efforts and discusses mechanisms by which its technical activities might be carried out more effectively.

1. INTRODUCTION

Because this paper was written for the IFIP 25th Anniversary volume, the original title referred to the **next** 25 years. However, because the paper focuses on near-term actions that may help to expand IFIP's technical activities, it became evident that a more modest time span would be more suitable. Therefore, on the assumption that steps initiated in the next five years will influence the subsequent five years, the title and the topic have both collapsed into the more poetic and less dramatic terminology of one **decade** into the future.

But first, a look backward.

IFIP was founded at a time when information technology was in its beginning stages. It was evident that computers would have a major effect on science and technology, but few anticipated the scope and magnitude of this effect. And probably none could have foreseen the speed with which the field would advance.

Information technology was simpler then. Links to traditional disciplines such as mathematics and engineering were relatively direct. Applications of information processing were limited to fairly well defined, numerically-based topics because of limitations imposed by cost, complexity and reliability. Since most of the financial support came from scientific, government or large industrial organizations, application topics were further limited by the interests of the sponsors.

Since that time, the field has become very complex. Information technology has changed the techniques used in traditional sciences and has created a host of new scientific disciplines and approaches, some of which feed, and some of which feed upon, information processing.

Dr. Tanaka is an Honorary Member of IFIP and was President during 1974-1977.

(1) Material which provides an introduction to this paper is contained in the paper, R.I.Tanaka, "IFIP: Its International Role" in Models in Programming, ed. E.J. Neuhold (Amsterdam: North-Holland, 1985).

Even more dramatic has been the expansion of applications into areas which are not necessarily numerical in nature. Computer applications have redefined the methods of industry and commerce and have brought about many social changes.

IFIP has tracked many of the important technological changes. This is evident in the contents of conference programs and publications and in the activities of the Technical Committees. Some of the newer Technical Committees were, in fact, created in response to the emergence of new areas of emphasis.

The basic organization of IFIP was influenced by the state-of-the-art at the time that IFIP was founded (1). Consequently, there are few built-in mechanisms for reacting rapidly to changes in technology. But even if there were, the issue is not a structural one, but one of procedure, of decision-making and of implementation.

IFIP has kept pace, but not across the full range of topics. Every professional computer organization has had difficulties in keeping up with the field, and none has the resources to work in every topic area of significance.

This is not necessarily bad. Topics of apparent importance often do not survive the test of time; they turn out to be fashionable but ephemeral. Some topics must await new techniques and solutions from other scientific disciplines. Others are simply beyond the economic resources of volunteer professional organizations, whether international or national.

Nevertheless, in looking to the future, it seems apparent that IFIP must improve its methods of reacting to technological changes. This paper suggests some approaches that may be useful.

1.1 IFIP History

As the summary of IFIP's history (1) shows, IFIP has been very stable. Many of its founding principles and procedures have survived over time. But IFIP has also been willing to adapt and to change when necessary.

However, most of the changes have not come about because of changes in technological emphasis. Rather, IFIP has evolved because of administrative and management necessity. The requirements of a numerically larger General Assembly, the growing awareness of responsibility to work with developing countries, and the need to cope with a larger number of topic areas have stimulated organizational changes. In many ways, these changes have been independent of the substance of the technology.

1.2 IFIP's Role

IFIP is a scientific and technical organization. It exists in a political world, but has been able to maintain its focus on science and technology.

It has responsibilities in areas of education and information dissemination. It has the support of its national members. IFIP has demonstrated that organizations from a wide variety of social, political and economic national systems can work together. It is therefore even more important to focus on making changes that will permit the Federation to expand its effectiveness.

In discussing how IFIP might be stimulated to change its emphasis, there will be no predictions of trends for the future. That would be foolhardy. Rather, the intent is to list some near-term directions to consider. Selecting from among these and correcting errors of selection are responsibilities of the General Assembly. It is an assignment of importance, and one that is interesting and educational to fulfill.

2. TECHNICAL TOPIC PRIORITIES

IFIP cannot do everything. Its financial resources are limited and international activities carry significant travel and communication costs. Consequently, IFIP must carefully establish its priorities and work in areas which are international in scope and in which it can be effective. These priorities are not necessarily the same as those of national organizations. In fact, many national societies look to IFIP as the mechanism for their international work.

Priorities are not determined by technological demands only. IFIP cannot work ahead of some of the technological achievements of the industrial sector. It has neither the resources nor the charter to do so.

How, therefore, should IFIP determine its priorities? It appears that the simplest way is almost sufficient. Its objectives as an international federation, combined with a general assessment of the state of technology, serve to filter out a high percentage of undesirable topics.

Some topics seem to fall naturally into IFIP's areas of interest; certain others do not. For purposes of discussion, the arbitrary lists of topics shown below are grouped into three categories: appropriate, neutral, and inappropriate.

The criteria for grouping the topics reflect personal biases and are subjective. The selection criteria consist of shades of gray, rather than black and white.

Appropriate topics include:

Technology basic to information processing
Relevance to global interests, e.g., education, medicine, agriculture
Relative independence of local interest only
Suitable fits with IFIP resources
Minimum duplication of national society activities

Neutral topics satisfy some of the above characteristics, but have attributes such as:

Narrow or specialized
At the limit of IFIP's resources
Some marginal commercial elements
Rapid pace
Relevance uncertain.

Inappropriate topics are defined mainly by looking at the opposite of the criteria for selecting appropriate topics.

Selecting, classifying and evaluating the topics is properly an exercise for a committee. The listings below are not self-consistent; some of the topics are sub-categories of another listed topic, but the examples illustrate how the effort might begin.

2.1 Appropriate Topics:

Language Translation
Pattern Recognition
Character and Image Processing
Applications to Humanities and Social Sciences.
Expert Systems independent of language or cultural background
Graphical Input and Output
Low cost and easily maintained data processors
Natural language processors
Low cost teleconferencing methods

Expert systems useful in medicine or education
Educational applications in general
Medical applications in general
Programming theory
Transnational communication theory and practice
Applications such as:
- Database definition and access techniques
- Information dissemination (e.g., electronic mail)
- Literature analysis and preservation
- Library linkages
- Agriculture, e.g., food production and distribution

Applications unique to micro computers
Computer networking
Economics of information processing
Office automation

2.2 Neutral Topics:

Speech recognition
Pattern recognition
Expert Systems focused on manufacturing and industrial techniques
Mini-computer development
Commercial business applications
Computer security
Micro computer design and manufacture

2.3 Inappropriate Topics:

Military applications
Specialized topics of interest to a few national members only
Applications indigenous to localized social or economic topics
Specialized language and character recognition
Direct manufacturing applications
Super computers

There are many areas from which IFIP can choose if the lists of Appropriate and of Neutral are combined.

3. IMPLEMENTATION

Selecting appropriate technical areas to emphasize is an inexact process. But what to do after reaching consensus on selections offers many uncertain choices. We can begin by discussing the methods by which IFIP currently carries out its programs. How might these existing approaches be improved or augmented?

IFIP currently implements its technical activities through: Technical Committees (and their Working Groups); conferences and seminars; publications; and joint activities with other organizations, i.e., national member societies, other societies, other international federations and Affiliate Members. These are discussed below.

3.1 IFIP Technical Committees

Most of the specialized technical activities of IFIP are carried out by the Technical Committees (TC's). To make participation in these activities equally available to all members, each national member of IFIP is entitled to appoint a representative to each Technical Committee. This approach is appropriate and also offers one the valuable advantages of being a member of IFIP.

Expanding technical activities by adding more TC's has surface appeal. But proliferating the number of TC's can also create a burden on national members, since the members must supply the resources to be represented on a TC.

Not having full representation in every TC is not necessarily bad. If there is adequate and well distributed membership in a TC, that TC can still be healthy even if not every nation is represented. In turn, if the well-populated TC's cover the appropriate range of topics, then IFIP is healthy.

However, it would be undesirable if very many of the TC's had limited or unbalanced participation. This would imply some combination of inappropriate TC topics or too many TC's or a lack of support for the TC concept.

An alternative approach is to limit the number of TC's. This is the de facto approach that IFIP has been following. Although new TC's have been established in recent years, they have had to overcome an implicit barrier imposed by the concern for over-proliferation of TC's.

Limiting the number of TC's, whether by fiat or by procedures, is an acceptable approach, but only if IFIP is able to maintain its priorities and enforce changes in the TC's in accordance with these priorities. At some level, this eventually means subtracting TC's at a rate equivalent to the rate at which TC's are created.

Disbanding an existing TC is even more difficult than starting one. Except for the simplistic case of a TC becoming inactive on its own, every TC can offer positive justification for its continuance. The dissolution process would also create emotional reactions, making it difficult for a volunteer organization to enforce the process. (For example, the Review Committee concept was meant to force a weeding out process; in practice, it has not done so.)

But even assuming that forthright action is being taken, dissolving a TC is a slow process. A TC or Working Group needs time to wind down its affairs.

Inertia supports a compromise approach. Limited and carefully selected additions of Technical Committees, accompanied by a redirection or elimination of some of the existing TC's, will serve IFIP's needs for several years. These changes will eventually result in an increase in the number of TC's, but if well implemented, would result in the elimination of the dinosaurs.

After several years, IFIP will be at either of the two limits described above -- too many thinly populated TC's or a demand for a moratorium on establishing new TC's. But if the number of TC's is large enough by then, it will be easier to weed some out or to implement mergers.

To accomplish even this level of change, IFIP must install a serious and sustained approach which will force the dissolution or merger of TC's of lesser priority. We are not sanguine as to the ability of a volunteer organization to maintain this process over a span of years. And yet, it is necessary to do so.

To permit IFIP to respond more quickly than the TC birth and death process allows, it would be helpful to permit informal, special technical groups to be formed quickly. National representation would be helpful. If a special activity establishes itself well, this may be the way in which new TC's are created.

3.2 Conferences

Conferences and seminars are among the most visible of IFIP's activities. These events can reach a wide audience and perhaps represent the best mechanism for keeping pace with technology. IFIP may not have sufficiently exploited this mechanism to position itself in the forefront of technological developments.

The events that IFIP sponsors include: the triennial World Congresses, specialized major conferences such as the World Conference on Computer Education

(WCCE), Medinfo (now directly sponsored by IMIA), and a large number of smaller conferences and seminars, many of which are organized by the TC's and their Working Groups.

In examining the role of conferences, the dimensions of size, timing, venue and focus all affect the manner in which they fulfill their role. These dimensions are independent, and different combinations can serve different purposes.

3.2.1 World Congresses

IFIP World Congresses are held every three years. Although each technical program starts out with separated areas of emphasis, each eventually covers a broad spectrum of topics.

At least 15 years ago, it became evident that a generalized technical program has difficulties in attracting leading edge papers, papers containing the latest and most significant developments. Specialists prefer to present such papers to their peers at specialized conferences.

In response to the fragmentation of technical interest, most large conferences began to organize sessions into topic themes, or a group of sessions into "streams" so that sequences of sessions exhibit some degree of correlation.

Many of the technical programs for generalized conferences therefore consist of several specialized programs, plus "miscellaneous" sessions. In principle, the program becomes an umbrella over a mixture of smaller programs, some of which are artificially constrained to adhere to a theme. This concept, if carried to its logical conclusion, offers an alternative which will be noted later in this paper.

A weakness in the IFIP Congresses is the fact that they are held at three-year intervals, in different locations. Continuity is difficult to maintain, particularly with the rapid pace of developments.

Congress program committees have tried to be responsive to trends in technology and, in general, have done well within the existing constraints. The appeal and prestige of the Congresses have helped to attract many high quality papers. Nevertheless, the inherent problems that characterize generalized conferences have not been overcome. The Congresses do not have a coherent image nor do they occupy the appropriate level of importance.

Many specialized conferences have captured their own audiences and have taken leadership roles. The specialized Conferences have the advantage of support from a core of technical specialists. As noted later, IFIP should continue to expand its sponsorship of specialized conferences, but must also find ways to enhance its general conferences as well.

Among many solutions, some that IFIP might follow are:

1. The Congresses might choose to emphasize and become identified with generalized themes:

   a. Tutorials
   b. Assessments of trends and developments
   c. Transnational or international applications in topics such as language translation or digital communications
   d. Applications for developing countries.

2. Provide an umbrella for specialized Conferences, some of which could be organized by the Technical Committees. Certain TC's might always schedule their Conferences as part of an IFIP Congress. This may result in concurrent meetings staged in the same location under IFIP sponsorship.

3. Scale down the goals and size of the Congresses and hold them more often, perhaps every other year or annually. If an annual schedule is adopted, one out of every three Congresses might be planned as a larger event than the other two. The greater frequency would permit more timely treatment of technical topics and would also allow experimenting with concepts such as those listed above.

3.2.2 Regional Conferences

As a supplement and not a substitute for the worldwide Congresses, regional conferences offer advantages. Regional conferences would involve all of IFIP, but would depend upon regions for support and topic selection.

As precedent, IFIP sponsored a regional conference, Euro-IFIP, in 1979. The results were mixed, but the objectives are still sound in concept.

Another variation would be for IFIP to be an active sponsor of Conferences involving a sub-set of its membership. Past discussions have often involved bi-national conferences, but expanding to more countries is easy to do. IFIP's role could range from that of an active participant to that of a primarily symbolic co-sponsor. Since some national organizations have difficulties in organizing meetings with other than domestic focus, IFIP's participation could be very valuable.

There were three bi-national Conferences between the USA and Japan in the early 1970's. These Conferences had positive results which, in retrospect, could probably have benefited from IFIP sponsorship.

An established regional conference, initiated and successfully organized from within the region, is the South East Asian Computer Conference. IFIP is a co-sponsor of the meeting, and the benefits of cooperative participation provide a good example of what can be accomplished. SEARCC is now a member of IFIP, and the positive working relationship established through sponsorship of their regional conferences has helped to build a good relationship.

IFIP should play a more active role in areas such as Africa and Latin America (but certainly not limited to these areas) and regional conferences offer a natural mechanism for doing so. The concept of a Pacific Basin Conference is invented every few years, involving countries as geographically separated as Australia, Japan, China, and the USA. Whether proximity to the same body of water creates cohesiveness could be debated. Nevertheless, an active interest on the part of IFIP to encourage and stimulate regional meetings could shake out specious objectives and help stimulate meetings with themes of local significance.

3.2.3 Specialized Conferences:

Specialized meetings are already part of IFIP's activities, since the TC's organize many of these each year. The participants are usually specialists, but there are also specialized conferences aimed at wider participation. Two examples of the latter are Medinfo and the World Conference on Computer Education (WCCE).

When medical informatics was under the auspices of TC-4, Medinfo was scheduled concurrently with the IFIP Congresses. When TC-4 evolved into a more autonomous association (IMIA, the International Medical Informatics Association), IFIP involvement became that of a co-sponsor.

WCCE, sponsored by TC-3, offers a technical program which is not as specialized as the conference name may imply, since education is a topic with wide appeal. Furthermore, the technical program is of interest to participants from all countries, not just those in IFIP. The conference provides worldwide dissemination of information on computer-related education.

IFIP involvement with specialized meetings, large or small, benefits both IFIP and the specialist community. Broadening the appeal to attract other than computer professionals also serves useful purposes.

3.2.4 Joint and Co-Sponsored Meetings

As a logical extension of the preceding discussion, conferences jointly sponsored with professional organizations not in IFIP would be helpful. Along with avoiding unnecessary duplication, the combined effort could facilitate cross-discipline discussions.

In the same manner, discussions exploring more active involvement with the Affiliate Members of IFIP should be encouraged, first to work on short-term events such as conferences. Depending upon the topic and timing, IFIP could serve as a vehicle for some Affiliate Members to expand their international activities.

3.2.5 Working Conferences:

A Working Conference is a meeting attended by a limited number of invited participants discussing a pre-defined topic. IFIP Working Conferences have usually been sponsored by TC's or Working Groups and almost always have produced a publication, usually a book.

The approach has been very successful. Most of the books generated by these conferences offer one or more of the desirable attributes of timeliness, international scope or retrospective insight. Although the books may not have the same cohesiveness or focus of a single-authored book, the advantages of multiple points of view on a timely basis can be significant.

One useful area for expansion would be to initiate Working Conferences which are not necessarily sponsored by an existing TC or Working Group, but organized specifically to discuss a topic of current interest which may not be within the scope of the existing TC's. Such events could be organized by special groups, established to implement special activities, as mentioned at the end of Section 3.1.

4. PUBLICATIONS

IFIP's publications program has been valuable in many ways. It provides an outlet for the work of the Technical Committees. The program also assures that the Proceedings and records of IFIP major events are made widely available.

TC-3 has published monographs in education, some of which deal with educational problems and issues raised by computers, some of which relate to curricula and specialized needs of developing countries.

IFIP publications could be expanded to encompass areas other than those derived from IFIP events. Specialists could be recruited to write books on selected topics. Tutorials or collections of reprinted papers could be made available perhaps at lower prices for an audience such as students or new entrants to the profession.

An interesting possibility would be the establishment of an ongoing program to publish a series of international state-of-the-art reports. The individual reports could be commissioned in any of several ways: as the product of a TC Working Conference, collected by an editor from papers presented at several generalized conferences, solicited from technical specialists or as the output from a special Working Conference. State-of-the-art reports may be of short-term but very high utility. They can indicate directions in which the technology is moving or give check points for trends and directions. As a minimum, they can shorten the time required to conduct a literature search.

IFIP can help strengthen the ties between IFIP's publisher and national societies. Some national societies currently serve as distribution sources or help publicize the availability of IFIP publications. The approach could be more widely encouraged. Having more national involvement could help assure wider dissemination of IFIP publications.

Periodicals have the advantage of timeliness, but require a working staff geared to a sometimes rigorous schedule. IFIP's past experience with periodicals has had limited and mixed results. However, the idea is still worth pursuing. Potential topic areas with international implications include: international computer history, indices of current international papers and books, technical developments of international significance and summaries of IFIP TC work.

5. SUMMARY

There are many ways for IFIP to expand its technical activities. This paper has named some of them. However, by listing some potential topics and the approaches that might be followed in working with these topics, this paper may help to stimulate some new plans in the technical area.

But agreeing on a list of topics for possible action is not useful without a time table. A schedule with deadlines is essential. Listed on the following page is a suggested schedule. Some of the actions may not be acceptable, and of those that are, not all will be completed on time. But each represents a step forward, and will help in planning the next step.

IFIP fulfills a useful and important role in the international information processing community. It has the capability of enlarging its influence and importance and of assuming an active role in shaping events. Alternatively, IFIP can be passive, focus on its internal organizational problems and maintain jurisdiction over a shrinking segment of technology.

The choice is clear.

5.1 Some Near Term Actions and a Suggested Schedule

ACTION	SCHEDULE
List new technical areas of potential interest. Select the topics of importance.	Complete the selection process within one year.
Perform critical reviews of existing technical activities.	Initiate the reviews immediately and complete the process within 3 years.
Based on the reviews, redirect or disband the low priority activities.	Initiate action immediately after each decision.
Review and either revise or retain current Congress program approach.	Complete the assessment and implement changes for Congress '89.
Organize regional conferences.	Stage at least two conferences before the end of 5 years.
Organize specialized conferences.	Present at least one new event per year and maintain the successful ones.
Organize joint conferences with outside organizations.	As opportunities permit, but initiate at least one per year.
Organize conferences in cooperation with affiliate societies.	Together with joint conferences, raise the total of both to an average of 1.5 events per year.
Organize working conferences on topics outside the scope of existing TC's.	Stage at least two per year.
Expand publications program.	New books will result from new activities, but also commission at least two additional books per year to supplement Conference Proceedings.
	Establish at least one new periodical before the end of 3 years.
	Define a sustained program to publish state-of-the art-reports.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

ON THE FUTURE OF IFIP

Towards the Information Age

Kaoru Ando
IFIP President

Special Assistant to
The President, Fujitsu

Tokyo, Japan

Based on the supreme concept of fostering international cooperation in the field of information processing, the International Federation for Information Processing (IFIP) was founded in Paris in 1960, just 25 years ago. With the wisdom of those who assembled at the early meetings, the objectives of IFIP were clearly laid out for

1. promoting information science and technology;
2. stimulating research, development, and the application of information processing in science and human activity;
3. furthering the dissemination and exchange of information about the subject; and
4. encouraging education in information processing.

This paper, somewhat documentary in nature, will try to present firstly how IFIP has grown to the present status, secondly how IFIP has been structured in line with the general development trend of hardware and applicationware (application software), and thirdly what would likely be the future outlook of IFIP. The Author hopes that direction set forth in section 3 will continue to remain as a meaningful and valuable contribution to the future operation of IFIP for years to come.

1. Looking back the growth of IFIP

In reviewing the successful operation of IFIP in the past quarter century at the occasion of the 25th Anniversary Celebration, I must acknowledge with deep gratitude and respect to the past six presidents who guided the course of action of IFIP up to the year 1983:

I. L. Auerbach (1960 - 1965)
A. P. Speiser (1965 - 1968)
A. A. Dorodnicyn (1968 - 1971)
H. Zemanek (1971 - 1974)
R. I. Tanaka (1974 - 1977)
P. A. Bobillier (1977 - 1983)

The meritorical achievement of each president is described in the first paper of this volume, the tribute by Vice-President A.W.Goldsworthy as presented at the celebration day in Munich on March 27, 1985.

1.1 The Congresses

In 1959, a year before the official inauguration of IFIP, the first international Computer Conference was held in Paris by those who were leaders, scientists, and professors in the field of computer science in various countries.

Encouraged by the success of the Conference which aroused the interest of more countries concerned with the information processing technology, IFIP ever since has been organizing the world-wide Computer Congress triennially. It has become the biggest technological event IFIP is sponsoring currently. In 1980, in order to make the international general public as well as professionals involved in information processing understand and appreciate more of the meaning and value of this IFIP Congress, IFIP has modified its title to the more popular name of World Computer Congress, 1980 being the 8th WCC, as shown below.

1959	Paris	
1962	Munich	
1965	New York	
1968	Edinburgh	
1971	Ljubljana	
1974	Stockholm	
1977	Toronto	
1980	Tokyo/Melbourne	(8th World Computer Congress)
1983	Paris	(9th World Computer Congress)
1986	Dublin	(10th World Computer Congress)

IFIP has established a good traditional practice for conducting such an international technical event. A chairman of the Organizing Committee is always selected from the hosting society of national level (IFIP member society) who is responsible for the total operation of the Congress but the technical program which is the "heart" of the Congress is under the responsibility of IFIP's Program Committee. Members of the Program Committee are composed of 13 international experts selected each from different nationalities.

1.2 The World Conferences on Computers in Education

In 1970, due to the increasing concern of computing technology in education among member countries, the first World Conference on Computers in Education was held by IFIP in Amsterdam, the Netherlands. The subject is so important internationally that IFIP decided to hold the WCCE for every 5 years since.

1970	Amsterdam, the Netherlands
1975	Marseilles, France
1981	Lausanne, Switzerland
(1985	Norfolk, U.S.A.)

Recognizing a vital role "computing in education" is to play in all levels of school system, with its impact and consequence on socio-economic environment on every country, IFIP wishes to hold this type of Conference in every major geographical region of the world. The WCCE is actually sponsored by IFIP Technical Committee (TC 3) Education and hosted by the full member national society where the Conference is being held.

1.3 The World Conferences on Medical Informatics

Another milestone has been layed down in 1974 when IFIP, the TC 4 Information Processing in Healthcare and Biomedical Research (established in 1967), sponsored the 1st World MEDINFO along with the IFIP Congress '74 in Stockholm, Sweden. The computing technology as applied to medical informatics is so vital to every nation of the world, IFIP has initiated World MEDINFO triennially since 1974. Since the coverage of medical informatics field is so broad and the activities involved are so diversified, TC 4 has developed into a SIG known as IMIA (International Medical Informatics Association of IFIP) in 1978.

1974	Stockholm, Sweden
1977	Toronto, Canada
1980	Tokyo, Japan
1983	Amsterdam, The Netherlands
(1986	Washington, D.C. USA)

1.4 The IFIP Technical Committees and Working Groups
It is obvious that these three big international technical conferences are not all the technical works IFIP is sponsoring. Experienced professional members of TC (Technical Committee) and Working Group are actually "carrying the ball" of all IFIP working conferences, symposia, seminars, and workshops, which represent the real substance of IFIP's international technological works. In effect, they are the "flesh and blood" of IFIP. For the list of Technical Committees and Working Groups please see in the IMP Silver Summary in this volume.

The establishment of new TC and/or WG has always been in line with the advancement and innovation of information processing technology as well as the development of expanded usage in application fields. Despite the fast changing speed and environment in these two areas, IFIP has been rather successful in keeping up with the innovative change in international movement. IFIP should be very thankful for the leadership and advices of chairmen, officers, and members of TCs and WGs.

1.5 Affiliate Members, FIACC and UN Family Involvement
Since IFIP intends to be a world umbrella organization in the field of information processing, it is mandatory that IFIP keeps good terms and relationship with other international and regional technical organizations. Affiliate members currently include

IAPR (International Association for Pattern Recognition)
IASC (International Association for Statistical Computing)
ICCC (International Council for Computer Communication)
EUROMICRO (European Association for Microprocessing and Microprogramming)
FACE (International Federation of Association of Computer Users in Engineering, Architecture and Related Fields)
IJCAII (International Joint Conference on Artificial Intelligence, Inc.)

and more applications for Affiliate members are being processed now. As many of IFIP sponsored international conferences, symposia, working conferences, seminars and technical meetings have similar subjects in common at their meetings, IFIP is encouraging every possible cooperation in a friendly manner to minimize duplication of work, loss of unnecessary time, energy and resources for the similar purposes.

Affiliation of IFIP has been expanded to the FIACC, Five International Association Coordinating Committee, which embraces IMACS (for Mathematics and Computers in Simulation), IFAC (in the field of Automatic Control), IFORS (for Operations Research), and IMEKO (in the field of measurement and instrumentation) for practical coordination of international technical works related in the field of information processing.

Further IFIP involvement has been extended to UNESCO and WHO who are keenly concerned with the consequence and impact of computer-communication-controlling technology in society and human activity in every country of the world. This is particularly important for developing countries to bring up their level of standard of living and quality of life which should be raised close to other developed countries. Undoubtedly, IFIP is willing to contribute in filling the "gap" between the South and the North as well as the East and the West through science and technology.

2. Keeping IFIP organization prepared for the "information age"

The structure of the Federation has been developed and modified to fit for and along with the technological advancement of computer hardware and software, inclusive of applicationware, with the belief that the international technical organization must be sensitive enough and flexible enough to cope with the changing environment both socio-economically and technologically.

2.1 IFIP General Assembly and Council

As at March, 1985, the General Assembly is the basic governing body of IFIP, with jurisdictions over general policy, Statues and Bylaws, program of activities, admission, elections and finances. The General Assembly is the supreme authority of the Federation, meeting annually and is composed of Full Members, Affiliate and Associate members, and of Individual and Honorary members. Full member is appointed by the national or regional society, representing his/her country or region. TC chairmen also constitute and play an important role during the discussion of General Assembly (but no voting right given to them).

The day-to-day operation of IFIP is directed by its Officers: the President, three Vice-Presidents, the Secretary and Treasurer who are all elected by the General Assembly. These constitute the Executive Body which functions in effect very similar way as the "Corporate Management Board" of business enterprize.

The Council, consisting of the six Executive Body members and up to eight Trustees elected by the General Assembly , meets twice a year to administer the Federation and to make or implement decisions between General Assembly meetings. When electing Council members, due to the international nature of the Federation, careful consideration is given to the geographical distribution and representation of the members in the Federation.

The headquarters of the Federation are located in Geneva, Switzerland, with IFIP Secretariat and operated under the Swiss law.

2.2 IFIP Technical Committees and Working Groups

IFIP's technical activities are initiated and managed by Technical Committees (10 in number as of March, 1985). A member of TC's may increase or decrease, depending on the current demands and requests of information processing contemporary technology. Each TC supervises a number of Working Groups (WG) from 2 to 10 which deal with specialized topic areas following within the technical areas of the parent TC.

Every Full member representing a country or region can appoint one representative to each of the TC's. Each TC, however, appoints members of its Working Groups, independent of national or regional origin. Thanks to the forward-looking and positive attitude of TC, including IMIA, Chairmen and Working Group Chairmen, IFIP now possesses over 60 such working groups with an estimated total of over 1,300 professionals. TC's and WG's are currently holding over 50 international working conferences, symposia, seminar and workshops a year, which are highly recognized and evaluated among information processing professionals and experts, helping the worldwide activity of IFIP. In addition to the three big IFIP events described in Section 1, IFIP considers that real technical work of the Federation is in the hands of TC's and WG's. Their works are really "flesh and blood" of IFIP.

2.3 IFIP Full Members and IFIP Regional Groups

In summary, during the past 25 years, IFIP has made an enormous stride in contributing computer science for the improvement of human societal activities, in terms of quality and quantity, through its technological accomplishments and services. The number of Full Members belonging to the Federation is 45 as compared with 10 at the time of the formation of IFIP in 1960. The Full Members are now composed of representatives from 43 National Computer or Information Processing Societies/ Associations and 2 Regional Groups. The Regional Group was introduced in 1980 as a qualified Full member of IFIP to provide an official representation from less developed national computer societies of the specific region. IFIP now covers 57 countries in the world.

One of the Regional Group members is the SEARCC, South East Asian Regional Computer Confederation, admitted in the Federation in 1980, covering the national computer societies from Hongkong, Singapore, Philippines, Indonesia, Malaysia, Thailand and India. Two more additional members are expected to join with SEARCC, according to the recent report from SEARCC. The SEARCC has been holding their regional biennial information processing conference successfully five times already and the last conference in Hongkong in 1984 was participated by over 800 attendees from 7 SEARCC countries and 12 member countries of IFIP.

The CLEI, Centro Latino-americano de Estudios en Informatica, composed of 10 countries from South American Region, was accepted as a new Regional Member at the General Assembly in 1984. It includes information processing professionals and experts from Argentina, Brazil, Chili, Bolivia, Colombia, Equador, Peru, Paraguay, Venzuela and Uruguay. IFIP is expected to support its XIth Latin American Conference of Informatics to be held in Sao Paulo in July this year.

2.4 A Compact History of Hardware Development

We cannot look back the history of IFIP simply because we are just celebrating the 25th Anniversary of its inauguration in 1960. The development of IFIP has been greatly influenced by the growth and direction of general hardware/software and applicationware of information processing technology itself.

The year 1985 has been just 40 years since the ENIAC was first introduced in 1946. During these 40 years, the computer hardware has gone through roughly four innovation stages.

The first decade between 1946 and 1955 is said to be the period for "throes of birth or creation" of computer hardware. Computer scientists and engineers have struggled for building faster in speed and larger in capacity of computer hardware equipments. Their major concern was more or less centred around the solution of scientific and technical calculation requirements.

Between 1956 and 1965, hardware technology has advanced to such a degree as to be able to accelerate and extend the potential usage of computer as a tool for management and control, demanded by the economic and societal environments. This period was characterized for handling data processing in "bulk" (batch processing fashion) and/or in centralized processing mode - the period of "practical usage" of computer systems.

The third period between 1966 and 1975 has further accelerated the technological advancement of computer hardware. The development has been supported by the improvement of auxiliary devices in input/output and terminal fields which helped to complete almost perfection of large and medium-scale computer hardware as the "system". The utilization of the systems during this period is characterized by decentralized and/or online information processing mode. In other words, the advanced hardware development in this period opened the way for unlimited potential computer usage - the period of "conspicuous hardware development".

Since 1976 to 1985, with the emergence of micro-processors and the introduction of mini-computers, personal computers and the like, the computers have now come to be a convenient tool available for ordinary common people, thus creating the "period of computer for the masses". It seems that 1985 may be the last year of this "popularization" trend. Hardware-wise, it is anticipated that the next 10 years would be the "period of computer technology integration or technology fusion". Three technologies - computing, communicating, and controlling - independently and separately developed in the past would probably be merged into one and will become a fundamental core of micro-electronics technology in the future.

2.5 A Compact History of Application Development
The trend of development of hardware (and its basic software) clearly indicated the direction and movement of applicationware development. It is fair to say that the history of computer utilization pattern almost coincides with that of the development of hardware by period described in Section 2.4.

Information processing application pattern started first from the scientific (1945-1970), and then moved into the managerial infromation processing area, (1955-1980). The next period from the managerial to the societal computerization seems to be the natural outgrowth and trend of advanced movement (1970-1990 and the coming 4th period (1980-2000) would be devoted towards enriching the quality of individual or life style of human beings.

The first concept of computer application development was initiated and accelerated by the direct militaristic requirement. With the arrival of peace at the beginning of this period, technology has gradually shifted to the development of space exploitation, aeronautics and other scientific and engineering areas where the demand for complicated and sophisticated calculations are most needed. (Scientific Information Processing Systems development period).

Experiences gained in this period opened the eyes of scientists and engineers but also of industrialists, economists and business people, with rapidly changing concept and value of the post-war society. Application of computing technology has targeted to increase the wealth and economy of the nation. The use of computers to pursue productivity and to raise efficiency in all phases of civil as well as Government activities has come to be the second major cause of computer utilization of the second period. (Managerial Information Processing System pattern.)

Spontaneous advancement in industrial development has brought us many serious social problems, for example, pollution. Corrective measures not just for pollutions prevention but for the improvement of overall social welfare have come to the target of computerization now. The third period of computer usage has been devoted to the betterment and improvement of societal welfare environment, an interim objective towards informationalization age of the future. (Societal Information Processing Systems development period.)

With the technological improvement and advancement of the computer hardware and software, the information system has become penetrating into the life of the people gradually and impacting on human beings themselves. If we could attain satisfaction of human beings through self-realization by means of developing intellectual creativity in harmony with the appropriate use of information processing systems, those in IFIP may be able to say proudly that we have really contributed in attaining the ultimate goal of the "information age". (Period of Individual or Life Information Processing Systems).

2.6 Conclusion
Considering the history of hardware development as the warp on one hand and of applicationware development as the woof on the other, at the time of the 25th Anniversary, it looks that IFIP is in the most ideal position for weaving the best and strongest durable cloth that can stand for long wear in the future international information processing world.

3. Looking into the Future of IFIP

Any organization, be it technical, educational, research, industrial or government, will always face and experience with the necessity for improving its organizational structure. The healthy organization will always change, evolve, develop and move forward for the better. This phenominon seems to be particularly true in the field of information processing where the dynamic and rapid changes in technology are constantly raising the issue of possibility for obsolescence whether of products, persons, or organization. And IFIP is not an exception.

Recognizing what IFIP has done during the past 25 years in contributing to the progress of information processing technology of the world, realizing how IFIP has experienced through its practice in working, developing, and promoting intellectual international exchange program with multi-national resources, and knowing some of the difficulties IFIP has gone through in managing volunteer-based international technical organization of such broadness, diversity, complexity and size, the following three points are urged in developing for the future operation of IFIP.

1. Strengthening TC and WG activities
2. Establishing closer coordination between developed and less developed countries in information processing applied technology
3. Maintaining flexible and sensitive multi-national organization

3.1 Strengthening TC and WG activities
In order to revitalize, stimulate, and encourage more activities in Technical Committee and Working Groups, one must first recognize the fundamentals that the true meaning and value of IFIP lies in the technical works carried out by the members of TC's and WG's. They are devoting their full efforts in planning, arranging and running international technical congresses, conferences, seminars, symposia and working conferences throughout the world. It is important to appreciate that the visibility of IFIP is maintained through the work they are doing. IFIP currently covers the following 10 technical areas as of March, 1985.

> Programming (TC 2), Education (TC 3), Medical Informatics (IMIA-former TC 4), Computer Application in Technology (TC 5), Data Communication (TC 6), Systems Modelling and Optimization (TC 7), Information Systems (TC 8), Relationship between Computers and Society (TC 9), Digital Systems Design (TC 10) and Security and Protection in Information Processing Systems (TC 11). (For details, please refer to "IFIP Technical Committees" edited by IFIP 25th Anniversary Committee.)

Since the speed of the technological advancement, innovation and enhancement in the information processing field is so fast and the development of application is so diversified that IFIP, despite its effort, has not been able to cover the whole technical areas currently. Some of the areas IFIP should be considering to take up would include such topics as Language Translation, Character and Image Processing, Artificial Intelligence, Office Automation, Computer Graphics, and Expert Systems.

Timing for installing a new TC or WG is so urgent that it is suggested that the intention be brought up by the TC's concerned to the attention of APC who will respond immediately to get the final approval from the Council or General Assembly. The procedure is also applicable for the requests by TC's for obtaining travel funds, loans and grants for holding conferences.

IFIP must be more concerned with the importance of geographical distribution of the conferences. The past trend of concentration of events more or less in the European area has to be modified to accommodate the requests from Regional members and developing country members. More active participation and solicitation for IFIP conferences held in the regional bases must be encouraged in the future.

The Federation is truly an international umbrella organization in the field of information processing but is not working with or for its members only. The nature of our information-oriented technical activities, conferences, and meetings many times calls for related subjects to be studied interdisciplinarily with other organizations. Closer coordination with our "Sister Federation" FIACC (IFORS, IFAC, IMEKO, IMACS and IFIP) and Affiliate members (IAPR, ISAC, ICCC, FACE, IJCAII) are particularly recommended in order to avoid the conflict in scheduling and duplicating the similar works.

In view of the future expansion of TC's work and the necessity for keeping better international relations with other organizations, it is desirable that IFIP may create the 4th Vice-president in charge of all TC affairs.

3.2 Closer Coordination Between Developed and Less Developed Countries
To establish and advance closer and more effective working relationship with developing countries is another important point IFIP has to be constantly aware of in the future operation. IFIP has been strengthening ICID (IFIP Committee: Informatics for Development) activities so as to be able to fulfill this mission.

The alignment of members of ICID has taken place recently. Chairman of the Committee has invited 3 powerful members, each from the advanced countries, UKCCD of UK, CICC of Japan, and AFIPS of USA, to join with ICID successfully. New members from the Region are also selected in addition to the already active expert members known in the field in developing countries.

It has been known in IFIP that developing countries are more concerned and interested in the development of applicationware rather than hardware technology. Areas that may be directed for are agriculture and food production, medical-care and health treatment, education, communication, and transportation. Since these application areas are fundamental in developing and "modernizing" the country, IFIP must feel the responsibility for actuating the help and accelerating the speed of contribution towards developing countries.

Since early 1984, IFIP is re-affirming the improved working relationship with UNESCO, who shares similar concerns for developing countries. IFIP is now directly involved in helping many informatics projects, originated, designed, scheduled, and budgeted by Informatics Section of UNESCO. IFIP has carried out several of these projects by contract in 1984 with the help and advice of ICID and TC members. Basic understanding and concept of mutual cooperation between IFIP and UNESCO are moving positive way, despite some difficulties UNESCO is currently facing. More informatics projects mainly for developing countries, are being under study to be executed by IFIP during 1985. However, it goes without saying that IFIP is not limiting its cooperation only with UNESCO and is always keeping good terms with other international bodies and even with local national societies where the requests for cooperation with developing country are needed.

3.3 Maintaining a Flexible Organizational Structure
The last point to maintain and up-date organizational structures in line with the quickly changing environment of the world information processing technology is an important and yet a difficult task.

Those involved with IFIP should always be sensitive enough to be able to run and manage an international technical organization of such nature and size like ours. We have to be constantly aware not to fall into managerial and technical pitfalls in order to avoid "bureaucracy". Awareness to technological, societal and economic changes, and flexibility in management must be conscientiously maintained.

At the occasion of the 25th anniversary celebration in 1985, we confirm that Aims and Scope of IFIP, are point of unaltered origin (of our operation). IFIP as a multinational organization in the field of information processing must serve for the betterment of global human society. At the same time, when carrying out IFIP's supreme mission, one has to recognize difficulties in keeping the suitable balance between idealistic and pragmatistic activities, and in maintaining the appropriate equilibrium between physical and mental involvements by and among members of different nationalities. IFIP is a non-profit organization, operated and served by volunteer members, which may basically inherit some of these fundamental problems and paradoxes.

However, recognizing above issues under the present structure of IFIP, the Author would try to recommend a few suggestions for improvement:

1) Better coordination of Officers (Executive Body members and Trustees as well as function-oriented officers such as Conference, Publication, and Newsletter) and TC chairmen (including WG chairmen). The attempt has been made through

APC/TC meetings in the past but not functioning satisfactorily yet.

2) Re-enforcement of duty and responsibility, in particular of Executive Body members. (Each Vice-president be charged to the specific IFIP Standing and/or Ad hoc. Committee functions which we have 13 at present.) TC Cognizant officer functions be re-aligned to Trustees.

3) More intellectual approach for international cooperation (at congress, conference, seminar, symposium, working conference and technical meeting) with FIACC, Affiliate members, Associate member, and Regional members by TC's and WG's.

4) Positive approach for developing country activities in the desired area on computer application, medical informatics and education with proper usage of mini-computers.
IFIP/ICID has been re-establishing closer working relationship with UNESCO and other international bodies and Regional Groups. Special attention should be paid for 3 institutions, UKCCD of UK, CICC of Japan and AFIPS of USA, who accepted membership in IFIP/ICID to help and advise developing countries.

5) Serious effort to improve IFIP's financial position (dues, royalty, surplus distribution, fund allocation, donations, etc.) has to be considered constantly.

In practical world in business, however one's idea is good, unless it is implemented rightfully with proper timing, its value will be lost. The management of IFIP is not an exception. Let us think first 25 years of experiences in IFIP is just a jumping board for accelerating further effort to develop, innovate, and advance new information processing technology of the world. Those in IFIP must have confidence that IFIP is really helping to create the better information society to live in the future.

References

A. A. Dorodnicyn	Ten years of IFIP	1970
Isaac L. Auerbach	A Future Strategy and Structure for IFIP	1979
Tadashi Uozomi	IFIP-Joho Kanri, Vol.26 No.8 (in Japanese)	1983
Kaoru Ando	Towards the Information Society of the Future	1984
Robert Iau	SEARCC Report	1983, 1984
Richard I. Tanaka	IFIP: Its International Role	1985
Kazu Watanabe	Joho Shori, Vol.26 No.2 (in Japanese)	1985
IFIP Secretariat	IFIP Bulletin & IFIP Summary	1974-1984
25th Anniv. Com.	TC Committees & Members	1985

PHILOSOPHICAL AND GENERAL PAPERS

Harry D. Huskey

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

AN ASSESSMENT OF THE CONCEPTION AND THE POSITION OF INFORMATION PROCESSING

Harry D. Huskey
University of California
Santa Cruz, California
U.S.A.

We discuss the origins of the automatic computer from conception to production models. The development of punched cards is covered. The relationship between memory technology and computer system design is mentioned. The explosive growth of integrated circuits is described. User language developments and architectural trends are presented. We end with "where we are today" with respect to micro-mini-mainframe developments, data bases, and automation.

THE AUTOMATIC COMPUTER

The title "An Assessment of the Conception and the Position of Information Processing" is quite broad. My first step is to limit the scope to the automatic processing of discrete information. In the hardware area I shall further limit my attention to general purpose devices. This omits many topics ranging from the Greek navigational instruments down through slide rules, counting tables and mechanical calculators.

The first proposed automatic digital computer was the difference engine of Charles Babbage. Of more interest is his proposed analytical engine, which in todays terminology would be called a tape sequenced von Neumann computer.

Such automatic computers can be classified on several bases. One is in terms of storage of information, another is relative to the kind of logic circuits used. Perhaps of more importance is the means of controlling the sequence of operations.

Babbage planned to use ten-position wheels for storage and associated gears and levers for the arithmetic processes. Sequencing was to be controlled by a "barrel" (drum) with pins on it (like the drums in mechanical music boxes) and in 1836 he thought of using cards (as used in Jacquard looms) to control the sequence of operations.

Little happened with respect to automatic digital computation until about 1940. Zuse (FRG) had been interested in doing computing and in 1941 his Z3 was "fully functional", however it was never used for routine computing. It used punched photographic film for input, the film transport device having been constructed in Darmstadt with the help of Walther and de Beauclair. Walther had planned to connect punched card machines to make a computing system. Both the Z3 and Walther's work were destroyed in bombing raids. In 1944 the Mark I (built by IBM) became operational at Harvard. At Iowa State College (now University) Atanasoff designed and built an electronic computer using condensers to store information. It was a special purpose computer designed to solve systems of equations using elimination. It failed to work reliably and the US entry into WWII caused all work on it to stop. It contributed little to the main stream of computer development

Another development of special purpose electronic computers was the building of Colossus by British Intelligence at Bletchley Park.

In the US the group at the University of Pennsylvania built the 18,000 tube ENIAC. Long before it was finished they had ideas on how to store much more information in the computer using very few vacuum tubes. Von Neumann visited the group and wrote his well known "EDVAC Report".

Hughes Aircraft had tied together some IBM punched card machines to do general computation. IBM marketed this as the Card Programmed Calculator (CPC) with first deliveries in 1949. Wilkes attended a summer course at the University of Pennsylvania in 1946 and went back to Cambridge to build the EDSAC. More or less concurrently with Wilkes, Williams at Manchester was building a computer using a cathode ray tube memory (Williams' tube). Eckert and Mauchly left the ENIAC-EDVAC project (1946) and started a company to build UNIVACs. After being acquired by Remington Rand they delivered their first UNIVAC to the US Census Bureau.

We summarize this phase of the development with the following table:

	Conceived	Operational	Production
Automatic computer	1833 Babbage	1941 Zuse Z3	1949 CPC
		1944 Harvard Mark I	
Electronic computer	--	1946 ENIAC	--
Stored program computer	1944 EDVAC	1949 EDSAC Cambridge	1951 UNIVAC

The stored program (placing the instructions in memory the same way as numbers) was important because it was the only flexible way that control of the sequence of operations could occur at rates comparable to the availability of operands from memory. Of much more importance was the fact that this permitted one to "compute" on programs -- which led to compiler development and the whole field of computer languages.

The table below shows the growth of computer memory size from 1945 to 1955.

Computer	Year	Memory Size (words)
ENIAC	1946	20-electronic
SWAC	1950	256-Williams' tube
SEAC	1950	512-delay line
UNIVAC	1951	1000-delay line
IBM 701	1952	4096-Williams' tube
IBM 704	1955	8192-magnetic core

Core memories reached a size of about 4 million bytes with cycle times of one microsecond (IBM 360-85, 1969). From about 1970 on all mainframe computers used semiconductor memories.

PUNCHED CARDS

Punched cards were developed to control looms in the 1700's and Jacquard engineered a practical loom which was demonstrated at the Paris Exhibition of 1801. Applications in information processing had to wait until the 1890 census. Hollerith (US) and Schaeffler (Austria) both developed machines which became widely used in census data processing. In 1896 Hollerith organized the Tabulating Machine Company which after consolidation with two other companies became International Business Machines. Powers (US) developed equipment which was used in the 1910 census. He formed the Powers Accounting Machine company which after some mergers became Remington Rand (later Sperry Rand). Bull (Norway) and Tauschek (Austria) invented and built punched card equipment. Key patents and aggressive marketing soon gave IBM the majority of the business data processing market.

The Harvard Mark I was sequenced by punched tape. The input and output for the first general purpose electronic computer (ENIAC) was an IBM card reader and a punch. A separate "tabulator" was used to print results from the punched cards.

The early development of an alphanumeric printer (the IBM 407-1950) has an importance that should not be overlooked. It made possible the development of user oriented languages -- first assembly language and then FORTRAN. The lack of an alphanumeric printer on the Bendix G15 (1954) made it difficult to develop a good user language. In 1959 the USSR had only numeric printers and their work on computer languages was more rudimentary than that in the US. As late as 1980 the same effect was noticeable in China -- Institutes without alphanumeric printers were not using higher level languages.

SERIAL VERSUS PARALLEL

In this first group of stored program computers two physical phenomena were used to store information. One was acoustic waves in mercury leading to "serial" computers. The other was by charge storage in cathode ray tubes (Williams' tubes) leading to "parallel" computers. Actually Williams' CRT computer was serial -- he provided "random" access to words and then processed the word serially bit by bit. Soon (1951) magnetic cores were developed and they became the universal (almost) memory component. Their advantage was not only parallel (high speed) operation but they were an order of magnitude more reliable than the earlier memories. They survived for more than twenty years finally being replaced by integrated circuit memories. Magnetic core memories finally marked the end of the serial computers.

The table below shows the performance ranges and costs of a variety of memory technologies in use today.

Technology	Access time (log)	Cents per bit cost
Bipolar VLSI	-6 to -8	0.01 to 1.0
NMOS VLSI	-4 to -6	0.008 to 0.07
Magnetic bubble	-2 to -3	0.01 to 0.0006
Magnetic disks	-1.5 to -2	0.005 to 0.00005
Floppy disks	-0.7 to -1	0.007 to 0.0008

COMPUTER LOGIC

Before 1950 electronic computers used dual control grid tubes (a two input NAND gate) or multiple cathode followers (positive OR, negative AND) for logic functions.

Computers finished in 1950 began to use semiconductor diodes (germanium) for logic gates. Soon came silicon diodes with better performance and greater reliability. The first transistors appeared in computers in 1954 (TRADIC at Bell Laboratories) and in production computers by 1955. Then came integration (1969) -- more and more logical units were placed on a single chip. Depending upon the number of units the circuits were classified more or less as follows:

Name	Logical elements	Year
SSI	2-64	1959
MSI	64-2000	1966
LSI	2000-64,000	1973
VLSI	64,000-2,000,000	1984
ULSI	2,000,000-64,000,000	?

In the next decade switching devices (currently 2 µmeters) will become so small that switching energies are comparable to that of stray alpha particles. This means that all circuits will have to use error correcting techniques, not only memory but logical functions as well. Whether we will soon reach the upper limits shown in the above table depends upon such pragmatic questions as (1) can we package 100,000,000 transistors each dissipating 10 µwatts (1 kilowatt) on a chip, and (2) at 5 volts can we have currents of 200 amperes without associated electromigration effects leading to reduced reliability?

Some authors have noted that IC designers (in 1984) are producing a few hundred transistor circuits per day. (This sounds like the number of lines of de-bugged code that system programmers produce.) Assuming the number is 500, our 64,000,000 transistor chip would require 500 man-years of effort. This places a great premium on design automation and "silicon compilers".

USER LANGUAGES

In the first stored program computers, finished in the early 1950's, the question was: would they work? Consequently, most effort went into memory design and the design of arithmetic circuits. Instruction sets were limited -- enough to do general purpose computing. Little attention was paid to how the user would do a problem.

Although some work had been done on computer languages (Zuse in Germany, Rutishauser in Switzerland, and others in the US) the first significant event was the release of FORTRAN by IBM (1957). This was soon followed by a committee designed ALGOL (1958-1960) and by a US Government sponsored COBOL designed for data processing applications. Although ALGOL was extensively used in Europe it saw little use in the US. These language developments led Bauer and Samelson to propose computers with hardware stacks. Both FORTRAN and COBOL survive today without significant changes and, in fact, it is probably true that more lines of code exist in these languages than all other computer languages combined.

With the development of time-sharing systems there was a need for simpler access to computing from terminals. Kemeny and Kurtz, of Dartmouth, filled this need with a language called BASIC. BASIC was simpler than FORTRAN or ALGOL but it had a superb user support environment. Incomplete fragments of code could be tried, variables could be inspected. It was interpretive so changes could be quickly made and tried.

In response to the ALGOL work IBM developed PL/I.

There followed the development of ALGOL 68 which, like its predecessor, was not attractive to the mainstream computer users. An alternate, PASCAL, was more widely accepted, particularly among small computer users.

The difficulties of writing large programs that could be written more or less correctly, could be maintained and which could be explained easily to others led to great interest in so-called structured programs. The ALGOL-PASCAL developments supported this idea.

These difficulties with large programs further led the US Department of Defense to support the development of a new language called ADA. Irrespective of its technical merits, about which there are great arguments, its forced use by such a major customer guarantees its existence.

The boom in personal computers has generated a market for special purpose programs. For example, more than 700,000 copies of WORDSTAR (an editor-formatter) and of VISICALC (a spread sheet program) have been sold.

ARCHITECTURE

The architecture of the first computers was as simple as possible, the emphasis was on "Let's get something that works!". The difference between processing and input-output speeds led to overlapping operations. Binary number systems promised more computing power per dollar -- so we saw the development of two lines: scientific computers and data processing computers (e.g. the IBM 704 and 705 computers). The ALGOL language development led to the use of stacks.

The relative decline in the cost of logic brought the two computer lines together. Thus, the Burroughs 5000 and the IBM 360 series had features for both scientific and business computation. There are exceptions -- the CDC computers were optimized for scientific computation.

The middle 60's saw the development of time-sharing. The MIT effort led to MULTICS. The effort at the University of California, Berkeley, led to the SDS940. IBM produced its model 67 and Digital Equipment produced its PDP11 series starting in 1970.

Three examples of modern architecture are given in the table below:

	IBM 370/168	VAX - 11/780	iAPX - 432
Year	1973	1978	1982
Instruction size	2-6 bytes	2-57 bytes	6-321 bits
Control memory	420 Kbytes	480 Kbytes	64 Kbytes
Number instructions	208	303	222
Cache size	64 Kbytes	64 Kbytes	0

These all use microprogramming.

Recently, reduced instruction set computers have been proposed on the basis that, being simpler, they can run faster and give more through-put than conventional architectures. The characteristics of three RISC computers are given below:

	IBM 801	RISC1	MIPS
Year	1980	1982	1983
Number instructions	120	39	55

These RISC computers do not use microprogramming -- control is "hard-wired", each instruction is 32 bits and execution is register to register (the references to memory are LOAD and STORE instructions). The design of these computers and their associated compilers have been integrated so as to produce improved performance.

WHERE WE ARE TODAY

The micro-mini mainframe situation.

New mainframes are becoming more powerful by the use of parallelism and the use of cache memories to make operands more quickly available.

The mini-computer has to find a new niche or it will be replaced by the micro (or the super-micro).

The micro-computer has become pervasive. Currently, Apple Computer is shipping 10,000 MacIntosh computers per month. For a cost less than the price of a cheap automobile, one can buy a computer with 512K bytes of memory, a 10 to 20 megabyte hard disk, a second processor that does 80 bit floating point arithmetic including a sufficient number of transcendental functions, a CRT (perhaps color) monitor with graphics capability, a back-up floppy disk drive (500K bytes) and a printer capable of 50 to 100 characters per second. This outperforms all but the largest mainframes of a very few years ago. It has changed the whole character of time-sharing systems and has made local area networks (LANs) a hot subject.

CS Net is a computer science network with 89 nodes in January of 1984 with 90% of the sites academic. It carried 800-1500 messages per day with lengths ranging from 1500 to 4000 bytes.

Data bases.

Many commercial data base companies are offering access to their information via personal computers. For example, Mead Data Central offers LEXIS, a 25 gigabyte file of legal information. Each week 65,000 documents are added to the file. Another file, NEXIS, contains the complete text of more than 100 newspapers and magazines. A search for particular information may take a couple of minutes, cost $20 and produce 100 to 200 hits.

Dozens of companies make commercial data bases available to PC users. Examples are: (1) Automatic Data Processing, (2) Interactive Data Corporation, (3) I.P. Sharp and (4) Wharton Economic Forecasting Associates. The financial data bases of IDC cover 10,000 companies, 14,000 banks, 250 utilities, 60,000 North American securities, 26,000 non-North American securities and 1,700,000 municipal bonds. Typically, access charges involve a minimum charge and hourly charges which may depend upon the time of day and the data base accessed. Some data base companies accept new customers and charge against their credit cards.

Soon video disk technology may offer customer specialized data bases with local access.

Automation.

The development of VLSI circuits has made it practical to automate production lines. We look at an example in the computer area. Printers are complicated devices with many parts requiring close tolerances. The Oki Electric Industry Company of Japan has described an automated production facility for dot matrix printers which became operational in November 1983. Of the 269 parts of the ET-8300 printer more than 80% are assembled by robots. 10,000 printers are assembled per month using only 27 assembly persons. They report that assembly costs exclusive of materials is one tenth of previous costs and, even more interesting, failure rate at the customer site is also 10% of previous rates. IBM has announced a printer manufacturing facility to be completed in 1986 which will be "one of the world's most highly automated" facilities.

Thus we are on the threshold of seeing completely automated manufacture of computer systems. Even many parts of the design process have been automated. This opens up the possibility of a sequence of computer controlled manufacturing systems each designing and fabricating the next and each capable of manufacturing certain computers. The control of this "induction" process is still in human hands. Perhaps a control algorithm can be found and the induction will "take-off"!

REFERENCES:

1. J.V. Atanasoff, "Advent of Electronic Digital Computing", Annals of the History of Computing, AFIPS Press, v6, n3, July 1984, pp. 229-282.

2. C.G. Bell, "The Mini and Micro Industries", Computer, IEEE CS, v17, n10, October 1984, pp. 14-30.

3. R.M. Burger et al, "The Impact of ICs on Computer Technology", Computer, IEEE CS, v17, n10, October 1984, pp. 88-95.

4. P.E. Ceruzzi, "The Early Computers of Konrad Zuse", Annals of the History of Computing, v3, n3, July 1981, pp. 241-262.

5. R. Dalrymple, "Printer Manufacturers Elbow for Shelf Space", Mini-Micro Systems, v18, n1, January 1985, pp. 128-136.

6. D.A. Patterson, "Reduced Instruction Set Computers", CACM, v28, n1, January 1985, pp. 8-21.

7. A.V. Pohm, "High-Speed Memory Systems", Computer, IEEE CS, v17, n10, October 1984, pp. 162-171.

8. H. Tanimoto, "Factory Automation: An Automatic Assembly Line for the Manufacture of Printers", Computer, IEEE CS, v17, n12, December 1984, pp. 50-68.

9. "Commercial Data Bases", PC Magazine, October 16, 1984.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

A CRITICAL VIEW ON THE POSITION OF INFORMATION PROCESSING

Niels Bjørn-Andersen
Institute of Informatics and Management Accounting
Copenhagen Business School
Copenhagen
Denmark

Many professionals still see Information Processing as a technical field primarily driven by the technical innovations within hardware and software. The paper argues that this fixation on the technical gadgets is too narrow. The concept of 'Orgware' is introduced as a crucial area next to hardware and software. Evaluation of consequences of information systems and socio-technical design are two examples of areas where a strong social science input is needed if the technology is to meet societal needs.

INTRODUCTION

This paper is partly an evaluation, partly an extension of the paper "An Assessment of the Conception and the Position of Information Processing" presented by professor Harry D. Huskey.

INFORMATION PROCESSING IN A TECHNICAL PERSPECTIVE

The main impression of the paper is that it is interesting and well-written. It is hard to disagree with any of the factual historical information. It is indeed a brilliant account of the conception and historical development of digital computers and computing. However, it does not do justice to what I see as the position of Information Processing today.

The paper takes an exclusively technical perspective and looks only at the advances in information processing - or rather data processing in terms of

- speed of computing
- bytes per chip
- storage capacity, etc.

and in terms of developments from

- punch cards to voice input
- semiconductors to GVLSI
- machine code to PROLOG.

These developments are certainly remarkable and important, but the paper is a good example of the dangerous tendency for us to see our field as limited to the technical achievements. A fixation on technical gadgets can too easily hinder seeing the area and position of information processing in a broader perspective.

The position of information processing is in fact determined by its application. A study in the US by Price Waterhouse in 1983 showed that 60% of those owning a home computer were not using it. An unofficial study in Swedish industry in 1984 showed that 50% of the personal computers were not being used, and in a Danish insurance company, 30% of the PCs were not even plugged in half a year after introduction in spite of a very extensive introduction/training program. In other words, unless the potential user perceives a need and the benefit exceeds the difficulties involved in getting started and using the equipment, people will not bother to use "our" technology. We may try to scare them by telling that "everybody who can not master a keyboard will lose his or her job in five years", and this has been done with some short-term success. People buy the equipment and perhaps even sit down and try to learn BASIC or use a spread-sheet. But unless there is a "real application need", they will not continue unless they are forced to.

When Neil Armstrong stepped on the moon in 1969 he said that it was a small step for one man but a large step for mankind. I would like to rephrase it. Technical achievements - as so aptly described by professor Huskey - are a big step forward for the industry and our profession, but will only be a small step for society if we fail to recognize the importance of the application side.

Futurologists and indeed many professionals within our own profession who talk about information society, the third wave, the leisure society, etc. are equating technical achievements with societal achievements. Unfortunately the equation is fake. The fact that we can compute 10,000 times faster does not mean that we solve societal problems 10,000 times faster. Sometimes we even run the risk of contributing to the problems. Accordingly we ought to be much more humble about the limits of our technology in the attainment of basic human needs.

ENLARGING THE SCOPE OF INFORMATION PROCESSING

When we move to the application issues it is obvious that the natural sciences (mathematics, computer science, numerical analysis, statistics, etc.) fall short of solving the problems. Many times we seem to be addressing the wrong problems. While we may be very good at avoiding the traditional type one or type two errors of classical statistical theory, we are committing type three errors: solving the wrong problem with the perfect tool and the most elaborate techniques. This is especially true when we address some of the more complicated organizational and societal issues.

If we look at the total costs of establishing a new information system we know that the costs of hardware relatively speaking are going down. Software costs are also being controlled. But an increasing amount of resources are going into what I have chosen to call "Orgware". See Figure 1.[1]

If this prediction about the economic magnitude of orgware holds true even in part, it would be foolhardy to limit ourselves by not recognizing and paying attention to the orgware issues as part of the field of information processing.

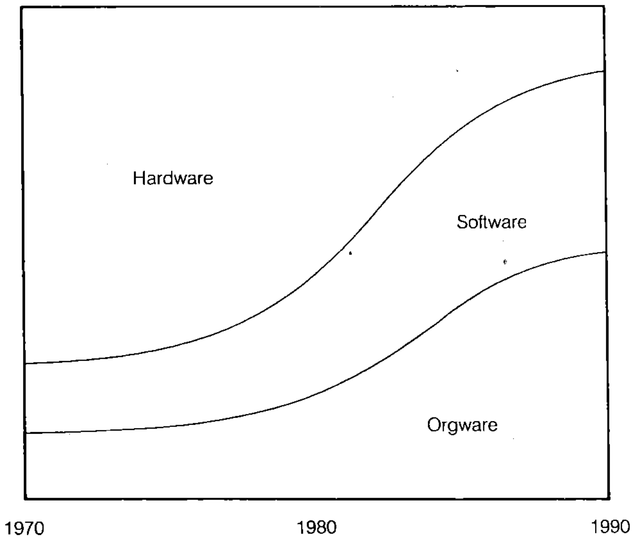


Figure 1: The distribution of total costs of an information systems project

But the main reason to do so is not economic but moral and ethical. It is my feeling that unless priority is given to human, organizational and societal values in the design and implementation of hardware and software, we shall run into greater conflicts in the future. The contribution of our technology to the attainment of true societal values may be just as non-existent as the "new clothes" worn by H.C. Andersen's emperor and sooner or later someone will start crying out "he has nothing on!"

Two areas of research are especially noteworthy:

- assessment of the implications of information systems
- socio-technical design.

These areas are not new, but have still not gained as much respect as other "harder", more "credible" subjects.

One of the first studies of computer impact was carried out in the late fifties by Ida Hoos in her study of the impact of batch computer systems, "When the Computer Takes Over the Office"(2). Many other studies of the impact of the newest technical innovations have followed, especially looking at issues like

- employment

- privacy
- job content
- intellectual processes.

A great deal has been learned from these studies and put into practice so that a good number of information systems have been developed or changed to take these issues into account. More needs to be done, but there is no excuse for ignorance of the fact that these studies have important implications.

The second area of information processing not discussed by professor Huskey is socio-technical design. The concept is older than computing, having started in industrial production settings where the need to design the social and the technical system at the same time was perceived more than 50 years ago.

The first attempt at an integrated socio-technical approach to the design of information systems was suggested by Enid Mumford(3).

These ideas have been further developed especially in two areas:

- user participation in systems design
- broader organizational design as part of an information systems design project.

(Incidentally, readers interested in the different orientations of the two sexes might note that both of the two key figures mentioned above are women!)

These ideas are unfortunately not always integrated in practical design, even when they are given lip-service. As recently as the first IFIP World Conference on Human/Computer Interaction in London, September 1984, I was appalled to see the way in which "human factors" research was addressed in most of the presentations. I get worried when, for example, a piece of work, such as providing instructions for getting a hard copy on the word-processor, is called a task and broken down into 20 "move a finger" subtasks, and the analyst does not consider any other level between this so-called task and the total job.

Change the setting from München (the place of the 25th Anniversary Celebrations of IFIP) to Bethlehem Steel, Pennsylvania, the time from 1985 to 1910, costuming from grey skirt to overall and the task from routine office work to moving steel. Then turn the office clerk into worried laborer Schmidt and replace the computer with the stopwatch. The ideas of Fredrich W. Taylor are not only very much alive, but have spread to new types of work.

The computing profession ought to recognize that the social sciences have progressed since 1910 and avoid copying the mistakes of Taylorism: specialization, fragmentation, pre-structuring, etc.

But in much of the work within the field of information processing these mistakes are repeated again and again due to fixation on technical gadgets. We are thus not utilizing the potential of the technology for liberating and supporting people.

One such recent example is expert systems. Almost all development of expert systems seems to be dominated by designers who are fascinated with the number of rules that may be included into the program or with the logic of the predicate calculus while they seem to forget the social and behavioral aspects. Most expert systems seem to be guided by the principle of expropriating the knowledge of the expert and putting it into the program instead of designing a system which will assist the expert in becoming a better expert.

Therefore much present day work may be characterized by the famous quotation from Abraham Maslow, "To he who has a hammer - the world looks like a nail." But we must not talk ourselves into believing that all problems may be treated as nails.

CONCLUSION

Fortunately there is a wide range of research projects and actual systems design projects where focus is not exclusively technology driven but need directed.

Only if we see the field of information processing as an applied research field drawing upon knowledge from social as well as natural sciences can we hope to realize the full potential of the technology. And that ought to be the position of information processing and of IFIP in the next 25 years.

REFERENCES:

(1) Bjørn-Andersen, N., Are 'human factors' human?, Key note address given at the IFIP Interact '84 conference, in Bevan, N. and Murray, D. (eds.) Man/Machine integration - State of the Art Report (Pergamon Infotec, Maidenhead, England, 1985).

(2) Hoos, I.R., When the computer takes over the office, Harvard Business Review, Vol. 38, 4 (1960) 102-112.

(3) Mumford, E. and Ward, T.B., Computers - planning for people, (Batsfords, London, 1968).

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

RATIOCINATION AND INTUITION IN THE PROGRAMMING PROCESS

Friedrich L. Bauer

Institut für Informatik
Technical University Munich

Programming has been considered an art (KNUTH: *The art of Computer Programming*) and a scientific discipline (DIJKSTRA: *A Discipline of Programming*). It has traits of both. Intuition is needed as much as its antonym ratiocination, i.e. rational reasoning. But the interplay between these symbiotic factors is complicated.

Ratiocination

The great LEIBNIZ, proclaimed by Norbert WIENER as the patron saint of the computer, used the expression *calculus ratiocinator* in his visionary concept of a *method of reasoning*, a logical calculus as we would say today.

This was in the year 1666, when LEIBNIZ was 20 years young. It took many years, until George BOOLE (1847) on the algebraic side and Gottlob FREGE (1879) on the relational side gave first realizations of LEIBNIZ's dreams.

LEIBNIZ has started at the age of 15 to reform logic, protesting against the form it was taught at the Leipzig University by humanists and scholastics. His *characteristica universalis* combined composite symbols according to certain rules, combinations (*"characters"*) which were aimed at characterizing concepts not only uniquely, but also completely with all their relations to other concepts. This was the beginning of a formal-deductive logic. Technically, LEIBNIZ's achievements were non-trivial; apart from the *principium rationis sufficientis ('nihil est sine ratione'*, nothing is without reason, '*nihil fit sine causa*', nothing happens without cause), which was so important for the causality principle in the philosophy of Natural Sciences, he gave the *principium contradictionis* (principle of the excluded contradiction) and the principle of the identity of the undistinguishable: if two things are identical, then the replacement of the totality of concepts about the one thing by that of the other thing does not change the truth of propositions about them: in modern notation (HILBERT-BERNAYS), this reads for an arbitrary predicate P

$$a = b \rightarrow (P(a) \rightarrow P(b)) .$$

By using a very special lattice, the lattice of natural numbers with respect to divisibility, LEIBNIZ fell short of Boolean algebras. In an example he gave, *animal* is encoded by 6 , *rationale* by 5 , *homo* by 30 , and thus $30 = 6 \cdot 5$ is written for *homo est animal rationale*. Conjunction and disjunction are properly encoded by least common multiple and greatest common divisor - but the model does not provide for negation. This is a minor blemish, since LEIBNIZ's work, though not successful in this respect, was an important stimulus to others, in particular to LAMBERT and to FREGE.

FREGE's *Begriffsschrift* is a realization of LEIBNIZ's *lingua universalis*. It offers the *calculus ratiocinator* of propositions expressed in this language, as it is now common in formal logic. In this frame, the theorems of a theory are purely syntactically distinguished without reference to their *content*. This makes the calculus feasible. In the powerful modern propositional and predicate calculi, reasoning has shrunk to a mere formalism.

The *calculus ratiocinator* is only one instance of LEIBNIZ's general drive to liberate man from the burden of monotonous mental labour[1]. Another one is LEIBNIZ's invention of a calculator that could mechanically perform addition, subtraction and, in this respect surpassing PASCAL, multiplication and division.

Liberation of Man from the Burden of Monotonous Mental Labour vs. Replacement of Man by Artifacts

82 years after LEIBNIZ's *de arte combinatoria*, in the age of shooting materialism, the French physician LAMETTRIE wrote, under the title <<L'homme machine>> a book regarding Man as a mere machine. These were the times of homunculi and sorcerer's apprentices, the times of the faked chess automaton by KEMPELEN and of the androids, reflected in the literary works of the phantastic realism (E. T. A. HOFFMANN's *sandman* with the puppet *Olimpia*) and continued to the Modern Age in Gustav MEYRINCK's resurrection of the claymade *Golem* (1915) and in the *Robot* of Karel CAPEK (1920).

It was stated above that in the formal logic, developing from LEIBNIZ's *characteristica*, reasoning is done without reference to the *content* of the concepts involved. This can be seen philosophically as the elimination of the *human component*. It may lead to the (unproved) view that Man can be replaced totally in his intellectual capability by a mechanical system of reasoning. Properly mechanized, an artifact, an artificial gadget would do what so far has been the privilege of the human mind. It is only a small step from the terminus "*intelligence amplifier*" introduced 1956 by W. Ross ASHBY to the preposterous phrase "*artificial intelligence*" that came up in the same year, according to Ed FEIGENBAUM, in a seminal meeting at Dartmouth College with Nat ROCHESTER being one of the organizers. The term - certainly influenced by Alan TURING's use of "Intelligent Machinery" and "Computing Machinery and Intelligence" as titles of two papers from 1947 and 1950, by Warren McCULLOCH's phrase "Machines that think and want" (1950), and by Ross ASHBY's "The cerebral mechanism of intelligent action" (1950), - raised fierce feuds when taken too literally. If one follows FEIGENBAUM, it means no more than "making a computer behave in ways that mimic intelligent human behaviour" (/1/ , p. 33). Elsewhere in this volume ZEMANEK puts it similarly: "the term is an abbreviation for artificial generation of results which normally are produced by an intelligent mind".

Whether or not the term is chosen well (it suits sensational journalists, but ZEMANEK states that it is "a contradiction in itself, because something either is artificial or it is intelligent, but not both at once") is immaterial here. However, the careless use of the phrase is apt to lead the general public to a simplified expectation. In particular, it provokes the idea that sooner or later we may dispense with human intelligence - which is not only wrong but may also cause undue fears. After all, Ambrose BIERCE was able to attract a lot of interest with his black humour in the 1893 story of the chess-playing automaton that, after loosing a game against its inventor, goes mad and strangles him.

---

1 The expression "*mental labour*" has been used already by BABBAGE; there is a chapter heading "On the Division of Mental Labour" in his book "On the Economy of Machinery and Manufacturers".

This is fiction. But to say it clearly: Ratiocination can not only help the human - like any technical achievement it can also be misused and finally turned against the human race. The latter we should beware of, but we should not throw the baby with the water. There is no point in giving room to the waves of anti-intellectualism licking periodically at the beaches of science (/2/) .

Intuition

Intuition has been defined to be "the power of knowing things without conscious reasoning" (Merriam-Webster Pocket Dictionary). To this extent, it is polar to ratiocination. If one says "intuitively, I think ....", then very often one can not give reasons at all (or does not want to give them), in particular if one is guided by superstition, presentiment, déjà-vu. KEKULE's dream of the benzol ring may be called intuition. On the other hand, the finding that the first six decimal digits of π are 3, 1, 4, 1, 5, 9 will hardly be termed intuitive.

Intuition often works (in an irrational way) with analogs. If somebody has understood that the (two-dimensional) area of a triangle is one half of the area of a rectangle with the same ground line and the same height, he is not unlikely to arrive *intuitively* at the result that the (three-dimensional) volume of a pyramid (with a polyhedral ground face) is one third of the volume of a prism with the same ground face and the same height. Maybe, he does not even feel the need for a proof - if so, he may again *intuitively* arrive at the proof idea outlined in Fig. 1 - in analogy to the decomposition of the rectangle into two parts of equal area, the prism may be decomposed in three parts which can indeed be shown to have the same volume. The rest is done by CAVALIERI's principle and by a decomposition of the ground surface into triangles.

As much as the literary world has its fables and parables, the world of science since ancient times works with instructive examples, with paradigms[1]. The above theorems for two and three dimensions are paradigmatic for an n-dimensional case. Based on paradigms, intuition is a powerful guide in problem solving. Only hard-hearted intellectuals may be inclined to place intuition below reasoning.

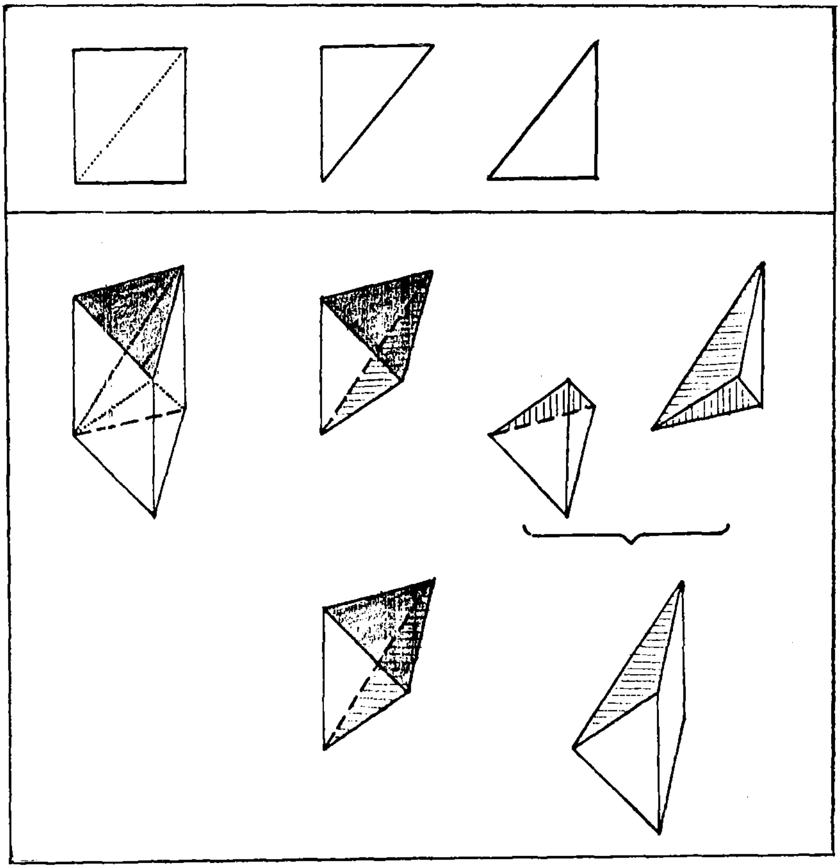
Paradigms should, however, be chosen carefully. A well-known card trick works as follows: if from a set of 13 cards - Ace, Two, Three, ..., Jack, Queen, King - one card is removed, the magician finds the missing one by the following procedure: While quickly inspecting the set card by card, he forms the sum of the card values (with 11 for Jack, 12 for Queen and 13 for King) modulo 13 and substracts this from 13 - the result is the value of the missing card. Just try!

If now somebody wants to perform this with 10 cards from a Spanish pack - Ace, Two, ..., Seven, Jack, Queen, King -, one might expect to form the sum of the values modulo 10 (which is quite trivial) and subtract this from 10 . But, alas, the formula does not work! If, however, one calculates modulo 11 , the trick works again.

---

1 Paradigm is used here in the classical sense. The misuse of the word, caused by T. S. KUHN (for lack of a word to replace the ominous "*theory*" in his Theory of Science) has been deplored lately by KUHN himself (Third Annual Conference of the Cognitive Science Society, August 1981).

Fig. 1 Decomposition of rectangle and prism



The explanation is simple: the sum of the first N numbers is $N \cdot (N+1)/2$ and

if N is even, then $N \cdot (N+1)/2 = 0 \bmod N+1$
if N is odd, then $N \cdot (N+1)/2 = 0 \bmod N$

The alleged paradigm is in fact deceiving. Intuition is misguided here.

"Unter Intuition versteht man die Fähigkeit gewisser Leute, eine Lage in Sekundenschnelle falsch zu beurteilen."
(Friedrich DÜRRENMATT)
"Intuition means the capability of certain people to judge within seconds a situation wrongly."

Intuition-Aided Problem Solving vs. Replacement of Rational Thinking by Feelings

Not being warned enough by the existence of false paradigms, some otherwise quite intelligent people may place intuition above reasoning[1]. Much worse, the general public applauds, if a politician says: In mathematics, I have been very weak, and logic is a nightmare to me - but I have a sixth sense about doing intuitively the right things. The result is, in mild cases, that a hospital costs eight times of what has been budgeted, or that the universities are flooded with students many of which can not find employment in their academic field. In worse cases, thousands or millions of people are killed by miscalculations, by lack of reasoning - it seems to be unnecessary to specify names of earlier or more recent history.

From disrespect for rational thinking, it is only a small step to the extreme position of[2] the *Maschinenstürmer*: All machines, products of the perverted human mind, are evil.

In the field of programming, a subtle form of intolerant attitude towards rational thinking comes up in two places. In some quarters, one speaks (misusing again the misused word paradigm) of a coming "change of paradigms" from Software Engineering to a view that puts the human user in the center (see e.g. /3/). This expresses a certain disregard for formal methods. In a rather different êlite subculture of certain software houses, "*creative tools*" and the study of "*human excellency*" have come to prominence (see e.g. /4/). This attitude shows likewise negligence of formal methods.

Careless use of the word intuition is apt to lead the general public to unjustified expectations, too. In particular, it provokes the idea that sooner or later we may dispense with all our civilization, which again is not only wrong, but also a dangerous halluzination.

To say it clearly: Intuition c a n help the human - but like any cultural achievement it can be exaggerated and then turns against the human race. There is no point in returning to alchemy, to astrology, to incantations.

Problem Solving - A Symbiosis between Ratiocination and Intuition

The situation is quite symmetrical: Ratiocination is a good thing, as long as it tolerates intuition, and intuition is a good thing, as long as it tolerates ratiocination.

In problem solving, however, ratiocination and intuition supplement each other. Take a chess player (his problem being to win): The chess rules are clearly defined; to apply them when analyzing a move and the opponents possible countermoves is a matter of the rational mind. Intuition, however, is indispensable in order to rule out a large number of possible moves as being unpromising or uninteresting. Intuition will also draw the attention of the player to a certain possibility of attack or defense, but without the rational mind analyzing all possible implications, the disaster is lurking.

---

1 This is not surprising if one is informed that the president of the board of directors of a large industrial enterprise believes in astrology.

2 Ludditism

It is often overlooked that even in the Computer Chess Tournaments, programs are changed by the "*human component behind*" between games. David LEVY (/5/) reports about a match he played in the middle of April 1984 against a CRAY Computer, "after the second game, the CRAY BLITZ programmers [Robert HYATT and Bert GOWER] decided that they needed to discourage their program from allowing blocked pawn formations in the center, as this had occurred in the first two games and was disadvantageous to the program". A fair Computer Chess Game would require a sealed program, and such a program would be considered good if after five years still some serious chess player would bother to play against it. In any case, only a sealed program could be used in pretending artificial intelligence.

Even the hard-boiled artificial intelligence freak knows the value of intuition, the role of which he tries to mimic in an "heuristic approach". And in a growing number of cases, the heuristics finally gives way to a systematic rational analysis - what, alas, does not yet prove that this will be so for all cases.

And also the esoteric computer artist with deep-rooted disdain for formalities will not refrain from using rational thinking now and then, for example when calculating his honorarium.

A well-functioning symbiosis between ratiocination and intuition, at any case, is a difficult thing, and to understand the principles of such a supplementary cooperation is one of the most challenging tasks in informatics. It requires "a new awareness" (if it is allowed to give the motto for the 10th IFIP World Congress in Dublin 1986 some concrete interpretation).

The problem is, that intuition has deceiving traits, as was shown by the example above. Its study needs a psychologist with a profound knowledge of the computer, such as Gerald WEINBERG (see e.g. /6/), and maybe more. But so far the necessary cooperation between the psychologist who may hope to understand what intuition is, and the formal logician, who may hope to understand what reasoning is, has not been very successful. At best, they listen to each other, but mostly they are not even doing this.

It is not surprising that two well-established disciplines with considerable self-esteem and a lot of inbred culture have such difficulties. The initiative should therefore come from neutral ground, preferably from the practical programmers and from their academic parents, the professors of informatics. That such an approach will bring fresh air into a sticky atmosphere has recently been shown by Georg V. ZEMANEK (the junior), who studied, motivated by H.F. LEDGARDS "Programming Proverbs" (/7/), programming errors made by beginners (there were no other guinea-pigs accessible to him). Mechanical mistakes, inattention, and lack of knowledge left aside, he finds the remaining sources of serious errors to be i l l u s i o n s , much in the sense the word is used for optical or acoustical phenomena, where one sees or hears not what one sees or hears. He lists a few of them: Illusion by predisposition, by inhibition, by repression, by repetition.

It is known that the classical illusions of the perceiving organs are the price we pay for the cerebral ability of *Gestalt* recognition in optical or acoustical form. It is plausible, that intuition, defined as above to be "the power of knowing things without conscious reasoning", amounts to some "unconscious" or "subconscious" Gestalt recognition of formal structures done completely in certain parts of the cortex. This is to be studied more closely.

It may one day explain why it is so extremely difficult "to program a computer so that it will recognize a face when someone has grown a beard" (D. KNUTH), or to write a program that learns talking like a child learns it. It was stated by Don KNUTH recently "All the things we do subconsciously are the things that artificial intelligence hasn't been able to do". Experimental work in the realm of subconscious is so hard to accomplish.

Programming as Problem Solving by Intuition-Guided Ratiocination

If programming is understood as the process of obtaining an efficient algorithmic solution for a given task - once this task, as the result of requirements engineering, is well specified - then successful programming in the large needs an intertwining of intuition and ratiocination to such an extent that frequently the mind gets tangled. A support system by the computer itself becomes mandatory.

In the project CIP at the Technical University Munich, computer-aided program development by intuition-guided stepwise transformation has been studied. The work is approaching completion, the conceptual basis and its linguistic setting being defined in the LANGUAGE REPORT (/8/), the transformation system being described in the SYSTEM REPORT (/9/). The transformation system comprises an „algebra of programs", a calculus of formal, syntactic inference rules for programs, reflecting the programmers power of ratiocination; it is an interactive system where the programmers intuition determines the inference rules to be applied by the machine. We consider it an essential experimental step towards Computer-Aided Problem Solving by Intuition-Guided Ratiocination.

A Toy Example and a Full-Sized Example

A toy example of this genre is given in what follows. The steps of a classical Markov algorithm are all of the following form:

> Replace within some given word A the leftmost occurrence of a given word B - if there is any - by a given word B' .

The problem is to give an algorithm for doing this on concrete strings of symbols.

Intuition may reveal to us to consider the following four mutually exclusive cases

- (i) A and B are identical.
- (ii) A is a proper left-part of B .
- (iii) B is a proper left-part of A .
- (iv) neither are A and B identical nor is A a proper left-part of B nor is B a proper left-part of A .

Ratiocination then allows us to give statements about the results of such an algorithm:

- ad (i) Replacement is possible, the result is B' .
- ad (ii) Replacement is not possible, the result is A .
- ad (iii) Replacement is possible. Let h denote the remaining right part of A (such that B followed by h equals A) . Then B' followed by h is the result.
- ad (iv) No immediate replacement is possible. But, since A is non-empty - otherwise (ii) or (i) would hold - A has a first symbol first(A) . Let rest(A) denote the remaining word (such that first(A) followed by rest(A) equals A). Then the result is obtained as first(A) followed by the result of the algorithm for replacing in rest(A) the word B by B' .

These findings allow a recursive computation of the result. Ratiocination gives us also

- that the recursive algorithm terminates - since every recursion step diminishes the length of the word which is subject to replacement
- that the algorithm, working from left to right, replaces just the leftmost occurrence of B , if any.

We have described the algorithm verbally - and still quite formally - but there is no difficulty in rewriting it in the form common programming languages prescribe[1]. The predicate *is-left-part-of* is a primitive here; to give an algorithm for it is a new, but much simpler problem which we shall deal with below.

The reader may ask: How did you arrive at distinguishing just the four cases - in particular, since the predicate *is-proper-left-part-of* does not show up explicitly in the specification of the problem? One possible answer is the following.

There is the partial-order paradigm: Whenever you know that in your data structure a partial order exists - and *is-left-part-of* expresses a partial ordering of strings of symbols - try the four cases.

This could, of course, also be done with the predicate *is-right-part-of*, but then we would not get the leftmost replacement. Intuition tells us to prefer *is-left-part-of* to *is-right-part-of* when using the partial-order paradigm, if the l e f t most occurrence of B is to be replaced.

Moreover, the *is-left-part-of* and the *is-right-part-of* predicate might very well have been used already in the problem specification. The very loose expression "replace B within A ..." can be worded more formally "if there exists a word K such that K is right-part of A and B is left-part of K , replace B ..." .

As a consequence of these afterthoughts we may now investigate whether the algorithm yields a "reasonable" result in any cancellative partially ordered monoid (cf. /10/ , 3.4.2). We may thus do an essential step into abstraction.

By the way, for the problem of finding an algorithm for the *is-proper-left-part-of* predicate, the classical paradigm "distinguish the cases of the empty and the non-empty word" leads to a solution. The predicate is specified as follows:

> Decide whether there exists a non-empty word X such that some given L followed by X equals some given M .

There are the following four cases

- (i) Both L and M are empty.
- (ii) L is empty and M is non-empty.
- (iii) L is non-empty and M is empty.
- (iv) Both L and M are non-empty.

Ratiocination then allows to derive the following statements about the results of the wanted algorithm

ad (i) The result is false.
ad (ii) The result is true.
ad (iii) The result is false.
ad (iv) No immediate decision is possible. But the result is true if first(L) equals first(M) and rest(L) is proper left-part of rest(M).

---

1 To be specific, we give a PASCAL-like version in the Appendix. The reader may be surprised that a purely iterative version, such as DIJKSTRA would derive it, despite its elegance will require a much more complicated argumentation.

The last paradigm is a special case of the Paradigm of Object Induction: *Distinguish the cases that are fundamental in the induction definition* ("generation") *of the object structure.* In simple cases, this paradigm leads to algorithms that reflect, in their recursion structure, the inductive structure of the objects they work upon. There are many classical examples from recursive descent compilers to VON HENKE's program generators that are covered by this paradigm; the JACKSON method of program design is a utilization of it.

Toy examples, admittedly, may be misleading. But a life-sized example would do no good here. We therefore refer to the CIP SYSTEM REPORT (/9/) . There, an entire program transformation system is derived formally (computer-aided and thus computer-checked) by an interplay of human intuition and machine-performed ratiocination. Since we refrained from heuristic measures, we also refrain from speaking of artificial intelligence - but we could quite well call the CIP System a logical expert system, with a knowledge base derived in itself.

A Refusal of Radical Attitudes

At present, there is a danger that the radical forces within the camps of "artificial intelligence" on the one side and of "creative tools" on the other side attract too much attention. The programming community should not be ground between these millstones. Instead, a constructive attitude to the existing, throughout promising aspects of both fields, a unification of formal mechanisms and intuitive guidance is recommended. And to suit the sensational journalists, wouldn't "artificial intelligence with creative tools" or "creative tools with artificial intelligence" make good headlines, too?

REFERENCES

/ 1/ Edward A. Feigenbaum and Pamela McCorduck, The Fifth Generation. Addison-Wesley, Reading 1983

/ 2/ Richard Hofstadter, Anti-Intellectualism in American Life. Knopf, New York 1963

/ 3/ Christiane Floyd, Eine vergleichende Untersuchung von Softwareentwicklungsmethoden. Vortrag bei der Tagung „Programmiersprachen und Compiler" des German Chapter of the ACM, München, April 1984

/ 4/ Peter Molzberger, Kreative Tools. Vortrag bei der Tagung „Software-Entwicklung; Kreativer Prozeß oder formales Problem?" des German Chapter of the ACM, München, März 1985

/ 5/ David Lévy, Chess Master versus Computer. Abacus Vol. 2 No. 2, p. 72-77

/ 6/ Gerald M. Weinberg, The Psychology of Computer-Programming. Van Nostrand, New York 1971

/ 7/ Henry F. Ledgard, Programming Proverbs. Hayden, New Jersey 1975

/ 8/ Friedrich L. Bauer et al., The Munich Project CIP. Volume I: The Wide Spectrum Language CIP-L. LNCS 183, Springer, Berlin 1985

/ 9/ Friedrich L. Bauer et al., The Munich Project CIP. Volume II: The Program Transformation System CIP-S. LNCS, Springer, to appear

/10/ Friedrich L. Bauer and Hans Wössner, Algorithmic Language and Program Development. Springer, Berlin 1982

Appendix: CIP program for the Markov step *replace*

```
structure s = replace, properleftpart, delete :
function replace (A : string ; B : string ; B1 : string): string ;
    if   A = B                 then B1
    orif properleftpart(A, B) then A
    orif properleftpart(B, A) then conc(B1, delete(B, A))
    orif not (A = B) and
         not properleftpart(A, B) and not properleftpart(B, A)
                               then prefix(first(A), replace(rest(A), B, B1))
    endif,
 function properleftpart (L : string ; M : string): boolean ;
    if       (L = empty) and     (M = empty)  then false
    orif     (L = empty) and not (M = empty)  then true
    orif not (L = empty) and     (M = empty)  then false
    orif not (L = empty) and not (M = empty)  then
        (first(L) = first(M)) and properleftpart(rest(L), rest(M))
    endif,
function delete (X : string ; Y : string || properleftpart(X, Y)): string ;
    if       X = empty  then Y
    orif not (X = empty) then delete(rest(X), rest(Y))
    endif
 endstructure
```

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

MUST WE DO EVERYTHING WE CAN DO?

Sense and Nonsense in Information Processing

Heinz Zemanek
IFIP Honorary Member
Vienna, Austria

Certain aspects of sense and nonsense in information processing are discussed under ten different definitions of information. In conclusion, a few remarks are made concerning the policy and ethics of science and technology.

We are happy that so many computer pioneers are present at this IFIP celebration. They certainly can still remember the great feelings when the idea of electronic computing was transformed from a crazy hope into a working machinery. It was the feeling of accomplishment, but insufficient performance. The question in those days was not at all *Must we do everything we can do?* - the question was *How can we do all the things which appear so urgently necessary and so hard to achieve even far away in the future?* If anyone talked about *Nonsense in Information Processing* he did not belong to the computer community and he usually was completely wrong. The profession was on its way to making sense, and there was no doubt for the insiders that the computer would be a big success. Indeed, it became a success, and a much bigger one than the keenest optimists could have expected.

More than 40 years after the first electronic computing devices and 25 years after the formation of IFIP the situation is still the same in many respects. Each of us can produce a long list of goals which today appear so urgently necessary and so hard to achieve even far away in the future. Nobody could say that all that can be done is being done - there is not time enough, there is not money enough, and we are not wise enough. The younger generation has plenty of opportunities to reach the feeling of achievement and to become inspired by the discovery of unresolved, but resolvable problems. As in the old days, there the conviction that the future will bring great success for information processing.

But there is an essential difference to the early days. While the pioneers moved into an undiscovered, into an empty space, the avant-garde of today has to start from a scenery full of concrete and abstract machinery, full of world-famous stories of achievements and defeats, and it is very difficult to be sure that the intended venture had not been tried already years ago and had turned out to be much less glamourous that it appeared at the starting point. The success-rate, in other words, has become considerably smaller. Not everything that can be done has a fair chance to compete successfully with what exists already. During the last 25 years, our field has reached a level of maturity and experience which provides a relatively safe judgment of any next step of advance. Clearly, the amazing next break-through may happen at an unexpected point - the safe judgment is an average truth with exciting exceptions.

Experience and maturity, however, do not only apply to future advance, they apply also to the judgement of the past and the present, and in a multitude of activities and applications there are many which make little sense or are sheer nonsense. And here we can ask: did we have to do that simply because we were able to do it? During the pioneering period a little share of nonsense is more creative than disturbing. Today, however, the question is indeed appropriate: must we do everything we can do? How much nonsense do we have? How much can we tolerate?

In today's programme, this is the only paper expressing a critical view already in its title. It was Professor Bauer's suggestion and I had very mixed feelings in accepting it; because it is easy to pathetically say, no, no, we must not do everything we can do. But it is by far not so easy to point out where we should stop ourselves and others. What looks like nonsense can turn into sense in the good end, and what looks perfectly reasonable now might be laughed about as total nonsense by the next generation.

Being critical and judging sense and nonsense is risky and requires more preparation that I could achieve under the circumstances. It would appear safer to change to a kind of metapaper on the question of how to distinguish reliably between sense and nonsense and what may be the principles by which a dicision could be made that something feasible should better *not* be done.

It is not my intention to escape into such a metapaper, but it seemed appropriate to look for some philosophical guidance for its design. Of course, I retrieved it from my research work on the theory of design which I call *Abstract Architecture*. It is a generalization of computer architecture, a notion created by the architects of IBM System/360 and knowingly or not based on the ten books on architecture by Vitruvius, the ancient architect and writer. One of the basic principles is appropriateness. It says that one should choose for a design a few principles, standards and features, as few as possible - but carry them out systematically. No fancy, ad-hoc created singularities should be added for the pleasure of the designer or for an atypical user. This principle should motivate the designer to concentrate on his main lines and to check again and again whether, in his zeal to include as much as possible, he has added unnecessary, confusing or harmful imponderabilities that should be removed.

It is obvious that one step of generaization leads to the architecture of the computer profession. Is information processing conscious in keeping its consciousness or has it included lots of whistles and bells, superfluous buildings of theory and unnecessary gadgets of technology which may confuse the computer user, the computer victim and the general public?

Now clearly there is no authority that could decide on appropriateness of scientific and technical, economic and social aspects and working areas. Definitely, nobody in IFIP should even come to the idea of having or proposing such an authority. But somewhere in the minds of all of us there is a clear voice telling the right way. It might be a week voice which needs some amplification. In this sense I have accepted the title suggested by Professor Bauer, with the intention of raising questions and triggering answers. And I have chosen the architectural principle to discuss ten versions of the definition of information and to reflect the main theme on each of them.

What is Information Processing?

This procedure makes sense. Because in order to critically consider sense and nonsense and whether we must do everything we can do, we have to carefully review what it is that we do. What is information processing?

Pragmatically speaking, our profession is to design, build, program, install, use, apply, maintain and teach computers. And these automatic electronic devices accept and store, collect and distribute, transform, compress and expand information. Thanks to our efforts, information has now become a merchandise, an omnipresent entity, which complements and controls material and energy. Information, hardly mentioned a century ago, has become a central issue of the world, and information processing has become a large scientific field and a big industry. Everyone requests more information, more data and more sophisticated programs. Our technology can fulfill a great deal of those wishes because we have achieved a unique and sensational improvement of the basic parameters: speed, size, complexity, cost and reliability. No other technology can present such a record of achievement - for the third time we are presently improving by a factor of 1000 within 20 years. And no other technology is as friendly as ours to the environment, can help as much against waste and pollution. That we are guilty of producing information pollution once in a while is an other story to which I shall come back.

Following a one hundred year old tradition of electrical engineering, we are not only sensitive to the hazards our devices and programs may carry, we work hard on reliability and correctness, and we are actively concerned as to the possible physiological, psychological and societal effects. Certainly, much more could be done. It might be a task for IFIP to take a lead in developing security and safety standards for information processing, aiming at a self-control similar to the one exercised by the professional societies of electrical engineering for electrical power and communication devices. We would have to go further: to information protection for the individual and for institutions. We could become a paragon for professions like lawyers, government officers and politicians who - motivated by their computer usage - might one day too establish security and safety standards for themselves, their customers and their victims.

Going a little deeper, we will have to ask *What is processing?* and *What is information?* It appears that the first answer is easy, the second is difficult.

Processing, in our case, is the application of logical automatic replacement rules to chains of symbols. This is what the computer does and this is all the computer can do. The meaning of the programs we write is defined by the switching devices on which they run. Since, however, programming does not begin anymore at the level of machine language and is not confined to numerical procedures, since it begins in the practical world, we are back in the situation we can remember from our school days when the teacher gave us a problem of the practical world and expected us to find the right mathematical formulation. As sure as we might have been of the algebraic operations, we were dubious about our transformation from ordinary language to algebra. Processing means formalization. And while mathematics and book-keeping look back on 300 years of homework and experience in formalization, most other application fields have not even yet started their homework and so they lack the feeling for what the computer can or can not do for them; they can not simply enter existing formalized structures and data bodies as a basis for their applications. The use of computers in the legal field or in the humanities are typical examples. A quarter century after all that was said at the ICIP Congress in Paris 1959, they are still in the beginner's phase and only slowly recognize how much work there is still to do. These professions, however, could rightly ask *Must we do all this only because it might be possible that it could be done?* But here we have an iron-clad answer: the computer is a powerful tool as well for them and it is always reasonable to apply an efficient tool. The danger in the humanities and in law is that formalization tends to kill life and spirit - an insight at least 2000 years old. Life and mind must remain stronger than the mechanisms - a request that gives a lot to think about.

Ten Definitions of Information

The second question, *What is information?*, is astonishingly difficult to answer. There is no standard or generally accepted answer, and I think there should not be one. Information is a live entity which should not be enshrined by a formal definition. In this spirit, we shall give ten different versions of defintions - and all of them together still do not exhaust the notion. Information is an open subject.

Etymology : DEFINITION # 1

Information is what the word tells.

The Latin origin indicates *form* as fundamental constituent of the word *information* - *form*-giving, trans*form*ation, in*form*ation. And it is, of course, man at whom information is aiming. Education is systematic information. Such was the meaning of the word *information* before it became a technical term, depersonalized and reduced to data and head-lines. I think that the old meaning, namely orienting and educating people, should be conserved, emphasized and cultivated. It marks sense and nonsense in information processing.

Computers : DEFINITION # 2

Information is the entity processed by the computer.

Since we work with computers, this looks like a perfect professional definition. But in fact, this is not a definition but a question: *What do we process?* And I shall be wise enough not to answer this question directly but to continue to discuss further definitions and add comments.

Sensory Organs : DEFINITION # 3

Information is the entity delivered by our sensory organs.

This is an extensive definition, and the body is a good teacher for a technology in an advanced state (not at the beginning - the tailor of Ulm rightly fell on his nose when he tried to fly like a bird by means of artificial wings; but now that the aircraft technology is advanced enough we could try to learn from the bird). From the nervous network we can learn, for instance, that the coding of information into bits does not necessarily deprive it of life and colour, because the nervous network, too, uses a code of unified pulse - not digital but analog and working heavily in parallel. We also learn that information processing means information reduction: at the level of our consciousness, millions of bits received by the sensory organs have been reduced to a channel capacity of 25 and less bits per second. We engineers are obviously not as good as nature in purposeful and effective information reduction. We should aim at more success in this respect because too much information is nonsense per se. We always should try to reach the same goal with less information.

Language: DEFINITION # 4

Information is the entity transmitted by language.

As far as we are able to express sensory impressions by language, definition # 4 is the same as definition # 3, but it is clear that some impressions are hard or impossible to translate into words, to express by words.

On the other hand, language - whether spoken or written - provides the combinatorial model which we follow in the computer. Language has a well-defined set of sounds or letters, an alphabet of about the size we cover by our keyboards. Words are formed by combinatorial rules. Ideograms (consider that the West has them as well as the Chinese language - try to estimate how many you recognize in the street) are more complex, but have a similar nature. The scientific investigation of language, begun by behaviorism and considered as the basis of philosophy by the Logical Positivism, is called *Semiotics*. It distinguishes three levels of investigation, *Syntax, Semantics and Pragmatics*, which obviously are also three levels in information. Since they are very important for information processing, it is useful to give the concise definitions for them.

(1) SYNTAX

Syntax investigates the relationships between the symbols of a language system, without reference to their meaning.

(2) SEMANTICS

Semantics investigates the relationships between the symbols and what they designate - in other words: between the text and the described reality (in the largest sense of the word), without reference to the user, the use or other aspects beyond objective meaning.

(3) PRAGMATICS

Pragmatics investigates all other relationships, to the user and to the use, to history and whatever else might be brought into the game.

The difference between syntax and semantics is the difference between form and meaning. Here is a crucial property of the computer: the electronic switching devices and the programs applied to them operate strictly syntactically - chains of symbols are transformed into other chains of symbols by means of rules valid between the symbols and without reference to meaning or to the real world. The latter might come in via input-output devices, but their influence is under the same restriction. The computer is an industrious and perfect syntax machine - semantics is reserved to the human being. It is, therefore, absolute nonsense to speak about the computer like about a human being; anthropomorphizing is what I would like to call *syntactical illusion*. Even those who agree but still tolerate this fashion of speaking may fall into the trap and inadvertantly assume what they do not believe.

Of course, it is possible to project meaning onto syntactic relations and models. Mathematics, for instance, is a game with syntactic relations, but this game has a meaning in itself; mathematical semantics is a modern discipline in this context. The value of mathematical models for reality depends on the applicability: mathematical correctness is not always equivalent to truth in the real world. Human control and human verification is required. The computer appears in this view as the most flexible model box that can be invented, so versatile indeed that one easily forgets the model character. It is possible to conceive, step by step, more effective and more daring programmed models - but their value and their sense is outside the model and beyond the computer, it is with the people who conceive the model and the people who decide. I repeat this triviality on purpose. Because it is so easy to forget it and to become a victim of the *syntactical illusion*.

The logical and formal nature of the computer invites the use of logical, formal language. The computer, itself nothing but a giant, electronically realized formula, pushes the world further on its way from the word to the formula. Formal expression and formal definition have many advantages - conciseness, compactness, and independence of the particular application. Formal communication with the computer is the appropriate style. The people who are propagating the fast transition to natural language programming underestimate the malice resulting from the strength of natural language: natural language is undefined or at least underdefined. This makes it the strong device for penetrating into the undiscovered, into what has never been said before. The computer, on the contrary, is restricted to what has been covered by the circuits and programs, but the computer does not tell and so turns into a trap. Textprocessing and natural language handling are fascinating computer possibilities, but nowhere is the margin betweèn sense and nonsense narrower than there.

Channel: DEFINITION # 5

Information is the entity transmitted over the communication channel.

Communication technology did not bother very much with what sort of entity its channels are transmitting; its attention goes to the symbol code and to the frequency spectrum of the sound band, the goal is undisturbed transmission what ever the information content may be. Transmission, by the way, is not only over space but also over time: storage is included. On its way from the sender to the receiver, information may undergo chains of transformations and translations, and in the favorable case it remains unaltered. Invariances of most incredible kinds may astonish the observer and may give a chance to gain information of unexpected categories.

Channels are not perfect, they bring disturbances: noise, unwanted signals, printing errors, reverberations and echoes, deformations of many kinds may hit the transmitted information, misunderstandings may occur up to the level of "cultural noise" - the disturbances caused by different cultural backgrounds. The statistical study of the transmission channel yielded information theory, the doctrine of the statistical properties of sources and of statistically disturbed transmission. The equations of information theory are of interest mainly for certain coding problems, but the notion of redundancy is of importance for our considerations. Redundancy is the contrast to surprise, the part of the information which could be predicted. Removing redundancy is an important task, it means concentration and efficiency. Redundancy, on the other hand, is a useful means to protect against disturbances. Information is sense and redundancy is nonsense - but sometimes the contrary is true. Information is a highly relative entity.

Rather than to go deeper into equations or technologies, I want to illustrate redundancy by two exmaples typical for our decade, namely telephone numbers and account numbers in computerized systems - both are getting longer and longer, in fact they are reaching a fantastic redundancy. If all digits I have to dial to reach, say, New York from Vienna, were redundancy-free information, I could call each human being on earth on 10 000 different lines. If the combination of bank code and account number here in Germany were redundancy-free information, each German could dispose of a billion different accounts. There are, of course, some good reasons to provide more digits than actually required for the selection, but obviously the imagination of the standardizers goes a little far and reverts back to the user and victim. Another proof for this are the redundant zeros ahead of significant numbers in computerized systems, a real disease of our time. One could write a book on gratuitous redundancy - it would be a book on nonsense in the computer world.

The computer can be seen as an information channel of an extremely complicated kind in which the contrary of undisturbed, of truly transmitted information is aimed at: one does not want to reproduce the input at the output - one wants the input transformed into the results of processing. It is obvious that this variant of transmission is also not perfect. Alone the finite number of digits in a word results in a "noise" which will first mutilate the last decimals, then wander up into higher places until all digits are nonsense instead of sense. There are mathematical ways to avoid this effect or to delay it, to save more places. But we have seen how processing "noise" can affect or perfect logical procedures. There is a whole spectrum of possibilities to enter dirt into the logical cleanliness of our structures and the smartest logics can contain bugs which do not lead to a conspicuous nonsense at the output but produce information pollution. The main difficulty with this kind of disturbance is that it usually looks like a good result. Polluted information consists of the same symbols as the clean one, and unless there is a context possibility to discover the pollution, it can go unnoticed a long time or for ever. In a way, polluted information is the worst of all pollution, and to fight it will become a main task in the future.

Protocol : DEFINITION # 6

Information is the entity registered in official files, in protocols.

Such information authenticates facts and statements or regulates them. We face here the transition from description to prescription (the next step to commands will be treated in the last definition). Prescription should involve order, and we have to note that order corresponds to redundancy and disorder to information. This may look rather discomforting, but it is irrefutably correct. Again we find that information is not only a strange, but also a relative entity. Very often what is order for the one is disorder for the other, what is information for the one is redundancy for the other. How, then, to distinguish sense and nonsense?

There are many reasons why the computer can have much power to introduce certain rules and regulations, to prescribe form and content of information and, consequently, form and content of reality. The relationship between information processing and power structures is a fascinating one; like writing in old Egypt, book printing in the renaissance and broadcasting in the first half of this century, information processing may have an important impact on the spiritual and political development in the next century. It is a big temptation to dwell on these aspects, but they would require much more space than available; a very short summary must replace a long deviation. And in summary it is my opinion that information processing is a science and a technology which brings the human being and the human aspects back into the focus of attention. Information, as this paper clearly shows, is not a physical entity, it is a human entity the physical embodiment of which is only secondary. Human behavior, human imperfection and human intellectuality will appear before the logical mechanisms of information processing in a sharper light than ever before. The danger that computer regulations will dominate us is much smaller than the chance that the computer will help us to get rid of the domination by technology and one-sided technological thinking.

Protocolling information invites for a second, equally long deviation which however shall be treated in a bit more detail. Because protocolling is the bridge to the philosophy of information processing, the highest level to consider sense and nonsense. This philosophy, strongly connected to the work of Ludwig Wittgenstein, has been treated extensively by my paper for the 10th Anniversary of IFIP, and I believe that this paper is still worth reading. The following 'micro-version' can only give a global idea.

In his *Tractatus Logico-philosophicus*, Wittgenstein gave in essence an algorithm for the perfect and complete description of the universe of scientific investigation. By this algorithm, Wittgenstein had believed to have completed philosophy once for ever and to have wiped out metaphysics. The method is to collect all protocol-sentences (these are sentences which are either true or false), to combine them logically, and to verify these combinations systematically on the facts. What can not be expressed this way, Wittgenstein concluded, should not be talked about scientifically.

Around 1933, Wittgenstein realized that semantics could not be reduced to the method of the Tractatus, and that protocol-sentences of perfect yes-no-character do not exist. He reacted by a second philosophy in which the meaning of a word depends on the *language game* within which it is being used.

The computer implements the world of the Tractatus: information processing consists of combinations of yes-no-decisions, of protocol-sentences realized by circuits and programs. What can not be reduced to this universe of logical bit-procedures can not be handled in the computer. Clearly then, the meaning of computer words and all outputs depend on the computer game within which they are being used. And the interpretation and evaluation depends on the human mind; the idea of replacing man by computers is nonsense or science fiction.

Merchandise : DEFINITION # 7

> Information is the entity which can be bought and sold in the form of symbols, numbers and texts.

Obviously, this definition is as valid for the book as it is for the computer, but the computer has changed something fundamental. Already the copier has altered the situation. What had been a clear property of the publisher and then of the book owner, could suddenly be manipulated - fast and at low cost: full pages or sections thereof can be picked out, enlarged or reduced, rearranged and mixed with other information. But the copier at least leaves the information on paper - the computer separates information from any particular carrier, makes it *information as such* which can be freely selected and combined, stored and transmitted, searched and distributed. Owning information will never be again what it had been for centuries. Legislation is trying to protect information property, but in the long run reality wins against the law. Information changes character, and while getting abstract and difficult to protect, it becomes a merchandise connected with powerful economic interests.

If I said that the logical circuits can only transform or compress information and expand redundancy, here is the counter example: an intelligent search and an imaginative arrangement of the findings can produce information which nobody could see in the full collection. Information changes character.

The computer possibilities not only permit the creation of new information in the described sense, they also permit new applications of stored information. Information becomes valuable for purposes originally not intended, not considered, not suspected. Information as a merchandise has strange aspects and business has not learned yet to cope with all of them. Alone the fact that material or energy can be sold only to one customer while the same information can be sold to many and each of them gets the full lot is confusing business and contradicts classical calculation. Many professions which would never consider information as a merchandise are all of a sudden entangled in information business interests. What could be regarded as free or at least harmless information on a classical carrier turns into confidential and even secret information when fed into a computer storage. The computer does alter the character of information, and secret information leads to definition # 8. But before going on to # 8, we will make a digression which fits best here in this chapter. It deals with the computer as an excuse, a piece of information which is closer to the contrary of a merchandise and yet is worth some money.

How often can we hear it: *sorry, but we now have a computer!* And this is used as an explanation and excuse for delays and restrictions, for mistakes and failures. Funny enough, it is the perfection of the computer which makes this sentence successful: if those drawbacks occur with this perfect device, then they must be *force majeure* - a kind of divine fate. In fact, however, nothing is more silly than to accuse the computer - it is always the human beings who are responsible for delays and restrictions, for mistakes and errors. Since it is well known that these imperfections tend to heap up when a new computer installation is put into operation, the statement is possibly not silly, but a code for the confirmation of the nonsense our profession permits to occur.

Intelligence : DEFINITION # 8

> Information is the entity collected by an intelligance service.

Not all information is free information. Only newspaper people assume that they have a general right and duty to disseminate whatever they catch. But can there be a doubt that individuals as well as institutions - the state, the military, companies and offices - have a right to keep certain information confidential or secret and to expect respect for this kind of information.

There are two ways to protect information: to lock stored information and control access on one hand side and to code transmitted information into a secret cipher. Ciphering and deciphering is information processing, and it is well known that already during world war II special computers were built for this purpose, like the famous Colossus. The British Intelligence Service had intelligent people who were ahead of their time.

Here, it becomes evident that information can be a weapon, a subject of war and a means of war. The computer is an important tool for ciphering and deciphering and this art has made enormous advances during the last years. The methods for locking and controlling access have also made progress, but not enough. In a way, the problem is much tougher. While a metal key was a reasonable protection device for centuries, in the computer systems of today the locks and fences are abstract and we have heard that even teenagers were successful in programming around the software security devices - they are not yet as safe as they should be; maybe we care too little. A lot remains to be done.

Definition #8 was chosen not without consideration of the associative link between *intelligence service* and *artificial intelligence* and a variation, DEFINITION # 8A, will lead to a digression on *Nonsense by means of bad terminology.*

Information is the entity cultivated by artificial intelligence.

No doubt that Artificial Intelligence deals with a particularly interesting kind of information and information processing: with the activity of the human mind in problem solving, its simulation by computer programs and with the difficulty to get information on how the human mind really "works". The term *Artificial Intelligence*, however, was an unfortunate creation; it is much better suited for the hunt for funds than for translation into languages in which *intelligence* means the particular faculty of the human mind and has not the connotation of *information*. Even in English the term Artificial Intelligence provokes the association of equivalence between mental activity and program execution; some representatives of this field seem to believe in this equivalence. In reality, the term is a contradiction - because something is either artificial or intelligent, but not both at once. The term is an abbreviation (at best) for 'artificial generation of results which normally are produced by an intelligent mind'. The association with Intelligence Service, however, may yield a milder judgment of this misnomer.

Information processing in its double function as a technology and a simulation of mind activities is particularly vulnerable of bad terminology and lots of nonsense can be created by using a term from the humanities for a technical notion. Because one can never separate the human context and even the creators of the use for the technical purpose are safe from mixing the contexts. A fast developing technology like information processing produces new notions faster than good names, and once a term is introduced, it is almost impossible to change to better one. We can only dream of an institution like the *Académie française* which works as an authority for language and terms.

There is much sense and much nonsense in Aritifical Intelligence and, consequently, it is highly controversial area. That the attempt to generate by the computer results which until now have been produced only by an intelligent mind makes sense is obvious: the principle applies already to mathematics - where nobody found a reason to talk of artificial intelligence. Let groups of intelligent people work on a subject, and you can be sure that intelligent results are achieved. The nonsense comes from the reduction, from the declared or hidden equality of mental activity and program execution. And the worst consequences are that efforts run off into the wrong direction and that mechanistic notions of man are promoted - while the computer needs the contrary, on the technical as well as on the philosophical side.

Knowledge : DEFINITION # 9 - plus four variations.

Information is the entity needed to perform a work or a profession properly.

9A Information is the entity which makes the expert.

9B Information is knowledge.

9C Information is the entity passed on by education.

9D Information is the entity distributed by media and publicity.

Variation # 9A is a concentration of the main definition, clearly into the direction of the expert system, and variation # 9B is the shortest form, alluding to the old slogan *Knowledge is power*. It can not be denied that the computer is a powerful instrument and that powerful instruments can become dangerous. Denying does not help, only proper application. The key issue is that the responsibility for computer usage is with the human being - but is it with the computer specialist or with the leading people to whom the specialists report? Responsibility is the counterpart of freedom: reponsibility can only be where the freedom of decision exists and freedom of decision is not free from the responsibility for the decision. In our complex society the margins for freedom can be very small (and the computer can become a tool for increasing it). The individual does not seem to have a big chance to influence what happens: everything we can do must be done because nobody can inhibit it. But this is not true. Even if the individual share is small, the sum is not, and it constitutes public opinion. And this paper, for instance, can contribute to it. The conclusion is obvious that information processing should focus attention the computer as an aid to transparency of decision making and to building up a well-grounded public opinion. This again is related to education, and this leads to variation # 9C.

It is common to all four variations that they are too narrow. Profession, expert, konwledge and education have an information aspect, but all are much broader and information is only a part of the whole. This becomes particularly visible when considering education, because the opinion that knowledge is nothing but a collection of data and algorithms leads to the idea that education works like a gasoline station: information is being pumped from a whole-sale-container to the consumer, and if possible to the zero-tariff. We are again confronted with the dichotomy of form and meaning, of syntax and semantics, and the promotors of computer-assisted learning are in particular danger to sell education as a pumping process with a few feedback loops. This century has gravely failed in maintaining and advancing (in the right direction) education, we were not able to cope with the flood of new subjects and details, because we still consider specialization as more important than universalization (in spite of the fact that both algebra and the computer represent unmistakably the right direction). The computer - if I may in exception fall into an anthropomorphic idiom - will not like that. The computer needs well and universally educated people around - otherwise information processing is on the way from sense to nonsense. The positive end - is my conviction - is re-unification of science and humanities based on the insight into the nature and the limitations of information.

Presently, all structures become more complicated and their interdependencies grow - consequently, in most professions more information is required to perform orderly (even if education had been somehow adequate). The number of products and tools on the market grows and orientation becomes more and more difficult. We face the phenomenon that growing information reduces orientation. This becomes particularly convincing if one considers variation # 9D of the last definition of information. The noise of media and publicity, the waves of undisciplined and purpose-oriented information produce unprecedented confusion. The ideal task of the computer is to protect the human being - in whatever position he is exposed to confusion - against too much, against unnecessary, against unwanted and against foul information, the probably most important aspect of sense and nonsense in information processing.

This is the point of this paper to discuss information pollution, a subject not easy to deal with. For the housewife, there is no problem to distinguish furniture and dust, inventory and garbage. In information processing a sequence of symbols may be useful information or garbage, both look alike. Additional criteria are required to sort them, special programs to *collect garbage*. Pure garbage would be an easier case, but mostly there is a mix of useful information and garbage, and the mix is difficult to recognize, to sort or clean. The key control and check point is of course at the input, because once information has been entered into a computer system it appears lucid and after being processed and eventually having passed certain technical checks, more confidence is attached to it that it usually deserves. The syntactical reliability of the circuits is automatically raised to the semantic level; this is an other aspect of what we have called *syntactical illusion*. Now it is known from many projects in non-numeric processing that even a sevenfold input check is not a guarantee for correctness. We do not even start with error-free information - not to speak about the programs.

We have discussed the problem of correct terms - nonsense production by careless naming - but misguidance by context is even worse, and many kinds of contexts contribute, from printout forms up to our conception and reflexion associating contexts of which the programmer, for instance, would not dream. And like with physical and chemical pollution, also in information pollution harmless looking small amounts of impurities may after some time - the faster our hardware runs, the shorter such time constants - add up to catastrophic and deadly amounts. Since one certainly does rarely die of information pollution - nonsense is not even always painful - *deadly* is meant in a metaphorical sense but nevertheless seriously. The reputation of our profession will depend of our success in fighting information pollution.

Returning to the main definition of this section, we state once more that knowledge is more than information. Knowledge watches and defeats information pollution; knowledge includes human experience, insight and understanding, beyond what can be programmed. And the expert represents more than a collection of information and procedures. The computer system designed to support the work of the expert is an extremely useful tool, and as long as the term *Expert System* is understood in this sense, no reservations are necessary. But there are the professional and the news-paper "short-cutters" who seduce to the belief that the system is an expert or can replace the expert, and that is an other case of nonsense production by bad terminology. In reality an expert system can replace only the dispensable expert, because the indispensable one will occasionally not do what what the computer programs intimate - and those occasions may be the decisive ones.

Action : DEFINITION # 10

Information is the entity expressed by the computer program.

This definition reflects the equivalence between data and program which is the basis of the stored-program concept. K. Ganzhorn has stressed in several papers the importance of the discovery of such equivalences for the progress of science. Information can be guidance, instruction and command. It can be the executable definition of an action, of a full real world process.

Let me choose the cooking recipe for lining out what the computer is bringing along in this sense of information. For the kitchen layman, the recipe is not much more than a purchasing list with ambiguous entries and a set of instructions which if carried out as they read, would lead to something pretty inedible. For the experienced cook, however, the same recipe can be an ideal definition of an excellent dish. The expert knows to combine the recipe with the kitchen tools, with the choice of ingredients, with standard cooking procedures he has executed many times and with his experience in the broadest sense. Between the classical information for action and the action itself was the human being. One could also think of the score of a symphony and its execution; even if notation is a programming language, it is the individual performance which is of interest and the connoisseur enjoys those aspects which are not explicitly contained in the "formal definition" of the score. With electronic music it can be different; a composition written as a computer program can be executed on an automatic music generator - formal information is sufficient for action. It is true, however, that music synthesized on the original RCA synthesizer was not an overwhelming success; it sounded machine made. But when Mr. Moog made a step back and reintroduced the keyboard into the system so that individual performance had its place again, the Moog Synthesizer became a hit.

The computer and the computer controlled production lines revolutionize commanding information. A program can not only control symbol replacement and then print the results; a program can trigger, control and complete real world actions and processes, provided of course that certain prerequisites are provided and within certain limitations indicated by our cooking and music examples.

Information processing advances from abstract procedures to concrete activity in industry, traffic and many other fields. So far, not too many of such possibilities have been realized, but the elements are ready and it is only a matter of time until programs for concrete actions will run through the world-wide computer-networks like today electricity in the power lines. At the receiving point, in the production line for instance, they will realize the programmed item. Here, we face a huge amount of decisions between sense and nonsense. We have a big future before us, and 25 glorious next years for IFIP, but we may also produce catastrophies. Where the human being is removed as the link between information results and real world execution, much more care must be given to system design, both on the technical and on the organisatorial level. The computer is the decisive tool for a positive development and for removing the dangerous aspects. Simulation, for instance, permits experiments and discovery of so far undiscovered aspects and unconsidered situations. A lot of work is before us.

We have passed in review a set of ten definitions of information and I hope that I have shown a number of aspects of sense and nonsense which can initiate your own thoughts. The main theme, *must we do everything we can do?*, has been indirectly treated, but it requires one more section. It asks a fundamental question with components of policy and philosophy. Let me discuss them in conclusion.

Must we do everything we can do?

The computer is the coronation of over three centuries of scientific and technological development during which the body of knowledge has grown steadily and turbulently at once. It appears natural to assume that this growth will continue during the foreseeable future. But there is an obvious obstacle to do everything we can do: it is only a matter of time that the amount of research and development which could be carried out surpasses the measure wich a company, an institution, a nation and mankind as a whole can afford. Restriction and selection become necessary and a policy for research and development must be worked out and followed. The future depends on its quality and efficiency. But a good policy is not easy to define and to enforce. Experts have a tendency to specialization which they then emphasize for obvious reasons. Policy making requires universalists with special knowledge - a rare species. Policy enforcing runs often against economic interests and arguments which are hard to beat. The situation is difficult and we will need a long time to reach the necessary compromises.

What is certain is that we can not do everything we could de because we can not afford it. But this is only one class of restriction - there is at least a second one, of philosophical and ethical nature, characterized by the question: *Are we permitted to do everything we can do?*

Some people give the answer that we must be allowed to do everything we can do because there is no safe and defendable method of deciding what we are allowed or not allowed to do. I think that this is too easy an excuse for escaping the decisions.

Each profession has a reponsibility for its actions, for the technical quality, but also for its implications on society. Clearly, this responsibility is restricted to areas where the professional is free to decide. Where others - owners or leaders of the institutions, their finances and their administration, where lawyers or politicians make the decisions, they also have the responsibility. They have the duty to consult the professionals, and the professionals have the responsibility to inform them - and the public - to the best of their ability. In my opinion, the distribution is very clear. If there is confusion, then it is caused by professional onesidedness which focusses on technical matters and neglects the context. The confusion is amplified by our poor technical language while the media are guilty of careless selection and wrong amplification of issues, their egoistic dramatization and endless repetition of clichês. A higher culture of information on information processing would avoid a good part of the confusion. And it would make clear that there *are* limitations - physical, mental and ethical limitations. No, we are not permitted to do all we are able to do. We have to respect the individual, the different human constellations, and society as a whole.

It is true that in many ways it is difficult to foresee which harm could develop and to determine which restrictions should be respected. The application of generally accepted moral standards to a complicated professional situation must not be left to the individual. We may need guidelines similar to the standards and similarly developed. Again - it could be an important task for IFIP to take a lead in their investigation and, eventually, in their development.

In summary, Ladies and Gentlemen, there is more sense and more nonsense in information processing than in the classical technical fields. I hope to have demonstrated by my discussion of ten definitions of information that we face a challenging next 25 years.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

MUST WE DO EVERYTHING? SENSE AND NONSENSE IN INFORMATION PROCESSING

Giorgio Sacerdoti

Associazione Italiana per l'Informatica
ed il Calcolo Automatico
p.le R. Morandi, 2
20121 MILANO

I began answering to Heinz Zemanek speaking to a 12 year old boy I know. I was thinking of the sense and nonsense of information processing and happened to ask him "what is a computer?" "A machine which works on information" he answered, "and where do you find the information?" He looked at me opening his arms as if he wanted to say "all around us".

Since that day it has seemed to me that all sense and nonsense of information processing consists in discovering in a satisfactory way the meaningful information which exists anyway all around us.

In fact the critical aspect is not at all in the processing. We perform processing all the time and we do it the only way which we are able to do it: i.e. according to the rules of logics which in turn is the daughter of those rules which allow the correct connection of cause and effect.

These same rules, implemented in Boolean algebra, are imbedded in the computer, who, obidiently follows them.

Not the same can be said about what we throw into the computer, and on which we require him to work. We call this "information" and sometimes it is, but sometimes it is not. It would therefore be much more correct to speak about "symbols" that we put into the computer, or are processed by it. In fact what is certain is that it always performes "symbol processing", not so much "information processing".

In order to bridge this gap between symbol processing and the subject of Heinz's paper I shall try to answer to two questions. The first question is: "why do we symbolize?" and the second "what is information?".

To the question about creating symbols the answer is: we create symbols in order to operate on them in logical terms.

I cannot see any other reasonable esplanation.

I could therefore even try to create the slogan "IF IT IS A SYMBOL IT MUST BE PROCESSED".

Otherwise it should not have been put in a symbolic form to begin with.

And the computer does of course his job when a string of symbols is introduced: it digests it just as a bee transforms vegetal juces in honey (or a snake in poison?), i.e. something originally neutral into something useful or harmful depending from the positive or negative sense of the transformation.

But positive or negative with respect to what?

To the usefulness to the user.
The user of what?
Of information

And so we come to the second question.
"What is information?".
Heinz Zemanek considers ten aspects of information which are related to the multiplicity and to the ambiguity in which the term has always been utilized, perhaps because, before the computer age, information, as bearer of a significance, was necessarily bound to the human being who created it, carried it, used it, without any clear feeling about where, when and how much, information had an own existance or it existed hidden in the human being who was handling it.

Artificial devices capable of using information have existed for a long time.

I may even say that every machine absorbs some amount of information from the human being in order to know what to do.
Let us take as an example just a simple elevator. In an 8 stories building it must absorb in symbolic form (numeric) through the buttons that we push 3 bits in order to know where to go.

In other cases as the car-driver, we find the human being included as an information processing element in the guided-vehicle system to which he comes to belong both as goal definer and feedback element in the driving cycle. In this case the information is in an analog form and it is fairly difficult to measure it.

But now arrives the computer. The computer can swallow "information" also without the necessity of using it for deciding what to do. It swallows information just for the fun of swallowing it and then process it and spit it out at the end of the process, always in symbolic form without any need for it of modifying the surrounding physical environment.

The computer is the first instrument to ever exist on the earth (including animals and humans) capable of operating remaining only and EXCLUSIVELY in the symbolic domain.

It is fully reasonable that we ask ourselves if this "processing" of symbols has a sense or else. The answer is that it has sense if it is meaningful information.
And then what is meaningful information?
My answer, which is not very original except for the convinction which I put in the definition, is "Information is what reduces the level of incertitude of a system". For me there is no information outside this definition and, from this definition I can try to find out wether there is sense or nonsense in the processing of what is called information, but not always it is. In fact, if it could not be applied to any system to reduce its level of incertitude before or after the transformation done by the computer it was not or it is not information.
Therefore it is nonsense.
The nonsense lays in the element which is called "information" not in the "information processing".
The reason is that not being meaningful information the processing was done on nothing to begin with.
It is of course possible to destroy information through absurd processing, but this case is trivial, we can do it also by throwing away the information support, and it is not worth discussing it.

So the machine, when it receives symbols it operates on them and this is allright. Symbols exist to represent information and everything would be in order if it was always so. But we, as human beings, operate all the time on symbols without asking ourselves if they contain information or not. The almost "ritualistic" use of the spoken and written word has entered in our habits particularly after generalized literacy has made everybody capable of making a speach which can also be well organized and with all symbols in the proper order and grammatically well connected even if the result is totally void of information.

When people get together they MUST talk.
It does not matter what is being said, or what part of it is being listened, or if some part of what is heard is also understood or, finally, if it reduces anybody's level of incertitude.

I think therefore that it is reasonable to conclude that the problem lays not in our "processing mania" but in the "symbol syndrome" which has affected all of us and whose microbe thrives with particular violence in the computer only because as a "purely symbolic machine" it behaves as a particularly pure and fertile colture broth. Perhaps we are not quite able to grasp how pure and fertile it is!

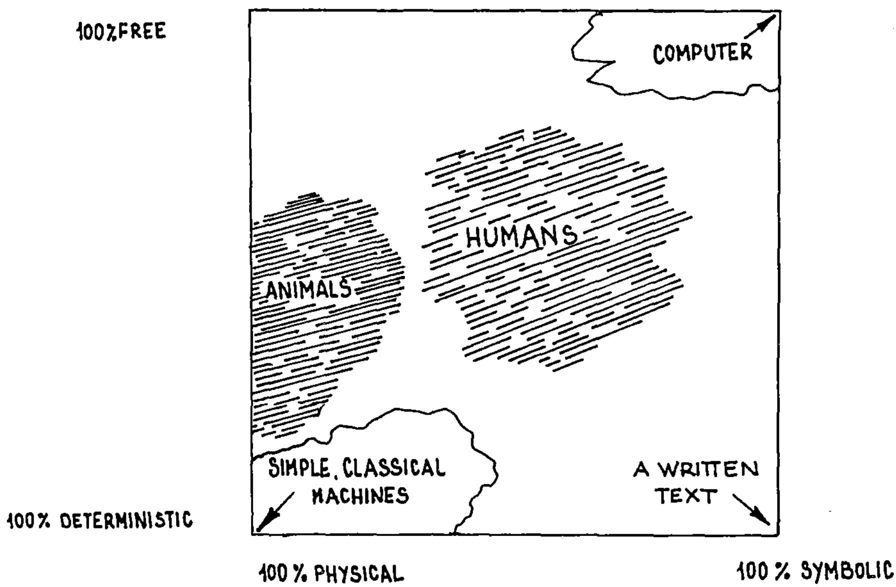
But, may be, the computer will also supply us with the drug for curing our symptoms.
Containing the representation of both the outside physical world (the data) and of the description of our mental processes (the programs), it is only the mirror in which we can see, clearly at last!, our insatiable hunger of symbols associated with our lazyness which leads us to the habit of operating on them with inertial relish.

Coming to the conclusion I am thinking to those windmills which on mountains of Tibet silenting recite the prayers which are written on cilinders that the wind makes to spin around.

These cilinders used to be pushed by the monks with their hands, and before the monks used to say the prayers aloud, and before, but here I am guessing, the prayers were just interior thoughts, and even before, in most religions, men did not pray at all but offered a sacrificial lamb, i.e. a physically tangible expression in a world which was not yet accostumed to the widespread use of symbols.

Through the computer we are following the same process: from the simple physically operated machine, to the use of symbols to tell the machine what to do, to the purely symbolic machine which may be taking off for unknown hights. Who knows wether one of these hights isn't a new Mount Olympus and the silent grinding of apparently meaningless symbols may be the way by which the computer is singing its hymn of prise to its gods.

	IT IS CAPABLE OF PERFORMING OPERATIONS ON THE OUTSIDE PHYSICAL WORLD	OPERATIONS ARE GUIDED BY INTERNAL FINALISM	IT IS CAPABLE OF PERFORMING OPERATIONS (PROCESSING) ON SYMBOLS
"CLASSIC" SIMPLE, MACHINES ∘ MACHINE TOOL • LOCOMOTIVE	YES	NO	NO
ANIMAL	YES	YES	NO
HUMAN BEING	YES	YES	YES
COMPUTER	NO	NO	YES



A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

COMPUTER TECHNOLOGY - COMPUTER INDUSTRY

Bruce Gilchrist

Center for Computing Activities
Columbia University
New York, N.Y.
U.S.A.

The important roles played by entrepreneurs and their employees, salespeople, job-hoppers, user groups, students and meeting goers in spreading ideas leading to the growth of computer technology and the computer industry are examined. These frequently unsung heroes and processes are essential complements of the work of individual heroes. The growth of the computer industry is dependent on the spread of ideas. Thus, as countries seek to stimulate the information processing sectors of their economies, they must take into account the diverse ways in which ideas are disseminated.

INTRODUCTION

When Dr. Heinz Zemanek asked me if I would be willing to discuss the topic "Computer Technology - Computer Industry" at the twenty-fifth anniversary celebration of IFIP, I must admit that I deliberately did not question him too carefully as to what he meant by this title. I sensed that its generality would give me the freedom to pick my own interpretation and hence allow me to discuss some ideas which I believe are important. Hopefully, Dr. Zemanek will not be too upset with my interpretation!

My approach will be to take a very broad view of the both computer technology and the computer industry and then to concentrate on some aspects of what I feel is one of the key linkage between them, namely, the spreading of ideas by essentially ordinary people. In doing so, I will interpret technology in its broadest sense and include hardware, systems software and applications tools. Similarly, the industry will be assumed to encompass both manufacturers and users of computers. Furthermore, I do not restrict the word "people" by qualifiers such as developer, engineer or scientist.

Because of my experience and knowledge, I will primarily use examples from the United States. However, I suspect that similar ones can be found in other countries and in other economic systems. The paucity of specific non-U.S. examples should be regarded as due to my ignorance and in no way as any denigration of the work and workers in other countries.

But first, let me set the stage.

A LOOK BACK

We all, or at least those of us who have been around since the early computer days, recognize that there have been tremendous changes over the years in both computer technology and the computer industry. A celebration such as this silver anniversary of IFIP provides an appropriate occasion for us to look back at where we came from and see what changes have really taken place.

When IFIP came into official existence on January 1, 1960 the information processing field was already thriving. In the fifteen years since ENIAC first became operational, technology had advanced significantly and the computer industry had been firmly established. Scanning the literature of the period, we find that in January 1960:

* the first of IBM's big transistorized machines, the 7090, had just been delivered but most of the approximately five thousand computers installed worldwide still used vacuum tubes;

* the integrated circuit had been invented but commercial production had not yet started;

* FORTRAN had been in use for nearly three years but COBOL was still almost a year away from first implementation. Similarly, ALGOL was much discussed but not yet implemented;

* IBM had annual worldwide revenues of approximately $1.6 billion;

* students at only 125 institutions of higher education in the United States had access to computers, computer science departments had not yet been established at major universities and no Ph.D.'s in computer science had been awarded, although a few doctorates in computer related topics had been awarded by engineering and mathematics departments;

* there were approximately 9,000 full-time programmers in the United States

Looking at this brief sampling of facts on computer technology and the computer industry, one cannot fail to be impressed with how much progress had been made in those first fifteen years following ENIAC. We are also reminded of how recent are the developments such as integrated circuits and high level languages which we now take for granted.

TODAY

If we take a similar look at the state of computer technology and the computer industry as of January 1, 1985 we find that:

* Integrated circuits are used universally in the tens of millions of computers now installed worldwide;

* 256K chips are readily available with 1M chips well along in development;

* COBOL is the most widely used computer language with billions

of lines of code in use. Higher level languages are used almost universally by applications programmers and to a growing extent also by systems programmers;

* IBM has worldwide annual revenues of $46 billion;

* students at virtually every institution of higher education in the United States (and in many other countries) have access to computers and approximately 250 Ph. D.'s are awarded in the U.S. each year in Computer Science;

* There are approximately 400,000 full-time programmers in the United States plus tens of million of "amateur" or "occasional" programmers with skill levels ranging from minimal to very high.

There are clearly many many other comparisons which could be made. However, additional ones would only reinforce and not modify in any fundamental way the picture of tremendous changes in both computer technology and the computer industry over the last twenty-five years.

HOW DID IT HAPPEN?

It is tempting to try to establish straightforward cause and effect relationships between the development of specific computing technology and the corresponding development(s) in the computer industry. This, however, can quickly lead to disillusionment. For example, one might assume that ENIAC, because it was built under military contract, was simply a specific response to the military's need for more rapid ballistic calculations. To a very large extent, this is true because the military provided all the funds. However, that may be too simple an explanation. As Stern [1] points out, Mauchly also referred to the possible commercial value of such a machine in his 1942 memorandum which eventually became the basis for the Eniac proposal. As we move on in time, unraveling cause and effect gets progressively more difficult.

I am sure that economic historians will long debate (but probably never resolve) the cause and effect issue. However, for my purpose here it is sufficient to recognize that some form of symbiotic relationship exists between the technology and the industry. After all, from a practical point of view, it is unnecessary to know whether the chicken or the egg came first!

Certainly, by 1960, the information processing field had grown to a point where the technology and the industry were developing in tandem. It is how the two have worked together since then which I would like to concentrate on in this presentation. In so doing I will emphasize some of the relatively unsung "processes" or "groups" rather than the better acknowledged ones or individual "heroes."

This emphasis is not due to my doubting the importance of individual achievements or my thinking that there will be no more heroes such as Eckert, Mauchly, Von Neumann, Amdahl and Wilkes, to mention just a few. Rather, it is because I believe that "progress" is usually made by a combination of a few heroes and a vast amount of hard work by innumerable ordinary people in developing and, most importantly, spreading the heroes' ideas.

This approach also relieves me of the unenviable task of trying to identify the heroes of the last twenty-five years; an effort which could only lead to argument and possible personal affront to those not included in the list. In any case, there is a growing collection of historical studies of the computer field which concentrate primarily on individual contributions and specific hardware/software developments [2].

The important but frequently overlooked "processes" and "groups" I will single out to discuss and praise are, in no particular order:

* the entrepreneurs and their employees;
* the salespeople;
* the job-hoppers;
* the user groups;
* the students;

and

* the meeting goers.

I deliberately exclude the scientists, teachers and engineers, per se, from this discussion since their contributions tend to be recognized if not always financially rewarded. There are others which I could reasonably have included but I leave those as "an exercise for the student."

The reader's immediate reaction to this list may be say that everyone knows that these groups play important roles so what is there to discuss. I question, however, whether adequate recognition has been given to their contributions. Furthermore, I believe that it is essential to understand their roles whenever we consider changing (and, hopefully, improving) our research, development, marketing and other business procedures. The latter reason appears to be especially important as information processing assumes an ever more crucial role in national economies and governments attempt to promote their information sectors.

THE ENTREPRENEURS AND THEIR EMPLOYEES

The role of entrepreneurs in the growth of United States computer industry has been frequently if not exhaustively discussed in the business literature as well as the computer trade press. Thus, entrepreneurs are not really the unsung heroes. However, all too often the stories about them concentrate on the creation of great wealth for a few individuals rather than on the role entrepreneurs play in the overall development of the industry. (See, for example, [3].) Also, it is rarely that any acknowledgement is made of the risks taken and the contributions made by the entrepreneurs' employees.

I would suggest that entrepreneurs play several key roles besides that of creating wealth for a few individuals. Among the most important of these are:

* the development of new ideas and approaches ahead of big and frequently bureaucratic organizations

and

* the pushing of the big organizations to move more rapidly to develop and introduce new technology.

Both roles are well exemplified by the introduction of microcomputer technology and the subsequent growth of the microcomputer industry.

Freiberger and Swaine [4] in their popular history of the personal computer comment that "without exception, the existing computer companies passed up the chance to bring computers into the home and onto the desk." Probably the best known instance of this is Stephen Wozniak's leaving Hewlett-Packard after that company reportedly showed no interest in his microcomputer design. Similarly, Ahl left Digital Equipment Corporation, Albrecht left Control Data and the list of similar departures from the major computer companies could be much longer. These people with the support of venture capitalists and aided by dedicated, frequently overworked and underpaid employees took the risks, technical and financial, which led to the booming microcomputer industry we have today. All of the fledgling companies did not grow like Apple Computer of which Wozniak was a cofounder but each, in its way, contributed to the growth of this new sector of our industry which, in turn, led to very substantial growth in virtually all parts of the computer industry - components, systems integrators, programmers, end users, etc.

The success of companies like Apple "forced" the larger companies in the industry to address the whole microcomputer area. We now have IBM, Hewlett-Packard, DEC, Sperry, etc. all competing along with the newer companies for a share of the expanding market which a decade earlier they had been unwilling to pioneer.

To date, Apple has survived the entrance of the larger and more established computer companies into the market it pioneered. Other early entrepreneurs in the microcomputer field have not always been as successful and their companies are now only minor players or merely footnotes in the history of the industry and their employees have had to seek other jobs. Nevertheless, those companies and their employees played important roles in driving the industry into new products and services.

A second good example of the importance of the entrepreneur can be found in the software area. This is the development of spreadsheets and Visicalc in particular. The pioneering development by Visicorp of a spread sheet program ahead of the "majors" definitely opened new markets and, in turn, prompted the big companies to move in the same direction either by buying technology or redirecting their own development efforts.

Unfortunately, unlike a fairy story, everyone did not live happily ever after. Visicorp could not keep up its initial momentum. After selling more than 700,000 copies of Visicalc, Visicorp was overtaken by others such as Lotus 1-2-3 and has now virtually disappeared [5]. Visicorp will, however, be long remembered for starting a whole new trend in computing which helped open broad new markets for the microcomputer hardware and software suppliers and provided work for many individuals in user companies.

It is very easy to think of additional examples from both the United States and other countries. For instance, the developments by Curry, Sinclair, Hauser and others in the United Kingdom are examples which show that entrepreneurship is not confined to the United States [6]. Moreover, the entrepreneur should not be regarded solely as a capitalist phenomena. He or she can and does exist and flourish (or fail), albeit under a different name and using different approaches, in socialist systems. One recent report [7] of a California company using programmers in the People's Republic of China indicates that entrepreneurship can also promote information exchange between countries with very different economic systems.

Even some large organizations have recognized that there are advantages to be gained from exploiting the entrepreneureal spirit. IBM, for example, is doing this through its "independent business units" and has the rapid growth in the IBM PC market as "evidence" of the success of this approach.

The lives of the entrepreneur and his/her employees, whether outside or inside a large organization, are not easy. The rewards can be great but the chances of failure are also high. There are many more "Visicorps" than "Apples" in the real world! Nevertheless, the overall contribution to the growth of our technology and industry of the entrepreneurs and those daring enough to work for them is surely positive.

THE SALESPEOPLE

Salespeople are frequently not held in the highest esteem by the technically oriented information processing personnel. I would suggest, however, that salespeople have played and will continue to play a significant, possibly even vital, role in transferring computer technology from the manufacturers to the users and in feeding user requirements back into development.

The challenges to the salespeople in our industry are great. Their employers expect them to increase revenue year after year but at the same time steadily and sometimes even dramatically reduce the price per unit of computation and storage. Employer pressure and declining unit costs combine to produce a very strong incentive for the salespeople to increase user demand by identifying new applications for the products and services they are selling.

Adding to the salespeoples' difficulties is the continuing need to keep up to date on a vast array of new technologies and products from their own as well as competing companies. Thus, many companies spend significant time and money on keeping their sales personnel technically up to date. This technical information is then passed on to the users and potential users as the selling process proceeds. What starts out as a necessary support for the sales force turns quickly into a source of valuable new information for almost everyone the salesperson calls upon, irrespective of whether or not a sale is actually made.

Similarly, the alert salesperson brings back valuable product requirement/deficiency information from both the successful and the unsuccessful sales calls. It is a foolish company indeed which ignores this very important feedback.

The classic story of the salesman's influence is that of the chance meeting on a plane between a sales executive from IBM and an executive of American Airlines which led to the development of SABRE, the pioneering project for airlines reservations. This type of meeting is being held many times every day, albeit frequently at lower organizational levels.

THE JOB-HOPPERS

In most fields, including information processing, employee turnover and job-hopping are generally regarded as bad words. Employee turnover has been especially high in the information processing field, particularly among systems and applications programmers. In surveys, data processing managers frequently mention it as one of their most serious problems. Annual turnover rates above 20% have been common [8] and occasionally organizations have lost virtually an entire group within a few months.

Nevertheless, there is a good side to employee turnover and job-hopping which should not be forgotten. This is the movement of ideas which goes along with the people movement. Moreover, since it is generally the better people who move, it is frequently the better ideas which get distributed in this way. Incidentally, this idea transferrence does not depend on stealing trade secrets or infringing on patents or copyrights. It is simply based on people taking with them to their new employers the accumulated skills and wisdom learnt at their previous jobs.

Another benefit of employee turnover which we should also not forget is that it creates opportunities for other, frequently younger, people to be promoted and thus given a chance to pursue their different and maybe better ideas.

Coupled with entrepreneureal efforts, job movers can significantly accelerate the growth of a segment of the industry. One of the best examples of this is found in the history of the chip industry in Silicon Valley. Starting with the seminal work of a few individuals, a host of major and minor companies grew rapidly as a result of spinoffs by groups of technical people from the more established companies and "raiding" of competitors [9]. Similarly, IBM has been a training ground for a great many technical and sales personnel who have subsequently formed their own companies or moved into top positions in other companies in the industry.

Job changing is not confined by national borders. Immigration statistics show that there is a steady inflow of information processing personnel into the United States. The precise number is difficult to determine as many immigrants are admitted without special reference to their occupations. However, Immigration and Naturalization records for calender year 1982 [10] show that 1674 individuals were admitted that year based on their professional standing in the computer field, primarily in systems analysis and programming. This number gives a lower bound to the actual number of information processing professionals admitted to the United States in that year. Samples of the records further show that many of these people have considerable experience and quite frequently are world travelers who have gained their experience by working in several countries along the way.

It must be noted here that the move of experienced people from the less developed areas of the world to the developed ones should be regarded, in the short term at least, as counter-productive to the losing country's economy. Of course, if the immigrant eventually returns to his or her home country, the net gain may be positive.

THE USER GROUPS

Starting with the formation of the SHARE and GUIDE User Groups in 1955, there has been a steady stream of new groups formed around a common interest in a particular vendor or a specific piece of hardware or software. Such groups were initially set up to provide a mechanism for free exchange of programs and the development of widely required support systems such as SOS, the SHARE Operating System. As software has moved from a "free" status to being a high valued and protected asset, the emphasis of the groups has moved to being a channel for conveying user concerns to the vendor(s), sharing techniques, promoting standards and sometimes undertaking projects that do not particularly interest the vendor.

A few of the bigger groups now have small paid staffs but the bulk of the work continues to be done by volunteers. The level of user support from large installations can be seen from a review of the rolls of officers and committee chairpersons of the larger user groups. These read like a "who's who" of the leaders in the user side of our industry. (See, for example, [11].)

Although some doubts have been cast as to the value of effect of the user groups on vendor policies and plans [12], the groups have clearly facilitated a tremendous amount of information exchange between vendor and customer, between experienced users, and between experienced and novice users.

The user group phenomenon is not confined to the larger companies, machines or software products. User groups organized around microcomputers have become very popular and vast amounts of information are being exchanged both at meetings and via electronic bulletin boards. Some of these groups were started by hobbyists when the early and quite primitive microcomputers needed a great deal of effort to make them work. (See [4] for examples.) In those early days, the pioneering microcomputer hardware and software suppliers depended heavily on such groups and the user groups remain an excellent sources of ideas for new and improved products.

THE STUDENTS

When students graduate and move to jobs in business and industry they take with them ideas which they then try to implement in their new positions. Indeed, even before they graduate, students play an important role in pushing the faculty into new areas. They are a stimulus which is hard to overrate.

If one accepts the importance of students, then the need to build up and maintain the faculties of computer science departments is given further support. However, that is a topic beyond the scope of this presentation.

In terms of numbers, the enrollment of students in computer science courses is growing in almost every country. In the United States, not only has the absolute number of degrees awarded in information sciences increased dramatically (see Table 1) but also the ratio of information sciences degrees to all degrees awarded has increased significantly.

In the case of bachelor's degrees, the share of those in "Computers and Information Sciences" doubled (from 0.5% to 1.0%) in the ten years between 1973/4 to 1983/84 [13]. This trend is likely to continue as evidenced by a recent survey [14] of 182,00 students who entered college in the fall of 1984. Of those surveyed, 3.4% indicated "Computer Science" as their probable field of study and a further 2.4% indicated "Data Processing and Computer Programming." When questioned as to probable career occupations, 6.1% selected "Computer Programmer or Analyst."

The data on degrees awarded in computer and information sciences only represent the "tip of the iceberg" in that many more students, while majoring in other subjects, take one or more computer courses. These graduates take into the work force a knowledge of the power of the computer and, as the occasions arise, they will promote the use of computers.

Academic Year	Degrees Awarded Bachelor's	Master's	Doctoral
1968-69	933	1,012	64
1970-71	2,388	1,588	128
1972-73	4,304	2,113	196
1974-75	5,033	2,299	213
1976-77	6,407	2,798	216
1978-79	8,769	3,055	209
1980-81	15,121	4,218	252
1981-82	20,267	4,935	251

Table 1
Earned Degrees Awarded in Computer & Information Sciences
1968 to 1982

Source: Reports published by the National Center for Education Statistics of the U.S. Department of Health, Education and Welfare.

As with job-changing, the movement of ideas via students is not confined by national boundaries. The number of non-U.S. students studying computer science in the U.S. is growing rapidly. In the 1979/80 school year, approximately 8,000 or 2.8% of the foreign students in the U.S. were studying computer science. Two years later in the 1981/82 school year, the corresponding numbers had grown to 13,800 and 4.25% respectively. These students came from over 135 countries and from every part of the world [15]. Although I do not have supporting numbers, I am confident that similar movements of students are taking place to other countries with developed computer industries. When these students return to their home countries, they take with them both technical knowledge and a vision of the ways in which the technology can be applied.

THE MEETING GOERS

Although it was not a computer conference in the current sense of the words, any mention of early computer meetings must include the one held at the Moore School in Philadelphia in 1946. This meeting entitled "Theory and Techniques for Design of Electronic Digital Computers" was really a six week course and was attended by representatives of approximately 20 institutions. The Moore School meeting is regarded by historians of the field as having had a significant influence on a number of computers including the EDSAC at Cambridge, built by Wilkes who was one of the attendees, and several at the National Bureau of Standards [16].

The first of the United States Joint Computer Conferences was held in Philadelphia in 1951 with only a few hundred attendees. However, the attendance at these semi-annual meetings grew rapidly and was soon in the many thousands.

On the international scene, several countries started national meetings in the 1950's and 1960 saw the first major multinational computer meeting held in Paris under UNESCO sponsorship.

From these early modest beginnings, the tradition of computer conferences has grown in the United States and in many other countries. Along the way, extensive exhibit programs have been added to the format of many conferences and in some ways these exhibits now dwarf the formal technical sessions. Although some purists object to this change of emphasis, I would suggest that both the exhibits and the technical sessions are very important mechanisms for the exchange of information.

A typical annual U. S. National Computer Conference now has 10,000 to 15,000 people attending the formal technical sessions, 30,000 vendor personnel manning exhibits, and 50,000 exhibit attendees [17]. From a straight economic view point, such attendance involves major transportation, living and salary expenses which must total well over $50 million. Thus, by continuing their support year after year, vendors and employers are implicitly agreeing that a great deal of valuable information is exchanged at these meetings.

Measuring the information gained at a conference is virtually impossible. However, I know from my own experience that I invariably return from attending a major conference feeling that the new ideas I have picked up were worth the time, effort and expense of attending. Sometimes the ideas came from the technical sessions but at least as often they came from the exhibit hall and informal conversations.

CONCLUSIONS

The major lesson to be learned from this potpourri of processes is that if reasonable environments/mechanisms are available then people will exchange ideas with little additional stimulus. In so doing they will provide the essential links between the developers of ideas and their implementors which will, in turn, result in the continued growth of both our technology and our industry. The leaders of our industry and profession must see that such environments/mechanisms are encouraged despite the fact that sometimes the immediate economic benefits are not apparent.

The same cautionary lesson applies on the international level where protectionism and trade barriers will be talked of more frequently as information and information processing technology become increasingly important to national economies in the coming years.

FOOTNOTES AND REFERENCES

[1] Stern, N., From ENIAC to UNIVAC (Digital Press, Boston, 1981), p. 48.

[2] See, for example, Annals of the History of Computing, published quarterly by AFIPS and books such as Metropolis, Howlett and Gian-Carlo Rota, (Eds.), A History of Computing in the Twentieth Century (Academic Press, New York, 1980).

[3] Levering, R., Katz, M. and Moskowitz, M., The Computer Entrepreneurs (North American Library, New York, 1984).

[4] Freiberger, P. and Swaine, M., Fire in the Valley (Osborne/McGraw-Hill, Berkeley, 1984).

[5] Sigel, E., Alas Poor Visicorp, Datamation, Vol. 31, No.2, January 15, 1985.

[6] See, for example, Macpherson, D., The New Glittering Prizes, The Sunday Times Magazine, London, January 27, 1985.

[7] Howe, C.I., Shanghai That Software, Datamation, Vol. 31, No. 3, February 1, 1985.

[8] See, for example, the various U.S. surveys conducted by A. S. Hansen, Inc., Lake Bluff, Illinois.

[9] Rogers, E.M. and Larsen, J.K., Silicon Valley Fever (Basic Books, New York, 1984).

[10] Data given over the phone by the Statistical Analysis Division of the Immigration and Naturalization Service.

[11] See, for example, Annals of the History of Computing, Vol. 2, No. 4, October 1980 and Vol. 6, No. 1, January 1984.

[12] See, for example, the article by Dorn on Computer User Groups in the Encyclopedia of Computer Science and Engineering (Van Nostrand Reinhold, New York, 1983).

[13] Projections of Educational Statistics to 1988-89, U.S. Department of Education, 1982.

[14] The Chronicle of Higher Education, January 16, 1985.

[15] Data from Profiles: The Foreign Student in the United States, 1979/80 and 1981/82 editions (The Institute for International Education, New York, 1981 & 1984).

[16] See reference [1], p. 95.

[17] Data supplied by the AFIPS staff.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

John Diebold, Chairman, The Diebold Group, Inc.
(Speaking Via Videotape)

Comments on a Paper Entitled
"Computer Technology -- Computer Industry,"
By Bruce Gilchrist of Columbia University,

25th Anniversary Symposium of the International Federation
For Information Processing Societies (IFIPS)
Munich, West Germany, March 27, 1985

It is a great personal pleasure to be with you via videotape on the 25th Anniversary Symposium of the International Federation for Information Processing Societies. The video presentation allows me to do two things at once: just as this is being shown in Munich, I am chairing the 65th Plenary Meeting of The Diebold Research Program in Point Clear, Alabama. It is only our 22nd year, not 25th, but it is important that I be where I am.

To begin my comments on Professor Gilchrist's paper "Computer Technology -- Computer Industry," let me say that it is a very useful paper, in which I found the choice of categories particularly helpful. I have organized my comments into five specific points:

1. When studying computer history, it is critical to differentiate between the technology and the industry.

If the two are mixed up, one can arrive at some misguided conclusions as to what the driving forces were, and why things happened as they did. In the course of the computer's history, there has sometimes been a considerable lag between the development of the technology and bringing it to market. Technological history and industrial history do not neatly coincide, and it is crucial to keep this in mind when studying policy formation. The problem hits especially close to home for me, because I am in the process of writing a history of information technology as a business history. Therefore, my first comment is to emphasize the value of differentiating between technological history and business history. Although both are important to study and are deeply intertwined, there are critical differences that are all too often overlooked.

2. A useful area of study is in the economic, social and other conditions that have prevailed at varying times and varying countries in the development and evolution of the field.

The national conditions that gave root to computer technology and the information industries have varied widely, country by country. It is important to study those conditions at each stage of the technology's development and in each country. For example, what has been the role of national planning? The last 30 years have seen some fascinating national planning efforts in various countries. A close look at these plans, I think, will reveal some enormous gaps between the goals envisioned and the actual results. That's all the more reason to look hard at national planning with respect to high technology, the consequences of these plans, where they have succeeded (or, more typically, where they have failed), and why, in order to gain a sharper focus on public policy. My own impression is that the real success stories have been market-driven and technology-driven -- not

politically motivated. It can help a great deal in better understanding where we are going in the field to understand the relationship of these two intertwined strands: the market force and the powerful engine of technology.
Why have some societies enjoyed dynamic markets for the technology while others, with equally good basic science, have not been as effective? Among the national characteristics worth examining are the societal tolerance of business failure, the willingness to egress, and the economic and social consequences of failure. How business failure is viewed by society is reflected to some extent in the bankruptcy laws, which are much less punitive in the United States than in other countries. As a result, risk-taking and entrepreneurship are more encouraged. The role of venture capital, as well as secondary financial markets, in getting the technology from the laboratory to the marketplace is another very key factor in the evolution of the industry. These are the sorts of things that I think need a lot more formal study.

Labor mobility is another very important social factor, and Professor Gilchrist very correctly focuses on the question of job changing. The significance lies not just in the nature of the job change itself, but in the way the society views it. Labor mobility may be treated either as a problem or as an asset, according to the social culture. This and other social factors are key elements in understanding the evolution to date and the current evolution of this industry.

3. The role of U.S. government-funded research and development (R&D), particularly the role of the military, is often badly understood, especially outside the United States.

I have often encountered gross misunderstandings as to the contribution of the U.S. military to high technology. This is not to say that there have not been isolated moments when military and aerospace funding played an essential part. However, the real impact of the U.S. military on technological advances has been an unfortunate diversion and misapplication of enormous manpower resources. Often the fruits of military R&D have been more a distortion than a reflection of market needs, leading to side shows rather than leading-edge technology. I am speaking now of commercial "spinoffs," and that is different from the role of government in basic science. Basic research is vital to all countries, and understanding the importance of both basic and applied science deserves more attention than it has received thus far. With respect to public policy, we would all be better served by a clearer understanding of both the negatives and positives of government involvement in high technology. It is not the simplistic relationship that is often put forward.

4. Studies of the computer's impact should focus less on the provider or manufacturer of the technology, more on the user.

Professor Gilchrist's paper focuses on people -- the computer users. I think that was a very useful thing to do. I think it would be helpful to explore further the role of the user today and throughout the history of the computer, especially in the first twenty years of the field. Many of the users, especially large corporate customers and government users, have been extraordinarily important in the way the field has developed. That started, of course, in the late nineteenth century with the Herman Hollerith machine, a direct result of the U.S. government's need to complete the census. That has been true in the electronic era of the computer as well, in many countries. One example I recall is the Lion's Teahouses in Great Britain, which was instrumental in the creation of the Leo computers.

This was a large user that focused attention on its own needs and exercised a clear influence in the early days of the computer field. Companies like Metropolitan Life Insurance Company of New York were also active in getting companies started to produce machines for their own application needs.

The user's involvement went well beyond encouragement; at certain periods the users have become direct players. In the last 20 years, as in the case of Citibank in New York, we have seen users establishing supplier companies to provide services, systems, and equipment that work and will be available. I would urge computer historians to focus much more study on the role of the user, not just the manufacturer, of computer technology.

5. The role of the university merits deeper attention in studies of computer history.

Professor Gilchrist has focused in his paper on students. On a wider plane, I think the role of the university in all aspects is extremely important, including scholarly research, teaching, and relationships with industries and communities that reach out beyond the normal area of the classroom. The university has been evolving in many countries to play a more active role in society. I think we would do well to consider how the university will develop in the future, and what new relationships might be formed among teachers, scientists, researchers, industry, and government.

I am very sorry not to be with all of you in the wonderful city of Munich. When Dr. F.L. Bauer first asked me to take part in this panel, I was delighted because I am indeed a great admirer of Dr. Bauer and I am pleased to be on the advisory board of the Deutsches Museum, where he serves as general chairman. I am very active and interested in the whole development of the computer, industrially and technologically, so I am very delighted to at least be with you by technological means. I wish you all very well.

- End -

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

MAINFRAME TECHNOLOGY FOR THE NEXT DECADE

GENE M. AMDAHL, Ph.D.

Trilogy Systems Corporation

There has been much speculation as to which technology will be employed in mainframe computers in the next decade. Josephson Junction appears to be out of the running and Gallium Arsenide has much development work still to be done. It appears that CMOS most surely will occupy the winning position for low and intermediate speed computers and ECL appears to retain its lead position for high speed computers for that time frame.

There is much curiosity as to how much longer the speed of computers can be increased from generation to generation, what will be the theoretical limits, for the technology for the architecture? Clearly there are fundamental limits, and in some cases the limits appear to be near for some of the device structures currently employed. This doesn't necessarily tell the whole story, however, for different structures may well provide limits sufficiently higher to permit considerable growth potential. It is also the case that mundane considerations such as packaging are more significant than the device switching times are today. Progress is being made along all of these lines and for the next decade or two there appears to be the promise of continued growth. With that expectation, I will speculate on the technologies which I believe will be important this next decade. The architectural questions will not be addressed, for they have similarly complex set of arguments to be explored and discussion would become prohibitively long.

For the small and intermediate mainframes there doesn't appear to be much dissension as to which technology will prevail, it is CMOS (Complementary Metal Oxide Semiconductor). CMOS has the properties of potentially quite high performance, relatively low power consumption, and, requiring a smaller number of process steps than many others, is also comparatively economical. It does not appear, however, to satisfy the greater demands of the high performance mainframes. For these the principal technology has been bipolar ECL (Emitter Coupled Logic). There has been, however, suggested challengers to ECL, such as the Josephson Junction and GaAs (Gallium Arsenide). In the late fall of 1983 IBM announced it was dropping its research on Josephson Junctions after spending many millions of dollars and much public promotion of its potential. In that same month two Bell Laboratory researchers presented a paper which presented their analysis of the consequences of the lower G_m (transconductance) of the GaAs depletion mode FET (Field Effect Transistor) compared to the Silicon FET. Their conclusion was that GaAs loses is speed advantage over Si in random logic of aggregations greater than 10,000 gates per chip. Since this size is current state of the art commercial offering in CMOS, the future of depletion mode GaAs devices for complex structures is null. It would, therefore, seem that ECL may have the upper hand for the next decade or so.

If we look at CMOS in somewhat greater detail, we see its potential and its limitation rather easily. If the devices are scaled down in size by a factor of "k" in all three dimensions, with the voltage scaled by "k" as well, then the switching speed improves by "k", the circuit density goes as "k^2" and the power dissipation per unit area remains constant. The local interconnect communication time remains constant, but, if the longer connections on the chip are of the chip dimension, then the long communication time increases as "k^2". The effective performance therefore increases only as long as the switching times is the governing factor, and decreases thereafter. The current commercial state of the art is two micron features, yielding 10,000 gate chips of sub-nanosecond local interconnect communication time. At the rate feature size and die size have progressed, by the end of the decade, one should expect in excess of 150,000 gate logic chips and four megabit memory chips. By this time physical limits on channel length are nearly reached.

Gallium Arsenide also merits a closer look. As long as the interconnect lengths are kept small, the depletion mode FETs perform faster than Silicon. This suggests that simple logic structures can utilize GaAs to considerable advantage. The improvement of process techniques for enhancement mode devices may also permit higher yields of devices with superior Gm's. This will put GaAs back into the complex logic high performance arena once more. The feature sizes and chip sizes attainable in GaAs should lag those of Silicon by two to three years, for more of the learning process in that technology is yet to be done.

ECL at the present has exhibited the highest performance of all for anything but individual device switching. Late last year NTT announced a 1,024 bit RAM (Random Access Memory) memory chip utilizing ECL which exhibited an access time of 0.85 nanoseconds. Although the device structures are considerably more complex in fabrication and require more area than the FETs, the future of these still show considerable promise for very high performance. New materials appear to promise some significant new breakthroughs in ECL transistors. In particular, the use of metallic oxides for the base region of the transistors, so that the conductivity of metal reduces the base resistance. The feature sizes and chip sizes for ECL will increase somewhat less rapidly than CMOS, for the competitive commercial pressures forcing progress is not nearly so intense.

With the semiconductor technology providing considerable potential speed improvement, it is of increasing importance to provide packaging structures which can provide short interconnections with low resistivities and capacitances in order to preserve the performance of the chips in the system. If we look at standard printed circuit board technologies with chips in dual in-line packages, we see enormous distances between the silicon chips relative to distances on the chips. Packaging of this sort are unable to provide performances suitable for high speed computers, even though they function perfectly satisfactorily for lower speed systems. The highest performance printed circuit board technology was achieved in the Amdahl computers. In the 70's, the Amdahl 470 put 100 gate ECL chips on one inch centers.

In the 80's, the Amdahl 5860 puts 400 gate ECL chips on one inch centers for the highest density of gates in the IBM compatible world. With those super speed chips at that packing density Amdahl was able to exceed the IBM thermal conduction module populated with denser TTL (Transistor Transistor Logic) chips. This was difficult to achieve because the thermal conduction module achieved such close packaging of the chips.

The thermal conduction module is a multilayer ceramic printed circuit structure where the chips are connected directly to the surface of the ceramic metalization by means of solder balls. The chips are able to be mounted close enough together to cover about 1/4 of the surface, compared to about 1/16 for the Amdahl printed circuit boards. IBM reputedly spent almost one billion dollars developing its structure and is, of course, improving it somewhat over time. It has limitations in the metal conductivity it can achieve and in the maximum chip size that can be accommodated without solder ball shearing, due to differential expansion between the silicon and the ceramic. Nonetheless it is a most effective package.

In Japan it appears that Hitachi is also working on a ceramic package somewhat similar to IBM's. They are using a new ceramic material of theirs, silicon carbide, which has the property of the same thermal coefficient of expansion as silicon, thus permitting larger silicon chips to be attached by solder balls, extending this form of packaging technology even farther.

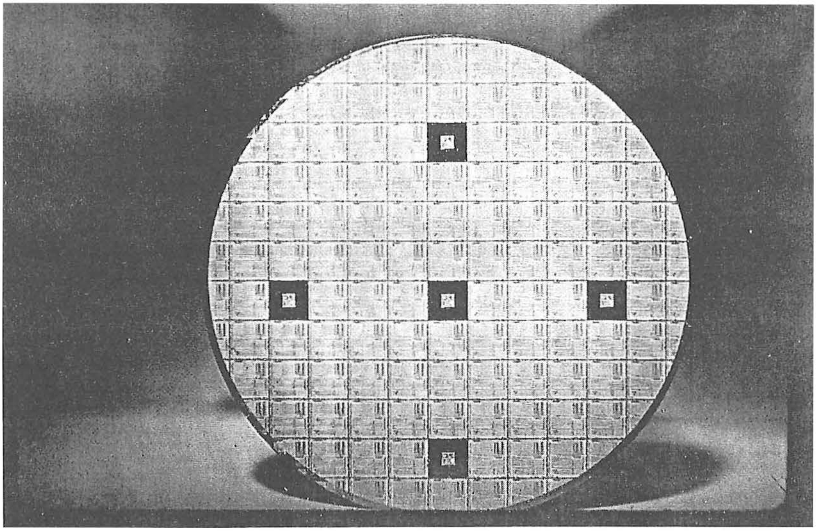


Fig. 1 Normal wafer - many identical chips.

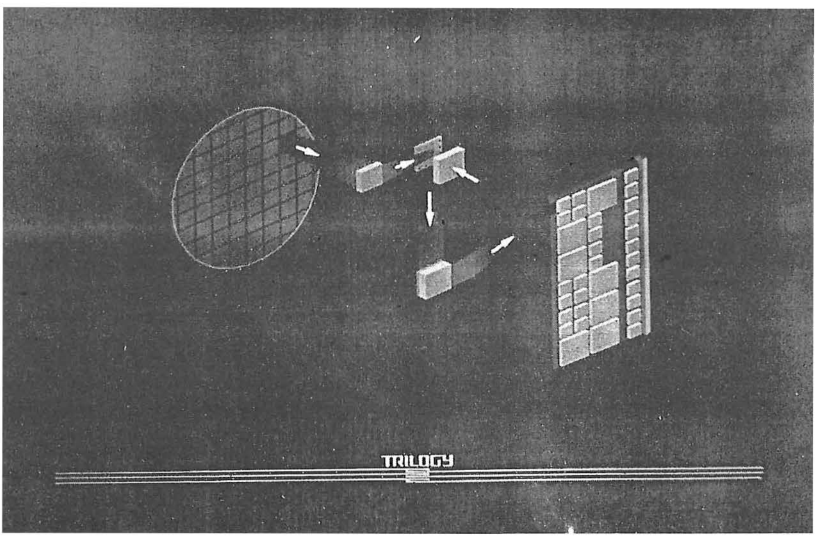


Fig. 2 Chips are tested, packaged, tested and mounted on a p-c board.

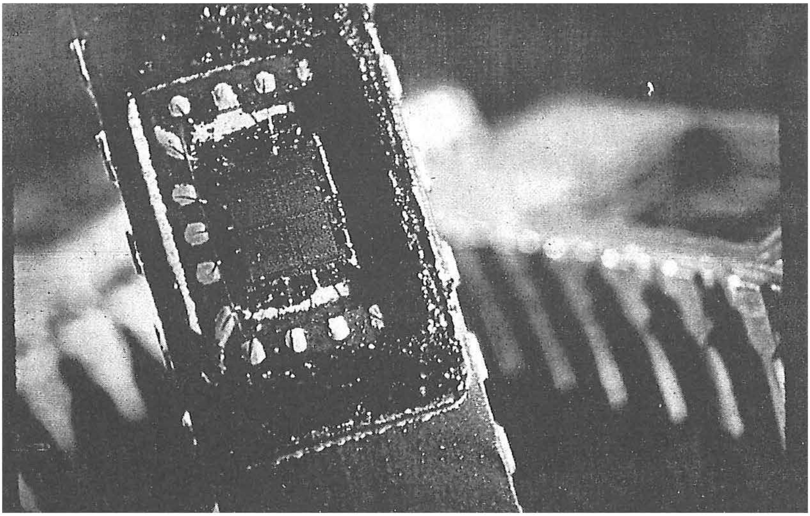


Fig. 3 Chip dimensions, small compared to package dimensions.

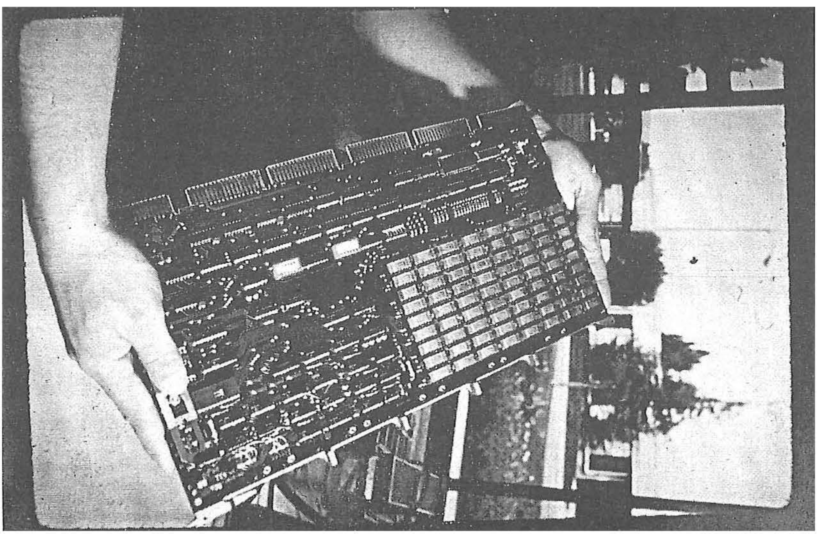


Fig. 4 Chip dimensions are extremely small compared to p-c board dimensions.

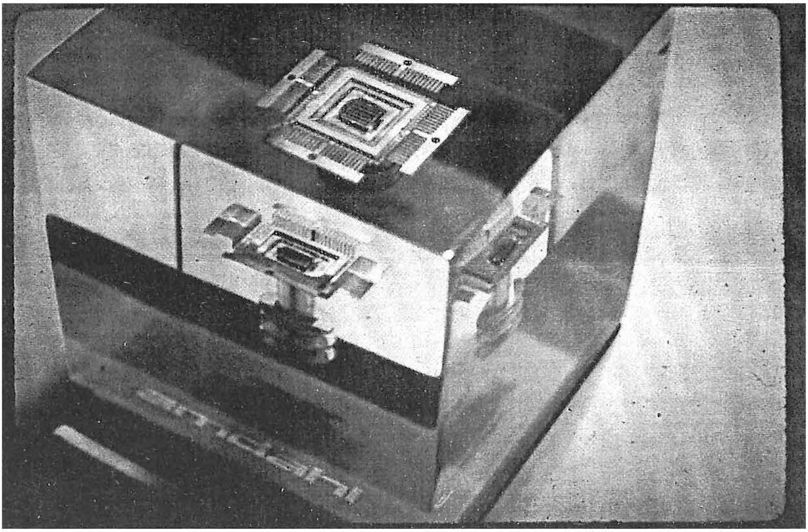


Fig. 5 Amdahl's 1971 LSI chips were first high performance in the world.

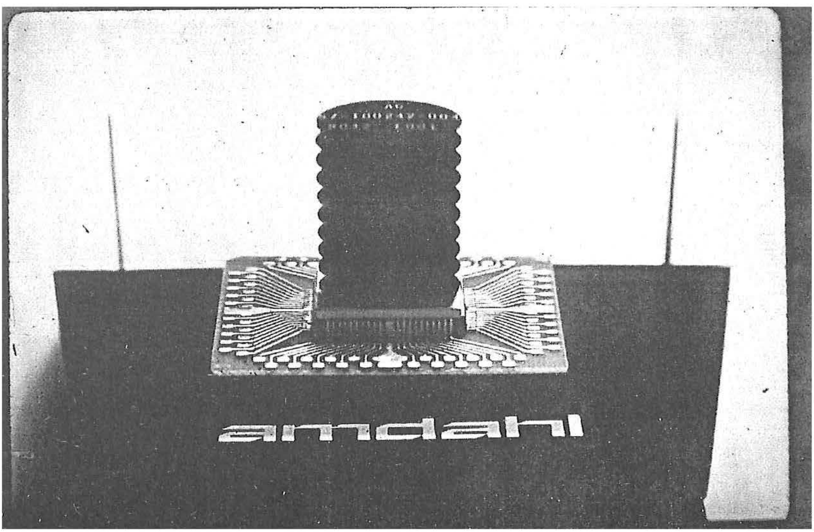


Fig. 6 Amdahl's 1980 chips had 4 x density of 1970 chips.

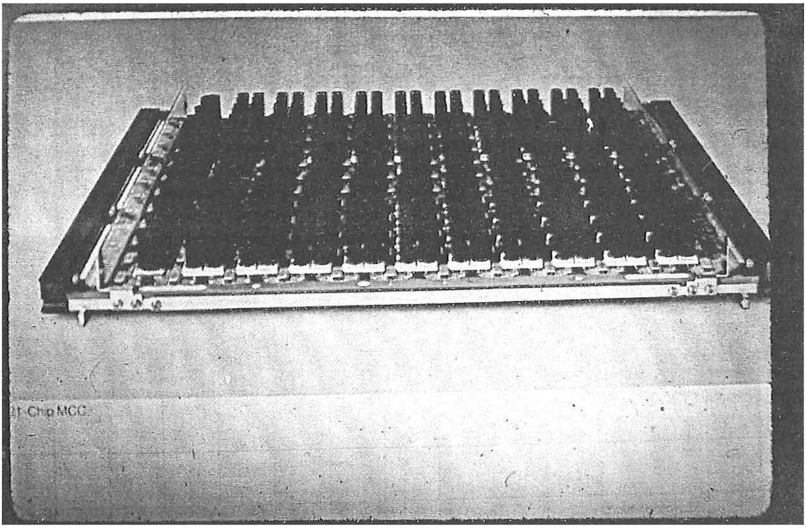


Fig. 7 State-of-the-art for chips on printed circuit boards.

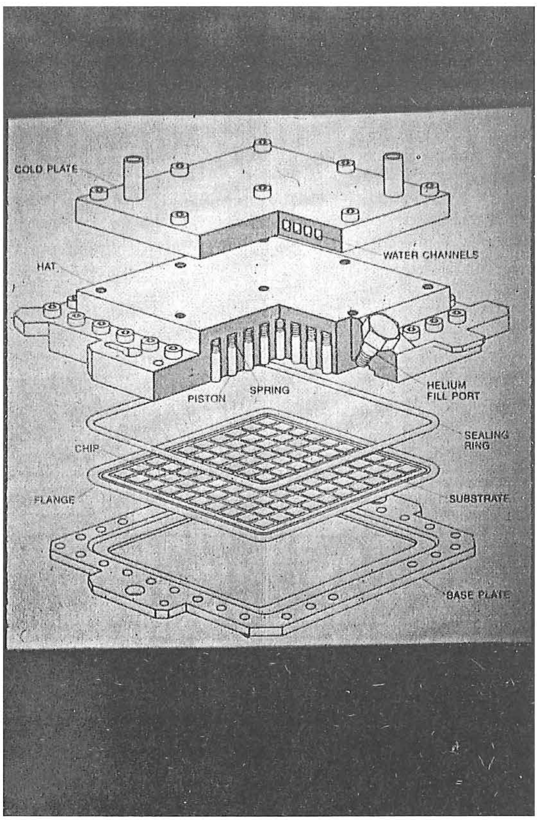


Fig. 8 IBM's thermal conduction module.

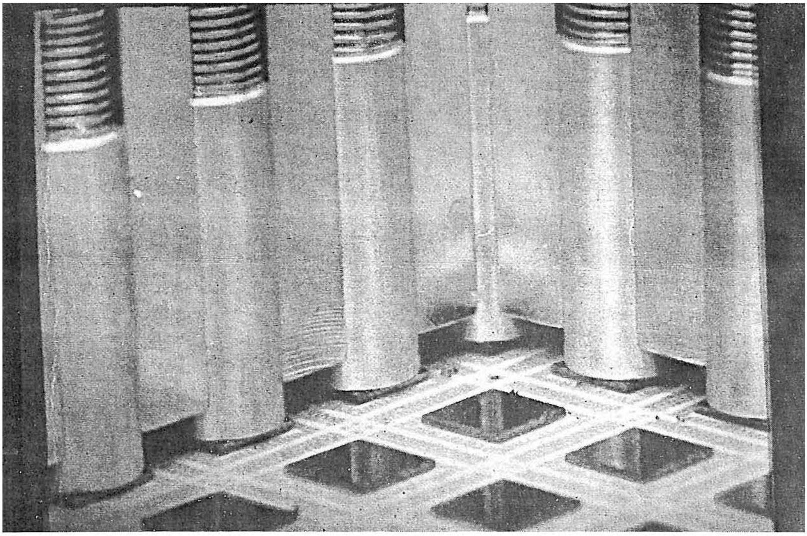


Fig. 9 View of head conduction pistons.

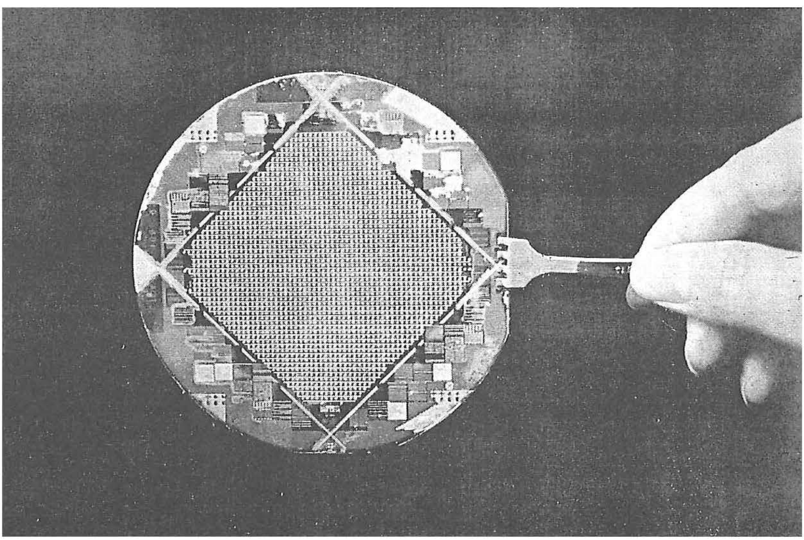


Fig. 10 Trilogy's 6 cm x 6 cm wafer scale chip.

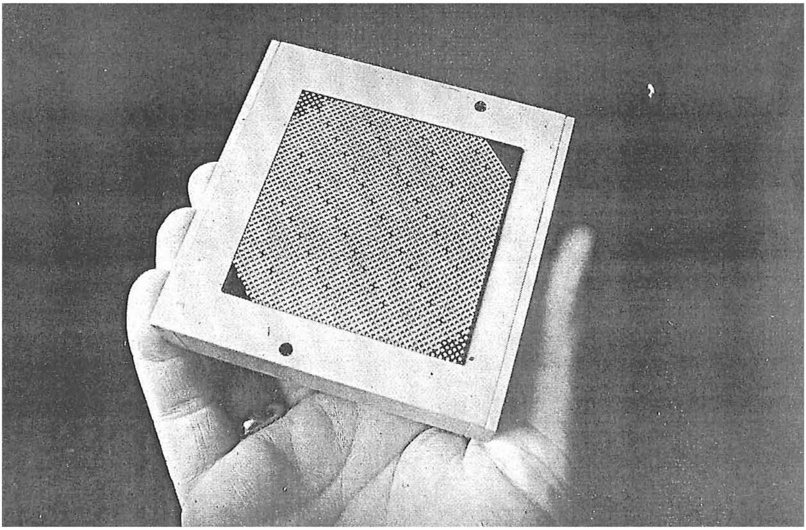


Fig. 11 Trilogy chip mounted on cold plate.

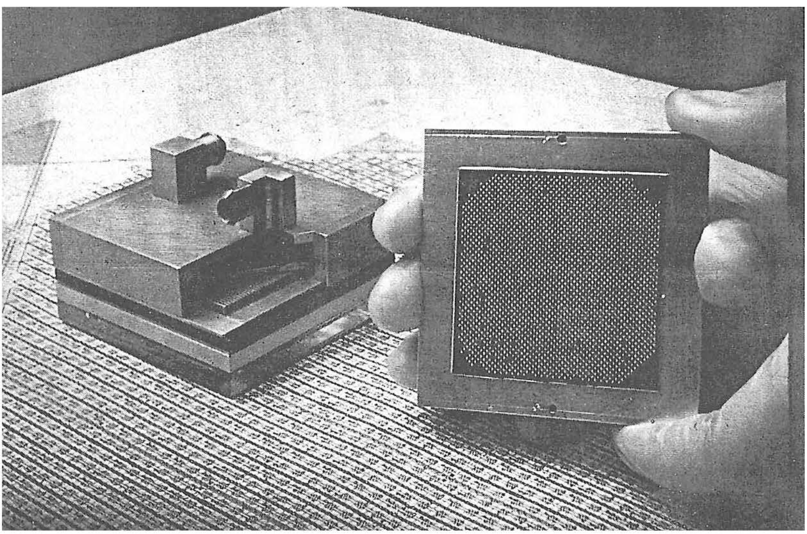


Fig. 12 Cut-away view of cooling structure.

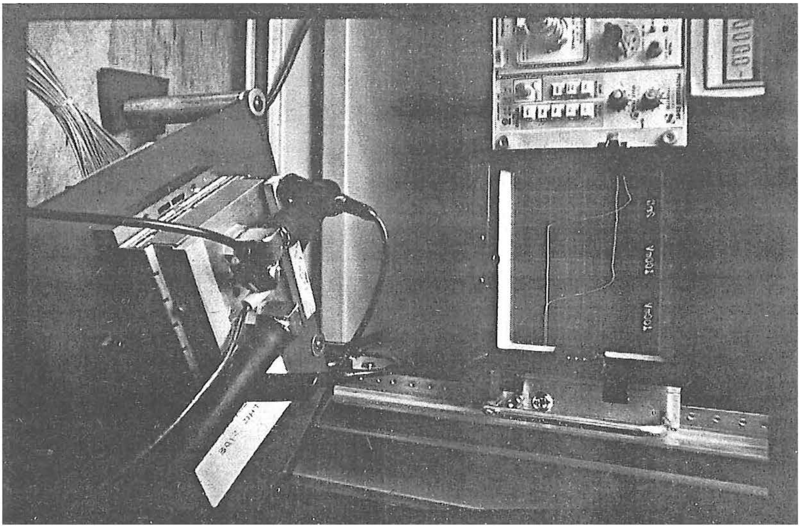


Fig. 13 Chip undergoing performance test.

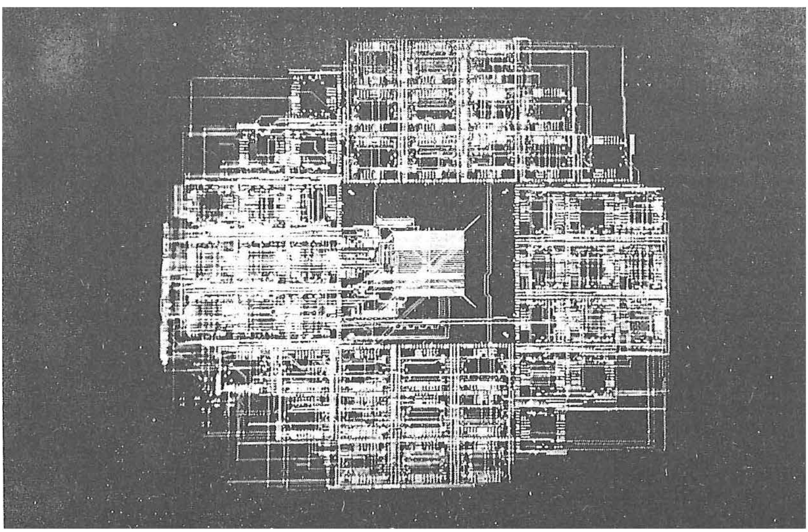


Fig. 14 Pattern of subset of chip interconnects.

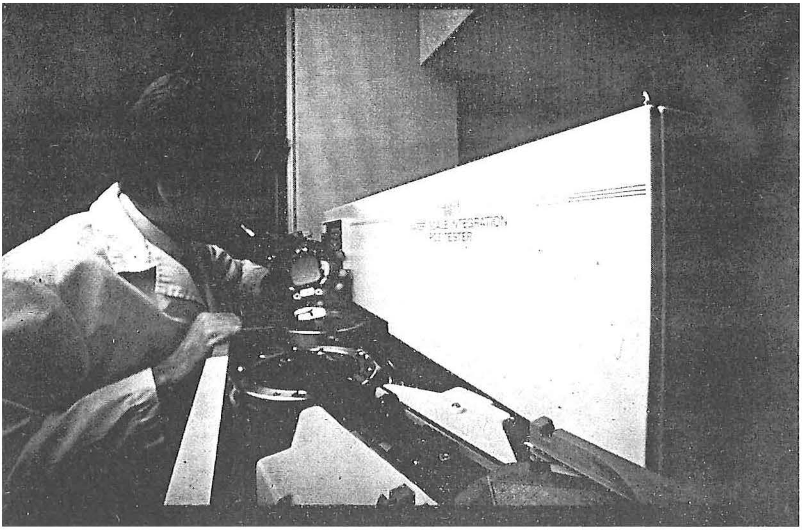


Fig. 15 Chip parametric tester.

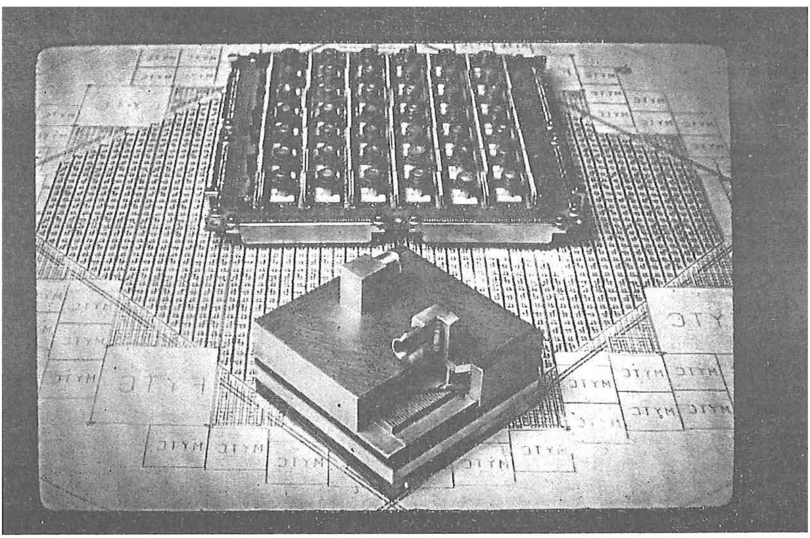


Fig. 16 Comparison of Trilogy chip to Amdahl 470 p-c board.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

MAINFRAME TECHNOLOGY FOR THE NEXT DECADE
Discussant's Contribution

Philippe Renard
Société Européenne de Propulsion (S.E.P.)
Paris, France

Mr AMDAHL has assumed the heavy burden to predict the future. He gave us some précious indications concerning the technological evolutions in the forthcoming years. The wishes each of us to leave this room, knowing what will be the number of gates on one single chip when IFIP celebrates its 50 th Anniversary ?
What will be the size and weight of a hundred MIPS CPU boxs ?
When a hand written paper will be read by a computer ? When speech recognition without vocabulary limitation will be usual and cheap. When the pattern recognition programm of my personal computer will be able to switch off my transistor radio at the beginning of the three minutes period dedicated to advertising and switch it on when normal radio program is resumed ?

But if you are here participating in this IFIP 25 th Anniversary, that means you followed the evolutions of data processing in the last years. In order not to hurt our self respect, I shall not remind you of the various forecasts that any of us may have expressed about the future of computer technology.

Mainly, we most often failed to predict the new computer applications from which technological improvements originated.

For these reasons, we shall not fully satisfy your curiosity and shall not take the risk to be quoted in 25 years from now, for the amusement of the participants to IFIP 50 th Anniversary.

I would like only to summarize some typical trends allowing to measure the way already gone :

The number of transistors that it is possible to integrate on a monolithic circuit is today several hundred thousands, Mr AMDAHL Said ; it was about ten in 1960.

The design rules allowed 50 microns as minimum spacing ; today this limit is between one or two microns.

In 1960, the price of one megabyte of central memory was two hundred times more expensive than it is in 1985. It corresponds to a declining trend of twenty-two per cent every year.

I have calculated the price for the same computer configuration in 1960 and in 1985 with peripherals like one printer, 40 millions bytes of disk memory, etc...

The common unit chosen to express these two prices has been the number of working months paid at the rate of the minimum guaranteed salary in France. This reference is regularly updated according to the average evolution of the prices and the cost of living.

The results of these computations are the following : a configuration which needs today forty months of work to be bought needed in 1960 six hundred and sixty <u>years</u> of work paid at the level of the minimum guaranteed salary.

The most surprising fact is that all these improvements accelerated in the last years instead of slowing down.(If we refer to a proportional scale and not to a logarithmic one). It seems that we are far away from the asymptote.

But we must consider that the field of microelectronics is contributing more than the area of computer science. Although substantial progress is made in architecture, we have to face the cost and complexity of software development.

And now the question is : will all these trends continue at the same rate ? If yes, how long will it last ?

If we go back to 1905 to consider what was predicted about the future of aviation, we read in the science-fiction literature of the period that each housekeeper was expected to go shopping with its personal airplane. But no one describes airplanes going faster than 200 km an hour. Of course, the situation is today very different from this prediction.

Moreover, if we exchange all our own forecasts about the future of data processing, we shall certainly meet with a lot of contradictions. To which, and as a conclusion, I shall reply like a french writer of the new wave : Alain Robe Grillet.

This one, in a conference I attented, was strongly attacked by a large number of participants, and not succeeding in convincing his contradictors, finally declared as last argument :

– " There is enough place in the world to allow each of us to be right " –

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

SOFTWARE ENGINEERING MANAGEMENT

Harlan D. Mills

IBM Corporation
and
University of Maryland

It is a privilege to participate in this 25th Anniversary of IFIP. These twenty-five years have been very instructive for mankind in dealing with the systematic development of complex software. But even so, we can be sure that there is much left to learn.

For example, when civil engineering was twenty-five years old, the right triangle was yet to be discovered. That illustrates how short twenty-five years is for the development of science and engineering, and what great and deeply simple discoveries must await us in software engineering.

With such a historical perspective, you can be sure that I present my thoughts about software engineering management with much humility. I am excited and enthusiastic about the progress we all have made. But I know much more mankind has yet to learn, even though I do not know what it will be.

SOFTWARE ENGINEERING

One major development for management in software over the past twenty-five years has been the emergence of software engineering itself, in moving software development from a black art to a visible process. A serious, wide ranging treatment was first given by Frederick Brooks [2] in 1975, based primarily on experiences in the development of OS/360 by IBM. Barry Boehm [1] has quantified other industrial experiences and developed some principles of economics in software development. Software engineering has begun to develop an orderly process that encompasses the software development lifecycle from requirements analysis to specification, design testing, and further evolution as discussed by Mills et al. in [20]. There is still much to be done in improving the process, but what has been done is already useful.

Creating a visible software development is easier said than done. Making all software details public by some management decree does not itself create a visible process. It may be public, but the best of intentions and diligence will merely create a public chaos if the specifications and designs are lost in a sea of details and terminology. And since there is literally a sea of details in any sizeable software development, they will swamp the specifications and designs unless extraordinary methods and disciplines are invoked.

Several of these extraordinary methods and disciplines of software engineering have emerged in the past twenty-five years, high among them in value for software management:

1. Structured Programming, as introduced by Dijkstra [6],
2. Program Modularity, as introduced by Parnas [21]
3. Program Verification, as introduced by McCarthy [5].

High level programming languages, particularly those with roots in Algol 60, have been useful for software development, but even more critical for methodology development. For example, Dijkstra's famous letter "GoTo Considered Harmful" [7] would not have made sense ten years earlier without an Algol 60 type language.

Structured programming provides a way to keep program or procedure design visible in a sea of details. Program modularity provides a way to keep a system design (of a set of cooperating programs and procedures) visible in a sea of details. Program verification provides a way to keep program documentation visible, by connecting specification and design. In particular, program verification creates an entirely new attitude for taking specifications seriously and keeping designs simple (but not simple minded).

What have these extraordinary methods and disciplines to do with management? Everything. For good management they improve the intellectual control of the process, and thereby the product. And with better intellectual control, management can concentrate on productivity, quality, schedule, or whatever is required for the moment. The management of software engineering is a technical activity that requires not only general management abilities but technical ability as well. In fact, it requires more technical ability to be a good software manager than to be a good software engineer.

Are these methods and disciplines enough for management? Not at all. Brooks and Boehm mention them only by name, while dealing with a host of other considerations. Management involves planning, work structuring and assignment, estimation, commitments to function, performance, schedules, and budgets for prescribed software products, in short, a substantial programming job itself with real similarities to sequential and concurrent program design. But even that is not enough. Management must not only make the right plans, it must make those plans right, by measuring progress, defining corrective actions, treating people fairly, completing the job.

The list of things that can go wrong in a software project is unbounded -- unstable requirements, unreliable hardware or support software, personnel idiosyncrasies and fallibilities, and on and on. It is a management's job to recognize and fix all these problems if they appear -- that's beyond the technical problems of software engineering, and requires eternal vigilance. What these methods and disciplines supply is intellectual leverage -- to permit the software engineering itself to proceed in a more orderly way by groups of people, but with all the problems any group of people have.

PREVIOUS SOFTWARE DIFFICULTIES

It is common in human undertakings for intellectual ambition to outrace intellectual ability. In mathematics, the paradoxes help keep our ambitions in check, as for example, did Russell's paradox [22] for set theory, and Godel's theorems [8] for logic. In the physical sciences, experimental observations destroy theories as well as confirm them.

In programming, this normal human fallibility was compounded by the remarkable growth in computer complexity and power in the first years of electronic computing. Hardware capability utterly outraced software capability. In retrospect, many reasons are apparent. A new generation of hardware can be created by a few brilliant people, then manufactures by many ordinary people. However, software must be created by many people. In every application, different software is required even though the hardware that executes it is identical. That is, a new generation of software requires a new generation of many people, not just a few.

The result of this unprecedented computing capability was a software industry in widespread difficulty. Projects were expected to be late and overrun. Many large projects were finally abandoned. Even when abandoned, society learned few lessons. Serious post mortems were the exception because people did not want to look dumb.

In short, the advances in hardware capability and complexity have kept software over its intellectual head in trying to use and exploit these advances. It might be suggested that society wait until it knows better how to deal with such advances, but that would be unrealistic. First, entrepreneurial and optimistic people are always ready to try to program new hardware capability, and are often commercially successful. Second, the very attempts to program new hardware capability, successful or not, give society experience to study the problems encountered, without which real progress would be difficult. For example, structured programming was successful, to a large degree, just because the unstructured programming experience had been so unsuccessful up to then.

One can imagine a quite different history if the hardware development had been spaced out over hundreds of years rather than tens of years. As it was, society had not learned to deal effectively with purely sequential machines before asynchronous systems of machines were common. By the time structured programming had been conceived, sequential machines were regarded as primitive and quaint as hardware. To be sure, operating systems and programming languages presented the fiction of sequential machines for much programming, so structured programming was very useful. But the operating systems themselves were dealing with asynchronous, concurrent behavior of many real and virtual sequential machines by that time, without adequate theoretical foundations in their specification and design.

In contrast, suppose that the first generation of purely sequential machines had lasted fifty years instead of five. The lessons of structured programming, program modularity, and program verification could all have been learned, a generation of university students and teachers raised, and society would be in a much better position to deal with asynchronous systems of machines in the next generation. As it was, society was programming the concurrent behavior of asynchronous machines before it had learned to program sequential machines one at a time with real proficiency.

This dismal state of affairs was reflected in a NATO Conference in 1968, and the term software engineering was used, more out of hope than prospect, in the title of its proceedings, "Software Engineering Techniques" [4].

STRUCTURED PROGRAMMING

In that NATO Conference in 1968, Edsger Dijkstra introduced the idea of structured programming [6]. It was the beginning of good things about which much has already been written. It is interesting that Dijkstra's initial motivation and argument for structured programming stemmed from program verification. By restricting control flow to a small set of nested primitive structures, the length and complexity of proofs of correctness could be reduced. Almost as a by-product, structured programs could be organized typographically for easier reading and for mentally tracing their control flow in execution. Furthermore, such programs could be conceived and written in more orderly ways than known before, by stepwise refinement, as pointed out by Dijkstra [5], Mills [16], and Wirth [23].

In retrospect, the public discussion in structured programming began about syntax (no gotos) and moved to semantics. It was easy to talk about no gotos but the important secret was that the semantics of structured programs are particularly simple. The internal structure of a structured program is mirrored by an algebraic expression in an algebra of functions [17]. In fact, structured programming can be viewed as a procedural form of functional programming, and stepwise refinement as prescribing rules of functions using simpler functions [13].

In practice, structured programming has been widely adopted in complex software development. There are exceptions at two ends of the spectrum. In business based software, which is dominated by COBOL, COBOL itself has been an inhibiting factor since the control structures of early versions of the language did not include the general control structures needed for structured programming. In systems programming, where dominated by assembly languages and extreme performance requirements, exploiting machine idiosyncrasies may not allow structured programming. But in a large middle ground of complex systems development in Algol derivative languages, structured programming is widely practiced.

The management advantages of structured programming, particularly of stepwise refinement, are large -- indeed against the prior difficulties found in complex projects, these advantages are immense. They make progress visible, in such a way that when a program is 90% done there is a good chance that there is only 10% left to do, instead of another 90% as was often the case before. The visibility of this progress is in direct proportion to the rigor and competence with which stepwise refinement is practiced. It is much harder to practice stepwise refinement for a hundred thousand line program than for a hundred or thousand line program. Such size calls into need considerable analysis and management discipline, but the basic principles are the same and provide a framework for the analysis and management needed.

A good example of the use of structured programming and stepwise refinement in a large scale occurred in the United States' manned space and shuttle programs, developed by IBM, as discussed for the on board shuttle software by Madden and Rone in [14]. There was a great deal more than structured programming to that development, of course, but it provided a visibility for design and implementation that was very helpful.

PROGRAM MODULARITY

David Parnas showed the way to collect data, programs and procedures into systems by defining program modules in a particular way [21]. The word module had long been used in software development, but its meaning was quite varied. Parnas stressed two ideas about modules -- first, in distinction with programs, modules could provide for the storage of data, not just the transformation of data, and second, module specifications should describe external interfaces for their users, not the internal representations of, or operations on, data, which Parnas called information hiding.

Although small examples such as stacks and queues may come to mind as program modules, any system or subsystem of programs or procedures can be viewed as a program module, too. Whereas structured programming cleared the control flow jungle of programs, program modules showed how to clear the data flow jungle of systems. Structured programs are indifferent to the source, disposition, and storage of data between invocations, but program modules are not. They identify and distinguish between input, output, and retained data. That is, whereas a structured program provides an implementation for a function, a program module provides an implementation for a state machine. As for the case of the functions of programs, these state machines of modules can be extremely complex, compared with those usually studied in computer science, but they are state machines nevertheless.

A state machine is characterized by its transition function, considered as a set of ordered pairs that map pairs (input, state) into pairs (output, new state). Note that when modules are implemented in procedures of ordinary programming languages, the procedure names, as well as their parameters are part of the input. Since program modules can be associated with functions in this way, it is a simple step to construct an algebra of functions for program modules implemented with structured programs and procedures. As a result, software systems can be developed by stepwise refinement, first by regarding an entire system as a program module (which will implement a possibly gigantic state machine), then identifying subsystem modules for implementing the original module, and repeating this process until the system has been fully implemented. It is illuminating to realize that typical data management subsystems and access methods of operating systems behave like state machines (and program modules) whether designed that way or not. They can serve as end points of the stepwise refinement of software systems.

The management advantages of program modules are particularly great at the system design and integration level. The theoretical foundation provides a consistent basis for system specification and design. It is much harder to practice stepwise module refinement for a system of several hundred thousand lines than for one of several hundred or thousand lines. But the principles are the same and provide a framework for the extra analysis and management efforts that are needed.

A large scale example of the use of program modularity is represented in the redevelopment of software for a U.S. satellite tracking and monitoring system by IBM, as discussed by Jordano in [10]. This development includes over a million lines of new software organized into a modular architecture with five major layers of common service modules that support nine major application modules. But for all its complexity, it simply implements one gigantic state machine as a program module in the sense of Parnas.

PROGRAM VERIFICATION

John McCarthy [15] discussed the mathematical correctness of programs early, but both Alan Turing and John von Neumann were aware of the principles known today. The mathematical correctness of programs takes some time for society to appreciate. Since programmers never intend to write anything but correct programs, but frequently do not formalize their intentions, proofs of correctness may at first appear either unnecessary or inconceivable. The value of program verification becomes real and clear only after society has encountered the software difficulties it has.

Once program verification is appreciated, it also becomes apparent that its value for management stems more from its effect on programmers than on programs. An understanding of program correctness changes programmer behavior in dramatic ways; first, in understanding the need and value of formalizing specifications, and second, in seeing how and why designs should be kept clean and simple. The economic value of proving programs correct in formal ways depends on the programs, and most programs written today do not merit such treatment. However, it is economical for most programs to be verified informally by the designers.

As already noted, Dijkstra's initial motivation for structured programming was to reduce the size of proofs of correctness, and two current approaches to verification rely heavily on the algebraic properties of structured programs. The axiomatic approach introduced by Hoare [9], takes the form of natural deduction with rules based on structured programming control constructs. Specifications are given as predicates and verifications are proofs in a natural deduction system called Hoare logic. The functional approach introduced by Mills [13] defines a function algebra whose operations correspond to structured programming constructs, and rules for verifying each operation in the algebra. Specifications are given as functions or relations and verifications are comparisons of the function denoted by the program (the program function) and the specification.

Although these two approaches are logically equivalent, their human factors are quite different. The axiomatic approach deals with predicates on data before and after execution of a program part. The functional approach deals with the effect of a program part on data, given as a set of pairs. Programmers seem to visualize functions better than predicates so functional verification seems a better tool for managing software than axiomatic verification. On the other hand, axiomatic verification lends itself directly to automatic verification.

Much of the promise of program verification has yet to be realized, but I believe it will eventually be decisive in three ways: as criteria for methodology, in day-to-day practice, and in automatic verification. First, the lengths of correctness proofs can be shortened not only by avoiding gotos but also by avoiding arrays, in favor of queues and stacks [19]. I believe it will only be a matter of time before arrays are treated as gingerly as gotos in software design. Second, we can expect the use of informal verification to increase in day-to-day software design. Society has not had much time to learn a fundamental new idea, but it will. Software groups that know and practice informal program verification will soon out perform those that do not. Third, verification based on fully automatic theorem generation and proving may be far off. But, we can expect interactive systems to find a happy medium between human work and machine work. A particularly instructive demonstration has been provided by de Bruijn [3] and Jutting [11] which the Automath mathematics checking system has checked a substantial mathematics text book of Landau [12]. I believe human ingenuity and insight will be indispensable in program verification for the foreseeable future, but that we will find ways to shift more and more of the clerical and checking work to machines.

REFERENCES

[1] Boehm, B.W., Software Engineering Economics. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1981.

[2] Brooks, F.P., The Mythical Man-Month: Essays on Software Engineering. Reading, Mass.: Addison-Wesley, 1975.

[3] de Bruijn, N.G., "A Survey of the Project Automath". To H. B. Curry: Essays on Combinatory Logic, Lambda Calculus and Formalism. Edited by J.P. Seldin and J.R. Hindley. London: Academic Press, 1980.

[4] Burton, J.N. and Randell, B., edited by. Software Engineering Techniques. Nato Science Committee, 1969. pp. 88-93.

[5] Dahl, O.J., Dijkstra, E.W., and Hoare, C.A.R., Structured Programming. London: Academic Press, 1972.

[6] Dijkstra, E.W., "Structured Programming." In Software Engineering Techniques, edited by J.N. Burton and B. Randell, pp. 88-93. Nato Science Committee, 1969.

[7] Dijkstra, E.W., "GOTO Statements Considered Harmful." Comm. ACM 11 (Mar. 1968): 147-148.

[8] Godel, Kurt, "Uber formal unentscheidbare Satze der Principia Mathematica und verwandter Systeme I. "Monatshefte für Mathematik und Physik, Vol. 38 (1931), pp. 173-198.

[9] Hoare, C.A.R. "An Axiomatic Approach to Computer Programming." Comm. ACM 12, No. 10 (Oct. 1969): 576-580, 583.

[10] Jordano, A.J. "DSM Software Architecture and Development." IBM Technical Directions, Vol. 10, No. 3 (1984): pp. 17-28.

[11] Jutting, L.S. van Benthem (1976). Checking Landau's "Grundlagen" in the Automath System. Doctoral Thesis. Eindhoven University of Technology 1977, Mathematical Centre Tracts nr. 83. Math. Centre Amsterdam 1979.

[12] Landau, E. (1930). Grundlagen der Analysis. First ed. Leipzig 1930, Fourth ed. Chelsea Publishing Company, New York, 1965.

[13] Linger, R.C., Mills, H.D., and Witt, B.I., Structured Programming: Theory and Practice. Reading, Mass.: Addison-Wesley, 1979.

[14] Madden, W.A. and Rone, K.Y. "Design, Development, Integration: Space Shuttle Primary Flight Software System". IBM Technical Directions. (25th Anniversary System Integration Issue) Fall/Winter (1980) pp. 33-43.

[15] McCarthy, J. "Towards a Mathematical Science of Computation." In Proceedings of the IFIP Congress. Amsterdam: North-Holland, 1962.
[16] Mills, H.D. "Top Down Programming in Large Systems." In Debugging Techniques in Large Systems, Courant Computer Science Symposium 1. Edited by Randall Rustin, pp. 41-55. Englewood Cliffs, NJ: Prentice-Hall, 1971.
[17] Mills, H.D. "The New Math of Computer Programming". Comm. ACM 18 (Jan. 1975): 43-48.
[18] Mills, H.D. Software Productivity. Boston, MA / Toronto, Canada: Little, Brown and Company, 1983.
[19] Mills, H.D. "Program Design Without Arrays and Pointers". SHARE presentation, August, 1983.
[20] Mills, H.D.; O'Neill, D.; Linger, R.C.; Dyer, M.; and Quinnan, R.E. "The Management of Software Engineering." IBM Systems Journal. Vol. 19, No.4 (1980): 414-477.
[21] Parnas, D.L. "A Technique for Software Module Specification with Examples." Comm. ACM. 15, No. 5 (May 1972): 330-336.
[22] Wilder, R.L. Introduction to the Foundations of Mathematics, New York, 1952.
[23] Wirth, Niklaus. "Program Development by Stepwise Refinement." Comm. ACM, 14, No. 4 (April 1971): 221-227.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

IFIP AND THE DEVELOPING COUNTRIES

R.Narasimhan
Chairman, ICID

Tata Institute of Fundamental Research
Bombay 400005, India

Informatics is a vital factor in development. Information Sciences and Information Technology are, hence, of critical importance to the developing countries. Realizing this, IFIP established in 1979, with assistance from UNESCO, the 'IFIP Committee: Informatics for Development (ICID)'. The principal objective was that ICID should act as an interface between informatics at the world level and the developing countries. This paper considers the issues that developing countries face in exploiting information technology and the role IFIP can play to assist these countries.

IMPORTANCE OF INFORMATICS TO DEVELOPMENT

In less than half a century, computers which started out as stand-alone 'number-crunchers' and commercial data-processing systems, have become all pervasive 'engines' that are transforming the Western Societies into 'information societies' and Western economies into 'information economies'. Information technology has undergone a radical transformation in the advanced countries due to the coming together of computer technology and communication technology. The integration of these two technologies has been made possible, of course, through spectacular developments in microelectronics and through major developments in laser, printing and display technologies, the use of fibre-optics and satellites in communication, and through basic innovations in the deployment of software technology.

Information technology has brought about fundamental modifications in the manufacturing and service industries in terms of their structure and content, and in terms of the skill requirements of the workers in these industries. Applications of information technology have given rise to new products -- both capital and consumer goods. The changes in the production process of such goods have resulted in the simplification of product design, increased automation of the production process, improved quality of performance, simplification of maintenance, and reduction in the cost of production.

In the service sector, again, major changes have been brought about through the use of point-of-sales terminals, automated warehousing and inventory control, electronic funds transfer systems, automated tellers in Banking, computer-assisted publishing, data-banks for legal and medical services, electronic scanning and analysis techniques for medical diagnosis, computer-aided design systems, and so on.

Innovations within the technologies based on microelectronics have been largely centrifugal in nature. That is, they encourage vertical disintegration and decentralised and fragmented production. By reducing the scale for optimal operation, they lower fixed and working costs and make it easier for new entrepreneurs to enter these fields.

There are many lessons of direct relevance to developing countries that can be drawn from the radical industrial and economic changes that are taking place in the advanced, industrialized countries. The first and the most important one is the need to become aware of information as an economic commodity, and of information technology as one with a great potential for income-creation and modernization.

Information technology allows certain kinds of skills to be transferred from a worker to a machine. Instead of negatively assessing this feature as one of deskilling, in the context of developing countries, one should try to derive benefits from "intelligent" machines which could be used to increase productivity although operated by lower-skilled workers. The relatively low capital cost of such machines should enable the deployment of more of these machines to increase employment and productivity.

Another important aspect of information technology is its intimate relationship to the service sector. Services of all kinds are in general very undeveloped in most developing countries. Imaginative deployment of information technology could bring high-quality professional and technical services (managerial, legal, medical and educational) to the service-starved population in the rural and geographically distant areas.

The real challenge in the developing countries is to build up the capability to design, fabricate and operate computer-based systems to manage, monitor, control, and otherwise support a whole variety of activities in the field, in the design room, in the production shop, in the office, and in all kinds of services. Developing countries face a variety of problems in acquiring, adapting and deploying information technology to solve their specialized socio-economic problems. It is important to understand the nature of these problems before we can determine in what effective ways IFIP can provide assistance to developing countries in this important area.

PROBLEMS FACED BY DEVELOPING COUNTRIES

Historically, in practically all developing countries the introduction of computers took place at the initiative of computer salesman -- for the most part of one or other of the multinational mainframe manufacturers. The typical scenario in most cases would have been something like this. The first computers would have been imported by foreign-owned corporations, or sold to subsidiaries of foreign commercial companies. The first applications would almost always have been in the areas of routine commercial clerical work -- book-keeping, accounting, invoicing, etc. The early computers imported into the country would have been systems withdrawn from use in the more advanced Western countries and refurbished for sale in the developing country.

This scenario would apply to most developing countries which were introduced to first generation computers -- that is, in the late 50s or early 60s. In the last two decades computer hardware has gone through three more generations of development. The introduction of micro- and mini-computers, and super-minis, has brought about major changes in the computer marketing scene in developing countries.

In addition to multinational mainframe manufacturers and their subsidiaries, large numbers of local agents -- with little or no background in computing or computer technology -- have set themselves up in the trading business selling mini- and micro-computers and their associated peripherals earning as commission some fixed percentage of each sale. Operating in what is essentially a seller's market, there is very little incentive for these middlemen to invest in providing training and after-sales service to their customers. Thus, developing countries -- especially those at the very initial stages of computerization -- face the problem of having computers, peripherals, and software dumped on them with no adequate information or training concerning their use, and no support service to maintain them in operation for any length of time. These problems raise important policy issues as regards procurement of computers, provision of adequate training in their usage, and ensuring continuing support services in maintenance and operation of these systems. While some developing countries have analysed these problems and tried to devise appropriate policy measures, a very large number of others -- especially the smaller countries and the newly emerging ones -- are in urgent need of assistance to evolve and implement such policy measures.

As earlier discussed, the first usage of computers in most developing countries is almost always in routine commercial applications. There are many reasons for this. These were the applications extensively computerized in the industrialized countries. Hence, ready-to-use software packages are available in these application areas and the computer vendors are only too ready and willing to promote the use of these packages when they sell computer hardware in developing countries.

These routine commercial data-processing activities, however, seldom mature into more significant management applications such as, for example, planning, project management and control, modelling, simulation, operations research applications, and so on. These management tasks can be computerized only through building up enough internal know-how in an organization for systems and software development. From the viewpoint of developing countries these management applications, and also applications in transaction processing, real-time process monitoring and control, engineering design, text- and word-processing, information storage in a data base, query and retrieval, etc., are far more important than routine commercial data processing.

More generally, the computational needs of developing countries can be broadly divided into four categories: (1) applications that relate to socio-economic programmes addressing the basic needs (e.g.,primary health, literacy, rural employment, housing, transport, water, etc.) and the agricultural sector; (2) applications in the government sector (federal, state and municipal administrative problem areas); (3) applications concerned with increasing productivity in the industrial sector (goods as well as services); and (4) applications relating to export and international marketing.

In some of these application areas, efforts already implemented in the industrialized countries may be transportable and immediately put to use. But in many other cases, creating systems ab initio taking into account, at the design stage, local specificities may be a necessity. The structures and expertise needed to create such systems may have to be dealt with on a case by case basis. Also transfer of know-how in these system design areas is likely to be less straightforward. But precisely these application areas are the ones of great immediate importance to developing countries.

Existing models in the developed countries are likely to be valuable and applicable in application categories (3) and (4) listed earlier. But, even in these cases, local conditions and contexts may require the creation and use of new structures. Industrial production establishments in the developing countries -- even in the more advanced ones -- seldom have the level of informatics awareness that is usually taken for granted in such establishments in the developed countries. Information processing practices, and software packages created to implement such practices, in the developed countries cannot, therefore, be transported to developing countries and made to work effectively in a straightforward way. Software practices, such as distributed-processing and word-processing, assume new dimensions in countries where the telecommunication infrastructure is undeveloped, or where the local script and mode of writing differ radically from those in European countries.

Creating structures and transferring methodologies for computerization are predicated on the availability of manpower with the requisite backgrounds in software engineering, knowledge of application areas, experience in consultancy and, not the least, marketing skills. The methodologies for manpower creation, again, cannot be directly transferred from the developed to the developing countries. Development in the developed countries has been the result of a historical, evolutionary process. This applies to skill and knowledge development also. In contrast, developing countries are trying to achieve development on a broad front simultaneously. The needed manpower also has to be developed at many levels simultaneously. A variety of approaches would have to be resorted to at the same time to accomplish this.

IFIP'S INITIATIVES : FIRST EFFORTS

IFIP's efforts in assisting developing countries in the informatics area has, for the major part, been carried out in close interaction with UNESCO. From its inception IFIP has maintained a close relationship with UNESCO. In recent years the level of joint activity has increased, particularly in programmes involving the two separate but related topics of education and developing countries.

In the area of education, IFIP's work with UNESCO has been performed by the Technical Committee TC3 concerned with 'Education'. During 1980, with UNESCO's financial support TC3 prepared 'A Modular Curriculum in Computer Science for Developing Countries'. The first draft was extensively distributed to elicit comments from developing countries. A revised version was presented at WCCE 81, IFIP 3rd World Conference on Computers in Education, held at Lausanne in Switzerland in mid-1981. This version has since then been published by UNESCO for general distribution. Other programmes on computer education have been jointly sponsored by UNESCO and IFIP.

To provide a focus for IFIP activities relating to developing countries, a separate group, "IFIP Committee: Informatics for Development (ICID)", was formed in 1979. The following general approach was a guiding philosophy in establishing initially the ICID programme with UNESCO's blessings: emphasis would be on events organized within the developing countries, on topics selected in direct cooperation with organizations or individuals in those countries. Technical experts would be supplied by IFIP. These participants would all be volunteers. Their travel costs would by subsidized through external resources. In-country expenses would normally be borne by the host country.

From 1980 on, UNESCO has been generously supporting ICID to fulfil some of its objectives as outlined above. UNESCO's support has enabled ICID to promote specialized informatics events in developing countries and provide partial assistance to experts from developed countries to participate in these events. Some notable events falling in this category were:

NETWORK-80, Bombay, 1980
INFORMATICS-81, New Delhi, 1981
EDINFO-82, Madras, 1982
NETWORK-84, Madras, 1984

and, in addition, two Conferences on Computer Applications in Food Production and Agricultural Engineering, the first in Cuba in 1981, and the second in New Delhi in 1984.

ICID has also taken the initiative to organize specialized events on topics of particular relevance to developing countries, often in close proximity to the IFIP World Computer Congresses which take place every third year. Examples of such events are:

Computers in Developing Nations; Melbourne, 1980
Regional Computer Cooperation in Developing Countries; Stockholm, 1983.

The UNESCO input has also enabled ICID to support partially the participation of informatics professionals from developing countries in IFIP Working Conferences and General Conferences on advanced topics organized by the Technical Committees. Such conferences, which normally are held in the Western countries, are usually inaccessible to developing country participants without special financial support. In this context, generous support from the Intergovernmental Bureau for Informatics (IBI) to this same end should also be acknowledged.

ICID, in addition to the above, has also organized Regional Consultation Meetings to enable informatics specialists from developing countries in a region to get together to discuss their problems and establish working level contacts. Such regional meetings have been organized to cover West Asia, Latin America, Africa and South-East Asia.

Yet another step that IFIP took in the early 1980s to enlarge the scope of its interaction with developing countries -- especially the smaller ones -- was to institute two new categories of membership: (1) a closely cooperating regional group of countries could become a Full Member (as a group); (2) Corresponding Member. SEARCC (South-East Asia) and CLEI (Latin America) have been elected to group memberships on this basis.

IFIP INITIATIVES : FUTURE NEEDS

Providing meaningful assistance to developing countries in the acquisition and deployment of advanced technologies in a self-reliant manner poses many complex problems. Developing countries span a very wide spectrum of technological preparedness and competence. In addressing this question of differences in levels of competence, an International Forum on Technological Advances and Development organized by UNIDO identified three possible entry levels for a developing country to begin the mastery of a new technology, as follows:

> Minimum Level: awareness, continuous monitoring, critical and relevant technological intelligence; identification of relevance, ability to assess, select, negotiate and utilize technology; autonomous decision making.
>
> Medium Level: the above and in addition ability to adapt and generate technology.
>
> High Level: the above as well as capacity for commercialization, design, manufacture of equipment, and participation in competitive international markets.

In the context of the above possibilities, what effective support can IFIP provide to developing countries? The essential strength of IFIP lies in its international character spanning a large number of countries, its wide base of expertise in the informatics field, and its wholly non-governmental character. Its essential limitation is that it has no resources to provide financial assistance on its own to start significant projects in informatics in any developing country. Taking its strength and limitation together, it can be seen that the most effective role IFIP can play is a catalyzing one. It can provide consultants and experts in specific informatics specializations when volunteers to play these roles are available. In collaboration with organizations like UNESCO, UNIDO, IBI, and other intergovernmental and non-governmental groups, IFIP can conduct specialized tutorial programmes, Workshops, Seminars, etc., to meet the specific needs of developing countries. Through such collaborations, again, IFIP could develop a scheme for publishing books, state-of-the-art surveys, compilations of seminal articles, and so on to assist the informatics education and training programmes in developing countries. IFIP, in fact, has offered to play such a catalyzing role in the enhanced informatics programme that UNESCO is hoping to evolve in the coming years.

Developing countries need assistance in informatics technology at many levels since their levels of preparedness to absorb and use this technology span a wide spectrum, as we saw above. IFIP is, perhaps, best geared to assist developing countries in the middle level of preparedness and those which are preparing themselves to move from the middle to the high level. For those countries which are at the minimum level of preparedness, perhaps the most effective strategy is to collaborate with other developing countries in the region which have moved to higher levels of preparedness and development. Regional cooperation in high technology matters holds a great potential for developing countries. In many regions (e.g., Latin America, South-East Asia, West Asia) frameworks have been already created for regional cooperation among countries in informatics. Such Regional Groups, organize training programmes

(Workshops, Schools, etc.), operate regional facilities (Computer Centres, etc.), and organize conferences and other events. The best help IFIP can provide in this context is to work with these Regional Groups and provide technical inputs to the events organized by them, and/or the facilities operated by them. Realizing the critical importance of such assistance, IFIP has recently created a modest ICID Development Fund from its own internal resources. Through contacts already established with some of the Regional Groups, this Fund is being used to subsidize the participation of technical experts & specialists in events organized by these Regional Groups.

In the coming years, perhaps the most effective role IFIP can play in promoting informatics for development in the developing countries, is to act as an informed intermediary bringing into working-level interaction countries which have a need of a specific nature in informatics with others (individual experts, professional groups, funding agencies, etc.) who may be in a position to meet that need in a well-defined manner. A prerequisite for playing this role is, of course, for IFIP to become well-informed not only about the informatics needs of developing countries but also about the individuals, groups and agencies with an interest in assisting developing countries to deploy informatics to achieve development. But before IFIP can become better informed in this regard, both IFIP and its activities must achieve greater visibility among the developing countries and also among the individuals, groups and agencies with a potential to assist. Information dissemination to this end must be given a high priority. Also mechanisms to aid effective dissemination of information must be built up within IFIP.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

MAN AND MACHINE
VIEWED FROM DIFFERENT CULTURAL BACKGROUNDS

Tosio Kitagawa
President of the International Institute for
the Advanced Study of Social Information Science
Tokyo, Japan

Special Comment by the Editor

The Author of this paper could not attend the Symposium for reasons of health. The paper was read by the discussant R. Rector - instead of a discussion contribution - and the other discussant, Professor A.P. Ershov, came only as far as Berlin from Novosobirsk and could not make Munich; moreover he was not able to submit a written contribution, also for reasons of health.

This paper confronts Man and Machine with Culture and Civilization and ends with five viewpoints and their implications for analysis and promotion in the man-machine relationship.

INTRODUCTION AND SUMMARY

The purpose of this paper is to provide a conceptual framework under which one will be able to discuss the topic of "Man and Machine Viewed From Different Cultural Backgrounds". Hopefully, this will be possible to be done with some emphasis of thought into the present era of information oriented societies.

There are a few basic premises regarding the terminology of this paper which should be explained at its beginning to make the following discussion clear.

Man should be and can be understood to have three gestalts: the biological, the civilized, and the cultural one. The civilized gestalt of human societies, is characterized by the existence of LANGUAGE and the usage of MACHINE. Here, the notion of MACHINE is understood in a broad sense to include not only physcial apparata, TOOLS and EQUIPMENT, but also MECHANISMS and INSTITUTIONS in human technological, social, economical and political systems. Hence, the totality of the existing MACHINES in this sense constitutes an indispensable component of CIVILIZATION in society. On the other hand, our notion of CULTURE is much more concerned with the biological gestalt in the ecosphere and with the symbolic gestalt under semiological aspects of creation. Since there is no MAN without MACHINE and LANGUAGE, CULTURE and CIVILIZATION merge together. Nevertheless, it is adequate and subtle to make a distinction between these two, keeping in mind the following correspondence, which is admittedly rough, but substantially useful, at least in the first approximation, and which reads

(1.01) MAN: MACHINE = CULTURE: CIVILIZATION

The implications will be explained in the following sections.

By virtue of the relationship (1.01) the topic in the title of this paper will start with a discussion of CULTURE AND CIVILIZATION in the present information era. This choice of a starting point is rather a strategic choice of the author so that efforts can be concentrated on a discussion of the current focus problems facing us, from the standpoint of logic of informatics and generalized ecosphere of knowledge information processing systems which the author has treated during the last fifteen years in a series of papers (1) to (15).

In section 2 we present a set of basic conceptual guidelines for discussing NATURE, CULTURE, and CIVILIZATION from our point of view. Section 3 is devoted to the formulation of our understanding of the MACHINE concept in the present era of information oriented CIVILIZATION. We point out the most essential features of the production technology in the present information CIVILIZATION, by appealing to the notion of knowledge information processing system (KIPS) and its generalized relational ecosphere (GREKIPS). In section 4 the specific features of interrelationship between CULTURE and CIVILIZATION in the present era of the information societies are described in terms of the logics of informatics. It is in this section that we have to address the crucial philosophical problems being treated by the contemporary thinkers. Here we appeal to our own conceptual frameworks and endeavour to apply them with some logically admissible adequate extension and without any sudden import of other procedures.

The last section gives a set of five viewpoints and their respective implications for analysis and promotion in the MAN-MACHINE relationship. Here we are dealing with the triple set, NATURE, CIVILIZATION and CULTURE, each of which corresponds respectively to each of the three gestalts: biological, machine, and symbolic. Our set of five strategies and their respective implications for analysis and promotion can be compared with several proposals by contemporary authors such as A. Toffler, J. Naisbitt and K. Takemura. It is to be noted that under high technological influence, as here in this paper, we restrict ourselves to the effects and implications of information technology innovation, while several vital problems connected with advancements of life science and innovations of biological engineering will be left to another occasion.

It is noted that there are several contributions by Japanese authors and communities regarding the problems of civilization and culture in the information oriented era. This can be observed in Asahi Newspaper(ed) (1), Imai (1) $\sim$ (2), Kato, Kinoshita, Maruyama and Takeda (1), Maruyama (1), Masuda and Masamura (1), Takemura (1), NHK(ed) (1), Tachi (1), Takeuchi (1), Umezao and Ishige (1) and Yamazaki (1). This paper does not discuss these contributions, but the author has not been able to escape the influence of these authors. Because of the same social backgrounds under which he is living and working, he has indirectly been influenced by these contemporary eminent authors.

We note that this paper is not a comparative study of different cultural effects of MAN and MACHINE problems. Instead, it aims at making clear how the different cultural backgrounds are generated with respect to the three gestalts, biological, mechanical and semiological. In the meantime, we are conscious of an existence of some characteristic features based upon the Asian way of thinking, as can be observed in the notion of "eizon" which will be later explained.

2. General Understanding of NATURE, CULTURE and CIVILIZATION

The term CULTURE is used both in the understanding of primitive human societies in anthropology and in the analysis and description of the advanced stage problems such as cultural shock and cultural interface among different nations. The term CIVILIZATION is also used similarly over the broad range covering primitive, ancient, medieval and modern times. In fact, it is rather a common understanding that CULTURE and CIVILIZATION are the two sides of the same human social existence, where CULTURE is more or less concerned with symbolic aspects, while CIVILIZATION with the uses of MACHINES in a broad sense.

In order to reduce the vagueness of these concepts and, at the same time, be broad enough to cover different situations of these two concepts, we appeal to the following restrictive explanations.

2a. CULTURE can be described with reference to its three components: (I) cosmology; (II) symbolism; (III) performance. In fact, CULTURE originates from the social attitudes of social lives based upon a certain evaluation which governs a certain signification system in the sense of semiology, leading to the formation of (I), (II) and (III) to secure its validity.

There are three fundamental features of the human attitude of lives: control, eizon (evolution) and creation, as we have explained in our three coordinate system formulation of informative logics in Kitagawa (2), (3), (4).

2b. CIVILIZATION is a social implementation of CULTURE in society by means of the three processes which are coined by the terms: (i) objectivization, (ii) operatorization and (iii) systematization, as is explained in the Kitagawa (8).

With reference to production technology these processes can be illustrated by pointing out the fact that (i) tools, equipment and apparatus are realized as <u>objective existences</u>. (ii) production processes are defined and performed <u>as sequences of operators</u> realized in the material and energy components through the <u>objective existences</u> (i), and (iii) the sets of objective existences and operators are <u>systematized</u> so as to form the production process as a whole.

It is quite a common phenomenon observable in various stages of CIVILIZATION that control and eizon features of attitudes of lives are easier to be implemented and realized than creation feature.

The concept of <u>eizon</u> was introduced by Kitagawa (2) as a new combination of two Chinese <u>characters</u> in the Japanese pronounciation <u>ei (営)</u> and <u>son (存)</u> whose implications can be interpreted as a part of <u>keiei (経営)</u> corresponding to management and also as a part of <u>jitsuzon (実存)</u> connected with existentalism of the French and German <u>philosophers</u>. The concept of <u>eizon</u> may be approximately denoted by a combination of evolution and <u>existentability</u>, as some European friends of the author have suggested. The author adheres to making use of the present terminology, with reference to the logic of informatics.

Technology, production, economy and administration are more easily and more effectively implemented and realized by appealing to machines, tools, equipment, scheme, mechanism and institution, that is to say, by appealing to MACHINE, in comparison with art or religion, which are more symbolic and creative. Eizon features of attitude of human lives are easier to be implemented and realized than creation features are.

The three features of human life attitude, <u>control</u>, <u>eizon</u> and <u>creation</u>. constitute three components which secure <u>the feasibility of the existence</u> for the human being. This is one of the author's basic standpoints, which is further explained and developed in Kitagawa (2), and which applies also to this paper. It is also noted that the eizon concept is remarkable in the Asian way of thinking, including that of Indian, Chinese and Japanese people.

2c. In discussing the man-machine relationship, we have to rely upon the triple set consisting of NATURE, CIVILIZATION and CULTURE in the following sense.

First of all, we must recognize that mankind is a biological existence

The following Table illustrates our usage of the specific terminology in this paper. Detailed explanation is given in the following sections.

Table 1 Mutual relationship among basic notions

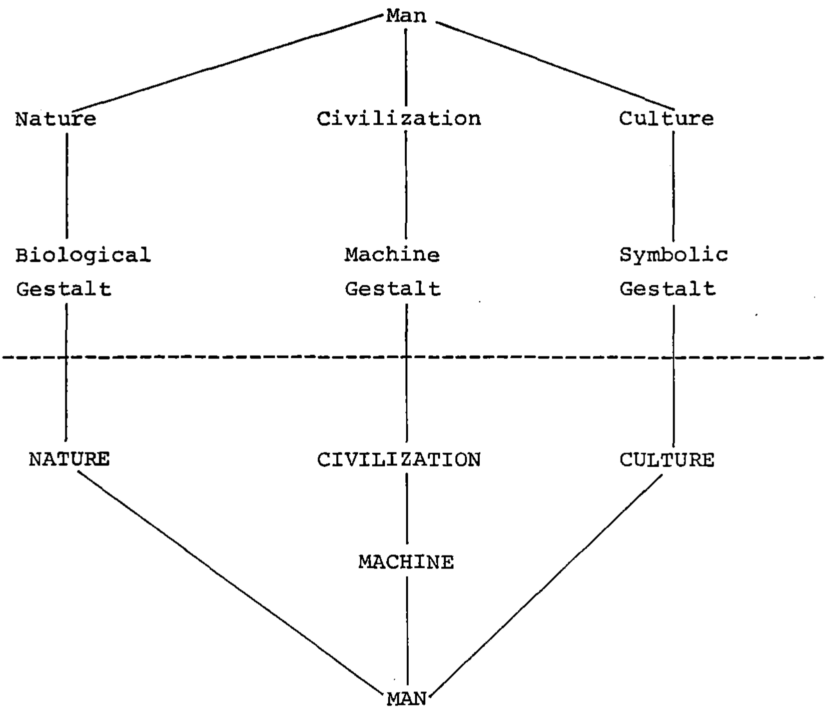


Fig. 1 (a) Different emphasis regarding the feasibility of existence sub-space in informatics and semiology.

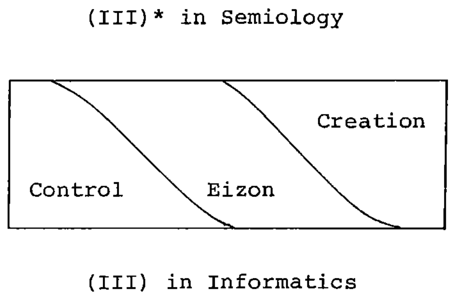


Fig. 1 (c) The triple gestalt relationship

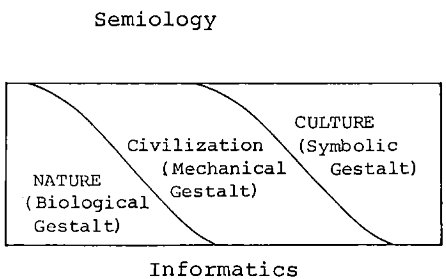


Fig. 1 (b) Amalgamations of structure and function sub-spaces in semiology.

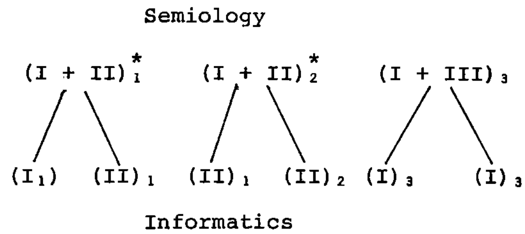
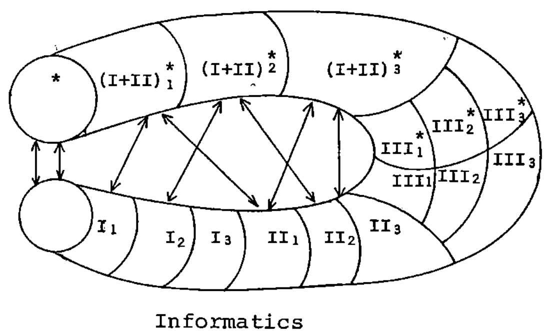


Fig. 1 (d) Methodological connection between informatics and semiology (= mathematical methods)



having a membership in nature, and in the consequences, we should rely upon one of the triple set: NATURE. This triple set in the current daily life usage is, however, neither clearly defined nor does it have any clear definition of the, but he is emphazing some essential features inherent in their deep connection by pointing out the notion of gestalt associated with each of them. Thus this paper uses the term CIVILIZATION to emphasise machine gestalt in civilization, while the term CULTURE points out symbolic gestalt in culture. In this connection it is adequate to make use of NATURE to cover biological gestalt in nature which does not belong to the former two gestalts. Here the term gestalt, coming from the German language, is used to imply the three features: (a) topos instead of space, (b) image instead of clear definiteness, (c) flexible structure instead of solid one. In this connection we refer to Kitagawa (5), (9), (10), (12), (13), (14).

3. Machine Gestalt in the Present Information Civilization

3a. Our first task in this Section is to point out some clear characteristic features of MACHINE in the contemporary production technology. The second task is to show our viewpoint, through which the roles and the functions of MACHINE in various fields of human social activities can be described and analysed. In this consequence the notion of knowledge information processing systems (KIPS) and generalized relational ecospheres of KIPS, denoted by GREKIPS introduced in Kitagawa (9), (10), (11), play the role of the core concepts in our discussion, as we shall now briefly explain.

3b. For our purpose, it is required to appeal to the following set of key concepts: M = Matter, E = Energy, I = Information, K = Knowledge, P = Processing, S = Systems. In terms of these key concepts and, with the aid of the parentheses, each denoting an inclusion and/or an embedding, we are now going to trace several stages of the recognition of MACHINE which can be observed in the historical development of production technology.

(i) MEPS denotes the stage of production technology in which the role of MACHINE is characterized as a matter-energy processing system, with reference to neither information nor knowledge.

(ii) ME(I)PS denotes the stage of production technology in which the role of MACHINE is characterized as a matter-energy processing system by using an information flow embedded in the system.

(iii) Me(KI)PS denotes the stage of production technology in which the role of machine is characterized as a matter-energy processing system by using an information flow and knowledge storage, leading to pattern understanding, both embedded in the system.

(iv) ME(KIP)S denotes storage, leading to the pattern in which the role of MACHINE is characterized as an objective existence system supporting an operatorization process due to knowledge and information processing. This appeals to an information flow and a knowledge storage leading to pattern understanding.

(v) ME(KIPS) denotes the stage of production technology in which the role of MACHINE as an objective existence is to provide a vessel in which an operator function of KIPS is embedded.

In view of the present state of production technology of the industries in which CAD/CAE and FA are being adopted, sometimes with the aid of robotics, it is understandable to use to notation ME(KIPS) in order to denote their most characteristic features. Looking back from the p.esent to the past, we may be able to trace a transition phenomenon among the five stages, which, in its typical case, can be denoted by

(3.01)⟶(i)⟶(ii)⟶(iii)⟶(iv)⟶(v).

The detailed discussion is given in Kitagawa (13).

3c. It is basically important to recognise how and to what extent the notion of information has built up its present status since the middle of this century. The substantially decisive factor in this connection was the establishment of the specific industrial technology called *information processing technology* as an integration of three technologies, each of which had been developed under the domain called *control, computation,* and *communication,* respectively. Artificial intelligence, system organization, and knowledge engineering have come to emerge as the important topics of information science, requiring the sophisticated investigation of knowledge processing in its development.

3d. An integrated set of MACHINES in the present state of production technology can be understood to form a generalized relational ecosphere of KIPS's, which denotes the crucial role of knowledge information processing systems embedded in it. This is, however, not restricted to the domain of industrial production. It is, instead, one of the characteristic features of the present civilization where the predominant existence and the remarkable role of various KIPS in their various connection states, either loosely or tightly, can be observed in various fields of social activities, including education, research, medical care, economy and administration whose integration adds up to be crystrallized and coined as information network society.

3e. Considering the recent advancement of information societies equipped with various GREKIPS's, it seems to us that the logic of informatics, in terms of three coordinate systems, proposed as early as 1969 and published in Kitagawa (2), is to manifest its important implication for understanding the present civilization. The three coordinate systems consist of (I) structure coordinate system, (II) function coordinate system, and (III) feasibility of existence coordinate system.

The structure coordinate system is formed by three axes, (O) Objectivity, (S) Subjectivity, and (P) Practices. Consequently, our structure coordinate system embedded in informatics is sometimes called the OSP system. The objectivity axis has three features, called pattern, chaos and transformation. It is noted that the Wiener formulation cybernetics start with a basis consisting of the objectivity axis. Also, some formal definitions of information in statistical mechanics and in statistical inference are based on the objectivity axis. For the general formulation of information we cannot confine ourselves to the objectivity axis, but we have to proceed to two other axes, called subjectivity and practices, even in connection with the structure feature of informatics.

The discrepancy between informatics and entropy theory becomes more evident when we consider the function feature of informatics. Here we have three basic function axes, called (C) Cognition, (D) Direction, and (E) Evaluation, which constitutes, as a whole, what we call the CDE function system of informatics. For instance, the cognition axis (C) consists of deduction, induction, and abduction in exact correspondence with the three fundamental logical principles. The direction axis (D) consists of three basically different subjective attitudes in appealing to the usage of information, namely, control, eizon and creation. To each of these, one of the three evaluation notions, efficiency, reliability or plasticity, corresponds.

Table 2 Three Coordinate Systems in Informative Logics

(III) / (I) & (II)		(III_1) Control		(III_2) Eizon		(III_3) Creation	
(II_3)	Evaluation	(γ_1)	Efficiency	(γ_2)	Reliability	(γ_3)	Plasticity
(II_2)	Direction	(β_1)	Control	(β_2)	Eizon	(β_3)	Creation
(II_1)	Cognition	(α_1)	Deduction	(α_2)	Induction	(α_3)	Abduction
(I_3)	Practices	(C_1)	Optimization	(C_2)	Stability	(C_3)	Learning
(I_2)	Subjectivity	(b_1)	Operation	(b_2)	Adaptation	(b_3)	Strategy
(I_1)	Objectivity	(a_1)	Pattern	(a_2)	Chaos	(a_3)	Transformation

What is the feasibility of the existence coordinate system? Is there any need for introducing a third coordinate system besides the structure and the function coordinate system? Any set of answers to these questions is deeply connected with our attitude towards informatics. From the traditional notion of orthodox scientific paradigm, the two features, structure and function, seem to be sufficient enough to provide a foundation on which any theoretical model can be established in the light of experimentation and observation. In the case of the new area called informatics, which should provide an interface connection between subjective and objective existences and which is concerned with the subjective attitude of MAN in real situations consisting of other subjective existences and/or environment, our answer should be 'yes' to the second question, and we should prepare ourselves for some positive answer to the first question. It was after long consideration that the supreme principle, which provides a standpoint in the third coordinate system, could be determined to be the notion of feasibility of existence axis in which control, eizon and creation are three different features which contribute to the feasibility of existence. It is to be noted that three components, control, eizon and creation, are used in the direction axis. In fact, the feasibility of existence is due to a direction scheme of the subjective existence.

3f. Among the three feasibility of existence coordinate features, control and eizon features are mainly implemented through CIVILIZATION, while the creation feature is much more concerned with CULTURE than with CIVILIZATION. This assertion is not far from the common understanding that technology, production, management and administration in industry, medical care and economics belong to the area to be approached in CIVILIZATION, while religion, art and pure science belong to the area to be discussed in CULTURE. In fact, our discussion appealing to a certain set of keywords may be recognized to give a more exact formulation of the present common sense.

Table 2 shows the three coordinate systems with (I) structure, (II) function and (III) feasibility of existence subspaces, cited here from Kitagawa (2). There is some modification of the location for the convenience of showing some relationship between informatics and semiology, which is illustrated by the preceding Figure 1, (a), (b), (c) and (d).

4. Symbolic Gestalt in Culture Viewed from Cultural Semiology

Some contemporary thinkers and opinion leaders have pointed out some remarkable tendencies which will lead to a cultural revolution in connection with the present information civilization. There are several schools of philosophers and humanists who have discussed the tendencies from the standpoint of cultural semiology. It is the purpose of this paper to integrate several different approaches in cultural semiology to reach a powerful and efficient solution. The basic idea of our integration is to endeavour to formulate a cultural semiology which can work together with the information which is crucial for our analysis of the present information civilization.

4a. Informatics has the following characteristic features: (i) It is suited to describe the present information CIVILIZATION; (ii) It works on the basis of structure and function to coordinate systems; (iii) It is concerned mostly with control and eizon features. Semiology has the following characteristic features: (i) It is suited to discuss a formation of coming CULTURE; (ii) It works basically with the interest in feasibility of existence coordinate systems; (iii) It is concerned ultimately with the creation feature.

4b. A formulation of semiology consists of three components: (1) semiological engines; (2) semiological processing procedures; (3) the cultural ecosphere. Semiological engines (1) are expected to work according to (2) semiological processing procedures to be applied to the (3) cultural ecosphere.

4c. Cultural engines are specified with respect to objectivization, subjectivization, and practices, each of which has its respective key concepts as follows:

(O) Objectivization: Cosmos - Chaos - Transformation

(S) Subjectivization: Relativization - Symbolization - Interpretation

(P) Practices: Ceremony - Festival - Performance

Remark 1.

Objectivization corresponds to the famous "triple" proposed by Yamaguchi (1) provided that transformation is realized as sacrifice making. It is evident that two sets of verbal expressions for objectivization are coincidental between informatics and semiology.

Remark 2.

Subjectivization in semiology corresponds to the cognition feature in informatics, as can be observed from the correspondence; (i) deduction through tree construction vs. relativization in network; (ii) induction vs. symbolization; (iii) abduction vs. interpretation.

Remark 3.

Practices in semiology correspond to the direction feature of the information function in informatics, as can be observed from the component correspondence; (i) ceremony is formulated and well-controlled in its proceedings, (ii) festival is adaptive and reliable to happening and disturbance; (iii) performance in drama is wholly designed, but not formulated as in (i) of Remark 2.

4d. There are three typical semiological processing procedures:

(i) Operating procedure

In this procedure the text is a raw material existence which is expressed in a sequence of symbols and is an operand to which symbolization and metaphorization, as operators, are applied so that the text has an interpretation as its output.

(ii) Abduction procedure

In this procedure the text can be deformed through a differentiation process which is applied to some local part of the sequence of symbols and which leads to a formation of an aggregate of virtual texts. These lead to deconstruction as a basis of abduction, that is, a formation of hypothesis.

(iii) Critique process

It is one of the basic roles of the semiological processes to give a critique of various existing civilization institutions and cultural enterprises. Semiological analysis, which appeals to (i) the operating procedure and to the (ii) abduction procedure by introducing a set of new hypothetical symbols with their syntax and semantics, forms a critique process.

4e. Semiological ecosphere

This consists of not only cultural contrivances associated with human social and private lives ranging over daily life performances, arts, religion and pure sciences, but also of semiological representations of various civilization mechanisms associated with civilization institutes, belonging to human social activity fields, covering education, medical care, industry, management, economics and administration and so on, all of which can be obtained as translations by the semiological processing procedures enunciated in 4d.

4f. Semiological structure

A semiological structure can be expected to be formulated in the coming years by means of the semantics of universal mathematics. This will be organized as an integrated field of (a) new mathematical science fields, covering (i) information, (ii) biology, (iii) society, in sharp contrast to the physical sciences and their application fields. It is also organized as part of (b) some recently established mathematical fields, such as category, chaos and catastrophe, where the notions of energy and entropy form a background of crucial importance, explicitly and implicitly.

4g. It is important to have a clear understanding of the relationship between the information approach to civilization and the semiology approach to culture. There are, in fact, three aspects to the relationship between these two science domains; (i) confrontation, (ii) continuation, and (iii) correspondence. The continuation (ii) is realized by the existence of two bridges, through which one can move from either domain to the other. In fact, one bridge belongs to the feasibility of existence subspace, while the other bridge belongs to the mathematical methodology area in which both informatics and semiology have their foundation.

4h. Let us turn back to the title of this section. The reason that we use the terminology 'symbolic gestalt' instead of 'semiological gestalt' comes from the fact that we are mostly concerned with CULTURE and not LANGUAGE, as we have shown in the preceding paragraphs 4a. - 4f. It also has to do with our problem setting, covering NATURE in biological gestalt and CIVILIZATION in mechanical gestalt. Furthermore, we are ahead of the cultural revolution which requires that our way of thinking should not be restricted to structuralism, with which authentic semiology is currently too much associated. (see Asada (1), Maruyama (1)). In short, in discussing the cultural revolution, we rely upon the development of cultural semiology and symbolic anthropology, both of which are essentially concerned with symbolic gestalt. It should be noted that cultural semiology is currently one of the central topics discussed by Japanese philosophers and humanists. The present author owes much to the original contributions of Asada (1), Maruyama (1), and Yamazaki (1). Nevertheless, a representation of semiology, given in the correspondence with informatics, is entirely the work of the present author, who has been working with the foundation of informatics. This can be seen in References Kitagawa (1) ∿ (15).

5. Five viewpoints and their implications for analysis and promotion in man - machine relationships

We can best discuss the subject of this section by providing a summary of the preceding four sections.

5.1 Five viewpoints for analysis

There are two coordinations that give the content of these five viewpoints. Coordination (A) comes from the logic of informatics and its modified generalisation to that of semiology: (i) structure (I) and function (II) in the two viewpoints, 1 and 2; (ii) two subspaces of the feasibility of existence, (III_1) control and (III_2) eizon in the viewpoint 4; (iii) creation subspace in the feasibility of existence in the viewpoint 5; (iv) localization and globalization in the viewpoint 3.

The other coordination (B) is concerned with gestalt formulations, biological, mechanical and symbolic. We appeal to the product of these two coordinations (A) and (B), which implies that each of the five viewpoints always refers to these three gestalts.

Viewpoint 1. (Cognition)

The notion of 'savoir' is introduced to cover cognition features in the three gestalts. There is a common understanding in comtemporary thought to the effect that cognition should not be confined to a crystallization of knowledge in the present paradigm of science. Some philosophers, anthropologists and scientists have proposed a movement which can be called a "savoir revolution", which emphasizes the need of introducing and developing various savoir types in our culture revolution.

Our own proposals in this connection consist of two assertions. In the first place, various types of different savoir should be classified from the three gestalts. More specifically, we have the following allocations; (i) wild savoir in biological gestalt; (ii) KIPS in mechanical gestalt; (iii) drama savoir in symbolic gestalt. Secondly, the crucial idea in developing various savoir types in a more systematic and concrete way is to appeal to a generalisation of KIPS which we allocate to mechanical gestalt, both of the biological and symbolic gestalts. Kitagawa (3) and (14) have discussed some aspects of biological gestalt. With regard to the savoir revolution, we refer to the recent contribution of Kitagawa (15).

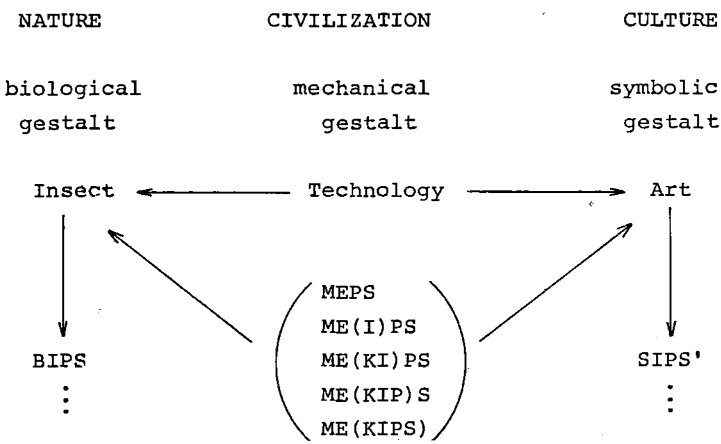
Viewpoint 2. (Direction x Evaluation)

From our point of view we can formulate that insects, technology and art correspond respectively to each of the biological, mechanical and symbolical gestalts. Here again the technology in the mechanical gestalt plays the leading role in interpretating the other two gestalts. In the present situation the technology in some industries has reached the stage ME(KIPS), as we have explained in Section 3. This suggests the need and the usefulness of the notion of the biological information processing system BIPS and of the symbolic information processing system SIPS, which can be derived from KIPS by degeneration, modification and metaphorization applied to the KIPS components. Our second viewpoint can be explained in the following Figure 2.

Viewpoint 3. (Communication)

Here we are concerned with temporal topos and time-space, both in locality and in globality with mutual communication chords. (1) In the biological gestalt a local temporal topos is given with respect to its body enviromental world associated with each individual biological existence. Biological existences can only exist under an ecosphere in which global temporal topos and global time-space relation are associated with communication through sense organization of each individual biological existence. They must also be associated with communication in a broad sense in time through genetics and in space through ecology. (2) In the mechanical gestalt, the typical situation is provided by the notion of KIPS and GREKIPS. To each individual KIPS there exists either a temporary topos or a space-time constitution. These KIPS's constitute a GREKIPS. Within each individual GREKIPS a set of communication relationships can be

Fig. 2 Insect, Technology and Art



expressed in terms of those relationships among the component representations of KIPS. Detailed discussions of KIPS and GREKIPS can be found in Kitagawa (9), (10), (11) and (13). (3) In a symbolic gestalt, temporary topos and space-time have a specific feature because here the triple components, cosmology-symbolism-performance, give us a specific notion of space or topos image, where the inside world, called cosmos, the boundary area, and the outside world, called chaos, are existing. As far as ceremony, festival and drama are concerned, temporary topos are rather common. It is noted that even artificial existences and texts may not be necessarily considered in a space-time constitution, because of the authentic viewpoint of symbolic gestalt. In this connection we refer to Kitagawa (14).

Viewpoint 4. (Control and eizon)

The control and eizon features of existing civilized institutions and cultured constructs should be analysed and evaluated with reference to the three gestalts, biological, mechanical and symbolic, on the basis of systematic discussions from the three viewpoints: (1) cognition, (2) direction and evaluation, and (3) communication, each already explained.

By civilized institutions we imply, for instance, schools for education, hospitals for medical care, factories for production, governments and parliaments for politics, newspapers, broadcasting systems, televisions for the mass media, markets for the economy and so on. It is characteristic of these civilized institutions to have a certain mission by which they are designed for their large part.

On the other hand, cultural constructs are deeply concerned with some cultured values by which their existences are signified, as can be observed in architecture. Moreover, they are sometimes heavily subject to metabolic changes and chaotic disturbances as may be verified in urban areas as cultured topos.

This viewpoint refers ultimately to an analysis of the MAN-MACHINE relationship in our present era through civilized institutions and cultural constructs.

Viewpoint 5. (Creation)

A creative approach in forming a new image of civilized institutions and cultural constructs should be promoted on the basis of the analysis described in the preceding viewpoint 4. There are many problems related to the MAN-MACHINE relationship to be solved in our present civilization and culture. For instance, the problems of human engineering concerning OA labour situations can be seen as a signal to warn us of the future of highly information oriented societies. Unemployment problems in connection with the adaptation of FA and OA, should be deeply and broadly considered. These problems are discussed in Japanese circles, as can be observed in Akagi (1), Inose (1), Kenmochi (1), Nippon Hyōron Sha(ed) (1). In order to have a set of powerful and efficient solutions to these problems, we urge two specific approaches, that is, one approach from the viewpoint 4 and the other approach from the viewpoint 5. Regarding the latter approach, our considerations should cover the three gestalts, biological, mechanical and symbolic. In a mechanical gestalt approach, we have to seek the vast range of fields for the applications of the recent advancements in information processing technology in computation, communication and controls, so that we can build up creative pictures of the future. Such a mechanical gestalt approach should not stand alone, but should always accompany the other two ones, that is, the biological and symbolic gestalt approaches, to be critical enough for the present civilization and culture.

5.2 Implications of the five viewpoints

(1) Viewpoint 1 refers to the science revolution in the name of the new savoir movement.

(2) Viewpoint 2 emphasizes an integration of the three gestalt approaches on the basis of an extension of logics of informatics with reference to the present state of technological advancement.

(3) Viewpoint 3 refers to an approach on how to solve the problem of establishing conflicts and harmony of individualism and collectivism. Our emphasis on both local and global subspaces in the present technology of distributed network processing makes it possible to realize both individual creativity as well as the participation principle in our future society.

(4) Viewpoint 4 suggests a new phase of consumption and service features in the future in contrast to the current emphasis of productive and administrative aspects.

(5) Viewpoint 5 indicates the need for borad Gedanken experiments to build up an image of a culture and a civilization revolution which is compatible with the high-technological innovation in the future and with the eizon features of human beings.

REFERENCES

Akagi, A. (1) Microcomputer & Robot = Shock (in Japanese), Iwanami Booklet, No. 11, Iwanami Shoten, 1982.

Asada, A. (1) Structure and Force-Beyond Semiology, (in Japanese), Keiso Shobo, 1983.

Asashi Newspaper(ed.) (1) L'Avenir de la Culture (in Japanese), Sommet Culturel franco-japonais, 1983.

Imai, K. (1) Industrial Society of Japan - Process of Evolution and Innovation (in Japanese), Chikuma Shobo, 1983.

Imai, K. (2) Information Network Societies (in Japanese), Iwanami Shinsho, Iwanami Shoten, 1984.

Inose, H. (editorial supervision) (1) Do Microcomputers Involve Unemployment? - Effects of Microelectronics on Employment (in Japanese), Computer Age Col., 1981.

Iwanami Shoten Editorial Division(ed.) (1) The Crisis of the Present Civilization and the Contemporary Spirit (in Japanese), The International Forum of the 70 Anniversary of Iwanami Shoten, Iwanami Shoten, 1984.

Kato, S., Kinoshita, J., Maruyama, M. and Takeda, K. (1) Hidden Form of Japanese Culture (in Japanese), Iwanami Shoten, 1984.

Kenmochi, K. (1) Microcomputer Revolution and Future of Labour (in Japanese), Nippon Shronsha, 1983.

Kitagawa, T. (1) Contribution to the Methodology of Futurology, Research Institute of Fundamental Information Science, Kyushu Univer., Research Report No. 6, 1970. 1-25.

Kitagawa, T. (2) Three Coordinate Systems for Information Science Approaches, Information Sciences, 5, 1973, 1957-1969.

Kitagawa, T. (3) Biorobots for Simulation Studies of Learning and Intelligent Controls, Learning Systems and Intelligent Robots, (ed. by K.S. Fu and J.T. Tou), Plenum Publ. Corp., 1974, 33-46.

Kitagawa, T. (4) Fuzziness in Informative Logics, Fuzzy Sets and their Applications to Cognitive and Decision Processes, (Ed. by Zadeh, Fu, Tanaka and Shimura), 1975, 97-124.

Kitagawa, T. (5) Mathematical Approaches in Theoretical Cybernetics and Informatics, Proc. of the 8th International Congress on Cybernetics, 1976, 267-284.

Kitagawa, T. (6) A Theoretical Formulation of Information Network System and its Implication to Social Intelligence, Intern. Institute for Advanced Study of Social Information Science, Research Report No. 1, 1978, 1-21.

Kitagawa, T. (7) Generalized Artificial Grammars and their Implications to Knowledge Engineering Approaches, Intern. Institute for Advanced Study of Social Information Science Research Report No. 6, 1979, 1-99.

Kitagawa, T. (8) Some Methodological Consideration on Research Automation (1) Objectivization and Operatorization, Research Institute of Fundamental Information Science, Kyushu Univ., Research Report No. 96, 1980, 1-29.

Kitagawa, T. (9) Some Theory of Generalized Relational Informational Ecosphere (in Japanese), Japanese Research Report of International Institute for Advanced Study of Social Information Science No. 1, 1981, 1-42.

Kitagawa, T. (10) Knowledge Engineering Approaches to Generalized Relational Ecospheres of Knowledge Information Processing Systems and their Implications to Creative Societies, International Institute for Advanced Study of Social Information Science, Research Report No. 29, 1982, 1-38 with R1-R7.

Kitagawa, T. (11) Model and Architecture of Distributed Data Base Sharing Systems Associated with Knowledge-Information Processing Systems, Distributed Data Sharing Systems, ed. by Van de Riet and W. Litwin, Proc. of the 2nd Seminar on Distributed Data Sharing Systems, June, 1981, North-Holland, 1982, 295-307.

Kitagawa, T. (12) The Forty Years of Statistical Science in Japan - My Retrospect and Prospect, Bull, Informatics and Cybernetics, 21, 1983, 1-21.

Kitagawa, T. (13) Informational Approaches to Knowledge Information Processing Systems (in Japanese), Japanese Research Report of International Institute for Advanced Study of Social Information Science, No. , 1983, 1-55.

Kitagawa, T. (14) Mathematical Formulation of Generalized Relational Ecosphere of Local Time-Spaces, Bull, Informatics and Cybernetics, 21, 1984, 1-18.

Kitagawa, T. (15) Science Revolution and Methodological Proposals in Creative Dimensions (in Japanese), Journal of Japan Creativity Society No. 2, Pattern of Creation, 1984, 14-26.

Maruyama, K. (1) Factitiousism of Culture (in Japanese), Keiso Shobo, 1984.

Masuda, Y. and Masamura, L. (1) How Does Highly Informalized Society Change Man? (in Japanese), TBS Britanica, 1984.

Naisbitt, J. (1) Megatrends - The New Directions Transforming our Lives, Warner Books Co., 1982.

Nakamura, Y. (1) Meditations on Witch Rangda - What is the Dramatic Savoir? (in Japanese), Iwanami Shoten, 1983.

NHK(ed.) (1) Interpretation of the Present Civilization (in Japanese) Nippon Hoso Shippan Kyokai, 1983.

Nippon Hyōron Sha(ed.) (1) ME Revolution and Labour Union (in Japanese), Special Issue No. 4 on Labour Problem, Keizei Hyōron, 1983.

Tachi, R.(ed.) (1) Softnomics (in Japanese), Nippon Keizai Shin Bun Sha, 1983.

Takemura, K. & Research Group on Megatrends (1) Megatrends of Japan (in Japanese), Taiyo Kikaku Shippan, 1983.

Takeuchi, Y. (1) Theory of Culture - A Way to Cultural Semiology (in Japanese) Iwanami Shoten, 1981.

Toffler, A. (1) The Third Wave, W. Morrow & Co., 1980.

Toffler, A. (1) Previews & Premises, Curtis Brow, 1983.

Umezao, T. and Ishige, N.(ed.) (1) Civilization Science on Modern Japan (in Japanese), Chuō Kōron Sha, 1984.

Wise, K.D., Chen K. and Yokely, R.E. (1) Microcomputers: A Technology Forecast and Assessment to Year 2000, John Wiley & Sons, Inc., 1980.

Yamazaki, M. (1) Birth of Soft Individualism (in Japanese), Chuō Kōron Sha, 1983.

Yamaguchi, M. (1) Culture and its Bivalency (in Japanese), Iwanami Shoten, 1980.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

MOLECULAR COMPUTERS ?

J.G. Santesmases

In the last few years, scientists in different countries have been considering seriously the possibility of building up computing devices in which the organic molecules would replace the silicon transistors in the computer technology. That is, it's a question of replacing the silicon chips by the "biochips", where the organic molecules would be integrated.

The computers based on carbon, should have great advantages over the present-day computers based on silicon. On the one hand, new procedures for information processing together with new methods to approach the problem of pattern recognition and artificial vision would be obtained. On the other hand, the density of computing elements could be much greater than those of the silicon chips which represent, without doubt, a technological superiority.

We must bear in mind that the density of the integrated elements on the silicon chips cannot be increased indefinitely. A physical limit of miniaturisation would be reached which cannot be exceeded. In fact, the density of these chips is increasing continously, and it almost doubles every year. At the present time, a density of nearly 500.000 transistors integrated into a chip of some square millimiters of size has been reached. The spacing between elements is of the order of 1,5 microns. It's a question of using gallium arsenide and employing lithographic methods which would permit reading higher densities of the order of 0,2 microns. A greater miniaturisation would run into a great difficulty because a "tunnel" effect between close elements could be produced which would cause a loss of information. Besides this limitation, we must take into account that the chips overheat when the elements density increases greatly. This is a great inconvenience of the silicon computers.

This physical limit to the chip miniaturisation has led some people to think if instead of continuing the present way of miniaturisation, it would be better to begin with the molecules themselves and build up computing elements based on these molecules.

By means of such "biochips" it would be possible, in principle, to obtain circuit elements much smaller in size than those obtained by the present silicon chips. Another important advantage of these molecular devices is the small quantity of heat that their elements would dissipate. This would allow three-dimensional structures which would contribute to increase their potential density.

It has been observed that some organic molecules may exist in two or more electronic stable/states, which depends on the charge distribution inside of the molecules. Thus, the hemiquinones present two states which can be switched by application of a voltage across the molecules. In this way, logic circuits can be obtained which function as Boolean operators.

The possibility of using organic molecules was first discovered by Aviran and Seidan of IBM's Thomas J. Watson Research Center in New York, in 1974. They patented a design of a molecular device which would function as a diode.

Another interesting way of research is due to Carter who proposes a molecular system using certain conducting polymers which consist of zig-zag carbon chains with alternating single and double bonds. Carter postulates the existence of "solitons", wave-like perturbations that are propagated through the polymer and change its electronic configuration producing a change in the placement of the single and double bands along the chain. Although the organic molecules are theoretically suitable for building up switching devices, there are, unfortunately, some technical problems which must be overcome. It seems that the synthesis of the complex structures using conventional procedures does not give good results. Genetic engineering must be employed in order to program suitable microorganisms for producing the desired structures.

Up to now we have considered digital biochips in which organic molecules should play the role of binary switches, similar to the elements of a silicon chip. But there also exists another and different method of research, that of the analog biochips which would employ proteines or enzymes as computing elements. It seems that the analog operation of these biochips is much better than the digital, for performing dynamic tasks such as process control and pattern recognition.

The protein molecules could be used for building up blocks of a biochip. The property of protein molecules for self assembling in the presence of other molecules such as DNA (deoxyribonucleic acid) permits through the application of genetic engineering, the production of bacterias or other organisms that could build up the biochip using their DNA code as an instruction set.

The research into computing molecular devices requires an interdisciplinary education. These researchers are grouped in the following areas: (a) Molecular biologists who research into the building up of biological blocks for the fabrication of computing devices. (b) Chemists who work on synthesizing chemical structures performing the same functions as those of the circuits and switches of conventional devices. (c) Specialists on computers in order to develop new architectures which might allow simulating the processing of biological information. (d) Physicists and electronic engineers who work on the problems of signal processing and input and output at a molecular scale.

No prototype of a biochip has been built up yet, although there have been several attempts, following different methods and trying to prove its possibility by means of experiments that achieved the chemical bistability or the self-assembly of three-dimensional arrays of proteins.

It is most likely that the first basic prototypes will be developed at the universities and research institutions. On the basis of these prototypes, big companies and laboratories will carry out the necessary further development in order to turn these prototypes into devices competing with microelectronic technology that might then exist, and applying them to artificial vision or Robots. To achieve a biological computer is a task that might demand more time and it could possibly be achieved at the beginning of the next century. Perhaps the biological Computer could arrive sooner than predicted. In fact, we know from experience that new technologies sometimes come before we expect them. When electronic computers appeared, nobody could imagine their nearly incredible development.

REFERENCES

Aviran, A. and M.A. Ratner, Chem. Phys. Letters, 29, 277- (1974).

Aviran, A., P.E. Seiden, and M.A. Ratner - Theoretical and Experimental Studies of Hemiquinones In: Molecular Electronics Devices, Marcel Dekker, Inc., New York (1982).

Barker, J.R., The Potential of the Biochip. Can. Electron. Eng. (Canada) 25, 26-32 (1981).

Barret, T.W., Energy Transfer and Molecular Switching, The Nerve Action Potential, J. Theoret. Biol. 92, 185-207 (1981).

Bruns, W. and P. Bansal, Molecular Dynamics Study of a Single Polymer Chain Solution J. Chem. Phys. 74, 2064-2072 (1981).

Bussert, J., Are Biochips the New Wave?, Mil.Electron. Countermeas. 8, 27-30 (1982).

Carter, F.L. (ed.), Molecular Electronic Devices, Marcel Dekker, Inc., New York (1982).

Carter, F.L., The Chemistry in Future Molecular Computers, In: S.R. Heller and Potenzone, Jr. (eds.), Computer Applications in Chemistry, Elsevier Science Publishers, Amsterdam, pp. 225-261 (1983).

Carter, F.L., The Molecular Device Computer: Point of Departure for Large Scale Cellular Automata, Physica, 10D, 175-184 (1984).

Clerman, R.J., Combining Biology and Electronics, Data Processing, 26, 25-30 (1984).

Conrad, M., Complementary Molecular Models of Learning and Memory, Biosystems, 8 119-138 (1976).

Conrad, M., Evolutionary Learning Circuits, J. Theoret. Biol. 46, 167-188 (1979).

Conrad, M., Molecular Computing as a link between Biological and Physical Theory, J. Theoret. Biol. 98, 239-252 (1982).

Conrad, M., Design Principles for a Molecular Computer. In: Chemically-based Computer Designs, F.E. Yates (Conference Organizer) Crump Institute for Medical Engineering, University of California, Los Angeles (1984).

Conrad, M., and K.C. Kirby, The Enzymatic Neuron as a Reaction-Diffusion Network of Cyclic Nucleotides, Department of Computer Science, Wayne State University, Detroit, MI 48202 (1983).

Hameroff, S.R. and R.C. Walt, Microtubules Biological Microprocessors? In: Molecular Electronic Devices, Marcel Dekker, Inc. New York (1982).

Hartmann, T., Molecular Computers, Pop Comput. (USA), 3, 65-70 (1984).

McAlear, J.H. and J.M. Wehrung. Biotechnical Electron Devices. In: Molecular Electronic Devices, Marcel Dekker, Inc., New York (1982).

Tucker, J.B. Biochips: Can Molecules Compute?, High Technology, 4, 36-47 (1984).

REFLECTIONS AND REMINISCENCES

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

IFIP - SOME AUSTRALIAN REFLECTIONS

John M. Bennett
Basser Department of Computer Science
University of Sydney
Sydney, N.S.W.
Australia

INTRODUCTION

First, a note of personal explanation. My association with IFIP spans the period 1961 (when negotiations to admit the Australian National Committee on Computation and Automation Control (ANCCAC) began) to 1980, when I ceased to be the General Assembly representative of the present member society, the Australian Computer Society (ACS). Despite appearances, this span does not put me among the longest serving representatives - as I was not the ANCCAC representative from 1963 to 1970. However, during that period, the official representative was unable to attend General Assembly meetings, and I was his proxy on occasions when the meetings were held at Congress times.

After 1971, when ACS took over the role of being the Australian member-organisation from ANCCAC, Australian participation became more active. Australian national representatives were nominated for various TCs, and, as ACS representative, I was able to attend all GA meetings, served on a number of IFIP committees and was for a time Trustee (1974-5 and 1978-80) and Vice President (1975-78). So although I have not had a silver (twenty five year) association with IFIP, I can reasonably claim a two decade association (I believe it is called a china one).

Perhaps the best approach to giving an overall view of the interaction of IFIP with the Australian scene is to begin by giving a sketch of the development of computing in Australia and the growth of the Australian computing profession.

THE ORIGINS OF AUSTRALIAN COMPUTING

The first computer to become operative in Australia, CSIRAC, was a memory delay line serial machine designed and constructed by T. Pearcey and M. Beard in the Radiophysics Division of the Commonwealth Scientific and Industrial Organisation. It began operating in 1952-3, and was presented by CSIRO to the University of Melbourne in the first half of 1956.

The first industrially constructed computer was SILLIAC. The individual modules of this machine were made in Sydney by STC under contract to the University of Sydney School of Physics. This machine, SILLIAC, was built by B.E. Swire, following the design of the University of Illinois ILLIAC I. It began operating in July 1956, and a magnetic tape unit designed by Swire was added later.

An idea of the growth of interest in computers in those early days may be gained from the attendance at some of the early conferences. The first of these was organised in 1951 by CSIRO and the University of Sydney - 13 papers were accepted and 160 delegates attended. The second was organised in Adelaide in 1957 by the Australian Department of Supply; 50 papers were presented, and about 200 delegates attended. The third, with 150 papers, was organised in Sydney in 1960 by ANCCAC, and was attended by 650 delegates. (For comparison the 1974 national conference organised by the Australian Computer Society in Sydney was attended by over 1500 delegates.)

The computer industry in Australia now has a turnover in excess of $A1600 million, the value of imported equipment being over $A400 million. In terms of the value of installed computers per head of population, it is not among the leaders. It has a thriving software industry and there is a small (but fast growing) computer manufacturing industry. The potential for growth of the computer manufacturing industry may be gauged from its ratio of imports to exports of computer related hardware. In 1980-81, this was over 40:1 the highest ratio among the OECD countries, the next ranking country being Spain, with a ratio of 2.8:1.

ANCCAC

The Australian National Committee on Computation and Automation Control (ANCCAC) was set up in 1959 for the express purpose of providing a mechanism for holding conferences on computer associated topics at regular intervals. Initially, the professional societies which formed ANCCAC were the Statistical Society of New South Wales, the Institute of Physics, the Australian Institute of Management, the Royal Australian Chemical Institute, the Australian Society of Accountants and the Australian Institution of Cost Accountants. The Institution of Engineers, Australia, though prevented by its charter from joining ANCCAC, provided the Secretariat. Later, the Australian Mathematical Society, the Chartered Institute of Secretaries and the newly formed Victorian Computer Society joined the Council.

Under the auspices of ANCCAC, computer conferences were organised at three yearly intervals starting in 1960. When the Australian Computer Society was formed in 1966, that Society organised conferences on behalf of ANCCAC until the official winding up of ANCCAC in 1970. After that year the conference series was continued by ACS: conferences became biennial after 1972 and annual after 1982.

ANCCAC was admitted to IFIP (or IFIPS as it was then) by mistake. As its current Chairman, I initiated enquiries in 1960 about the possibility of joining IFIPS, and forwarded details of ANCCAC as requested by the IFIPS Secretariat. This action was taken to be an application for admission, and a letter dated 27 April 1961 from Isaac Auerbach, then IFIPS President, informed ANCCAC that its application had been successful and that it had been admitted to IFIPS as the sixteenth member society. At the time, mainly because of the practical problems of obtaining agreement from the member societies of ANCCAC to underwrite the membership fee of $250 and the small surplus from the first conference, ANCCAC was reluctant to join IFIPS until it had been established on a firmer financial basis. However, faced with a fait accompli, the Committee capitulated, and became the Australian IFIPS Member with effect from the beginning of 1962. As ANCCAC Chairman, I became the IFIPS representative and attended the 1962 General Assembly in Munich.

In 1963, the centre of activity of ANCCAC was moved from Sydney to Melbourne and I was succeeded as Chairman by Lawrence Cohn, who also became the IFIPS representative. However, he was unable to attend General Assembly meetings, and I deputised for him at those meetings which were held at the same time as Congresses.

THE AUSTRALIAN COMPUTER SOCIETY

The Australian Computer Society (ACS) came into existence on 1 January 1966 after formal ratification of its Constitution and By-laws by the five founding State computing societies which amalgamated to make form ACS. These societies, with their dates of formation, were the South Australian Computer Society (November 1960), the Victorian Computer Society (April 1961), The Queensland Computer Society (February 1962), the New South Wales Computer Society (August 1963) and the Canberra Computer Society (March 1965). The Western Australian Computer Society (founded in October 1966) became part of ACS on 1 January 1967. All of these Societies became Branches of the Society, and additional Branches were later set up in Tasmania (1975) and the Northern Territory (1983).

Each Branch has its own committee, and the national affairs of the Society are managed by the ACS Council. The Society has a permanent secretariat in Sydney.

In addition to various Branch activities, the Society, as described above, organises annual conferences, conducts a professional development programme and has a number of awards and prizes. It publishes the Australian Computer Journal and the Australian Computer Bulletin. The Journal is a quarterly publication containing original papers, survey articles of high quality and reviews. The Bulletin is published monthly and contains short papers, letters, notices and announcements. It is primarily a vehicle for keeping members informed on ACS matters and for providing communication between members. In addition, several Branches have their own bulletins or newsletters.

Membership grades and conditions for admission are similar to those which apply with the British Computer Society. The Professional Membership grades, with current members shown bracketed, consist of Honorary Life Members (8), Fellows (89), Members (7058) and Associates (2021). Non-professional membership grades are Students (581), Affiliates (1756) and Corresponding Institutions (286).

IFIP REPRESENTATION AND ACTIVITIES

The details of ANCCAC and ACS representation on the General Assembly up to 1980 have been discussed. Since 1980, ACS has been represented by A.W. Goldsworthy, who is currently an IFIP Vice President.

Australia has been represented on IFIP Technical Committees and SIGs as follows:

. TC2 (Programming): P.C. Poole (from 1976),

. TC3 (Education): J.M. Bennett (1964-1973); F. Hirst (1973-1981); I.G. Pirie (from 1981),

. TC4 and IMIA (Medical data processing): D. Race (1977), J. Leigh (1978-1982); D. Bennett (from 1982),

. TC5 (Computer applications): G.A. Rose (1971-1977); J. Reinfelds (from 1977),

. TC6 (Data communications): A. Coulter (from 1972),

. TC7 (Systems modelling and optimisation): R.W. Rutledge (1972-1982); I.G. Moore (from 1982),

. TC8 (Information systems): C.H.P. Brooks (from 1974),

. TC9 (Computers and society): A.W. Goldsworthy (from 1974),

. TC10 (Digital systems design): D. Wong (from 1972),

. TC11 (Security and protection in information systems): W.J. Caelli (from 1984), and

. IAG (Administrative data processing - disbanded 1980): B.H. Crook (1972-1977; K. Arter (1977-1980), I.G. Pirie (1980)

Several Technical Committee events have been held in Australia, viz.:

WG2.4: In 1982, after a WG2.4 meeting in Melbourne, systems implementation languages workshops with a attendance of about 100 were held in Melbourne and Sydney.

TC6: In 1976 and 1981, TC6 held symposia on communications technology and practice (COMTAP) in Sydney. Each of these symposia had an attendance of about 400.

TC9: In 1984, a joint (with ACS) international symposium in information systems was held in Sydney, with an attendance of 240.

One non-IFIP activity which deserves special mention is Australia's Information Technology Week, initiated by the TC9 representative (and IFIP Vice President) Ashley Goldsworthy. This event, which took place first in 1979, has the support of Federal and State governments and of a member of organisations in the private sector. In 1984, it was extended to become Information Technology Month.

The event, which is similar to one held in Japan, is marked by a wide range of activities. These activities include the publication of a volume consisting of a collection of papers by authors of diverse backgrounds and interests. They are designed to enhance the Australian community's understanding of information technology, its possible uses and benefits and its attendant disadvantages.

IFIP CONGRESS '80

In 1972, Australia made an unsuccessful bid for the 1977 Congress. In 1974, it became a contender for the 1980 Congress, the other contender being Japan. Prior to the General Assembly meeting at which the venue decision was to be made, Heinz Zemanek, then IFIP President, attended the ACS national conference in Sydney, and from an informal conversation with me at that time about possible reactions within ACS if our bid were to be unsuccessful, the possibility of a split Congress emerged. It was clear to us that normal attendances at national conferences in both countries was such that the financial success of a split Congress would be guaranteed. The financial viability of a Congress held either in Japan or in Australia was not so certain.

Further discussions showed that the possibility was quite practicable. The Council meeting could be held prior to the first half of the Congress and the General Assembly prior to the second half. In the event, the schedule arrived at was as follows:

Technical sessions:	6- 9 October (Tokyo)
	14-17 October (Melbourne)

A summary of the attendances at the two venues is shown below.

Congress venues attended	From Japan	From Australia	From elsewhere
Japan only	1485	-	398
Australia only	-	1173	197
Japan and Australia	57	49	306

The total attendance of 3665 should be compared with a total attendance at the 1974 IFIP Congress in Stockholm of 3366 (including 1290 from the Nordic countries, of whom 834 came from Sweden) and at the 1977 IFIP Congress in Toronto of 2682 (including 1837 from North America, of whom 1188 came from Canada). If the 1980 Congress had been held entirely in Australia, and all the "Japan only from elsewhere" delegates had gone to Australia, the attendance would have been 2180. If none of these delegates had come to Australia, the figure would have been only 1782. (For comparison, the number of delegates at the 1974 ACS Conference in Sydney was 1542.)

So it seems that tne numbers argument for the financial success of a split Congress was well based.

SEARCC

During the 1974 Congress in Stockholm, a chance conversation between Professor Narasimhan (the representative of the Computer Society of India) and myself lead eventually to the founding of the South East Asian Computer Confederation (SEARCC). We discussed the possibility of setting up a mechanism for holding regular regional conferences in south-east Asia; and, on my way back to Australia, I raised the matter with Robert Iau, who was then the President of Singapore Computing Society. As a result, Robert Iaú undertook to chair the Local Arrangements Committee, and F.C. Kohli, then President of Computer Society of India, chaired the Organising Committee, for the first South East Asian Regional Computer Conference, which was held in September 1976.

At that conference, six computer societies in the region (later joined by the Computer Society of India) agreed to form SEARCC (the South East Asia Regional Computer Confederation), which has since organised four biennial conferences. The six societies were: The Singapore Computer Society, the Hong Kong Computer Society, the Philippine Computer Society, the Indonesian Computer Society, the Malaysian Computer Society and the Computer Association of Thailand.

The existence of SEARCC led IFIP to make provision for regional membership. At the General Assembly meeting in Rome (1982), SEARCC was inducted as IFIP's first Regional Member.

ICCC 84

The International Council for Computer Communications (ICCC) was admitted to Affiliate Membership of IFIP in 1981. From the Australian point of view, this affiliation was important as Sydney was to become the venue for the 1984 Congress - the host organisations being Australian Telecom and the Overseas Telecommunications Commission.

The Conference was held in October/November and was attended by 982 delegates (379 from outside Australia). In addition to the invited papers, 141 papers were accepted for presentation from the 211 submitted. The infrastructure provided by ACS and local TC6 activities contributed substantially to the success of the conference.

With Trevor Pearcey, I undertook the task of co-editing the ICCC-80 proceedings. The participants edition was printed locally following the procedures laid down by North Holland and the final edition will be published by North Holland in the near future. I would like to record here my appreciation for North Holland's assistance in this task, and for their support of IFIP publications over the years. The effectiveness of the working relation which they have built up with IFIP has perhaps not been as widely appreciated as it deserves.

One final point about ICCC is that there are now five Australian ICCC Governors.

OTHER IFIP COMMITTEES

At various times, I have served on a number of IFIP committees, including the IFIP Committee for International Liaison (ICIL), the International Conference in Computer Applications in Developing Countries (ICCA) IFIP Liaison Committee, the Congress Guidelines Committee, the Regional Conference Policy Committee (as Chairman), the Review Committee for TC5, the Review Committee for TC6 (as Chairman) and SEARCC Liaison Committee (as Chairman). I have also served as Cognizant Vice President for TC2, TC6 and TC9.

The first two of these committees brought me into contact with the mechanism provided by FIACC for interfacing with bodies such as UNESCO. The other activities brought home to me the extent to which the meetings organised by its technical committees and its conferences and the publications which arise from them are seen by the computing community as a measure of IFIP's real worth. It is for this reason that I applauded the moves made in the late 70s to include TC Chairmen more in IFIP's policy making machinery.

OTHER AUSTRALIAN COMPUTER ORGANISATIONS

The Australian Computer Society caters for the community of Australian computer professionals. However, a number of societies serving members of the computer community with more sectional interests have been formed in recent years. These include the following:

. ASHA (Australian Software Houses Association),

. ACEMA (Australian Computer Equipment Manufacturers' Association),

. ACSA (Australian Computing Services Association),

. ACAD (The Association for Computer Aided Design) (in all States),

. CUA (The Computer Users Association),

. AISA (The Australian Institute of Systems Analysts),

. MEG (The Microcomputer Enthusiasts Group),

- AIIA (Australian Information Industry Association - until recently named ACESA - Australian Computer Equipment Suppliers Association), and
- ACSPA (Australian Computer Science Professors Association)

In addition to these formal organisations, there are two informal ones which reserve special mention. University computer science departments take it in turn to host an annual conference to which papers are contributed mainly by staff and research students - the 1984 conference was the Seventh Australian Computer Science Conference. And the colleges of advanced education hold an equivalent series with more emphasis on teaching.

COMPUTER EDUCATION

There are 17 computer science departments (or departments with equivalent titles) in universities and 22 in colleges of advanced education. Currently, these departments are graduating over 1200 computer science majors a year. Most of them now have restricted entry, and so this number is not likely to increase very rapidly. Courses are also offered by technical colleges and some private organisations such as the Control Data Institute. Another source of computer programmers and systems analysts is immigration. These specialists are an accepted immigration category, with a quota for 1984-85 of 550.

SOME THOUGHTS FOR THE FUTURE

There was a time when IFIP catered for most of the needs of the computing fraternity. True, there were some grumbles from users with accounting applications, who felt that most of IFIP activities were too rarified for them. At that time, a major justification for the IAG activity was that it was the only group within IFIP catering for this large group of users.

In recent years, a whole crop of specialised societies with international membership have sprung up - societies catering for special interest groups such as computer lawyers, computer linguists and the artificial intelligence community. Most of these have no formal association with IFIP, although the grade of Affiliate Membership has provided mechanism which has been successful in bringing some of these groups (IAPR, IASC, ICCC and EUROMICRO) into the fold. However, most of them do not have access to a forum for cross-fertilisation with other specialist groups such as is provided by IFIP Affiliate Membership. It seems that there is a strong case for ensuring that these groups are aware of the advantages which Affiliate Membership could provide.

A second point concerns the need to ensure that younger workers in the field are encouraged to attend IFIP-sponsored events, including congresses and major conferences. To this end, closed conferences should be avoided and there should be ample provision for submitted papers at major conferences. Closed meetings tend to restrict attendances to an "in" group - who all grow old together. Provision for submitted papers encourages the exchange of new ideas whereas a high proportion of invited papers inevitably repeat information already available in the literature. Moreover, as the provision of travel expenses for younger computer scientists often depends on having a paper accepted, a policy placing undue emphasis on invited papers inevitably reduces the number of younger attendees - the very group needed to guarantee continuing support for future conferences.

SOME PERSONAL REMARKS

I have found that IFIP does much more than provide a mechanism for the exchange for technical ideas. Contacts made through IFIP are the equivalent of an invisible college, a world-wide network, which has given me an initial point of entry to the computing community in any member country.

Moreover, through my IFIP activities, I have made a number of friends with whom I share common interests which go well beyond computer science. And special mention should be made of the generous hospitality of the countries which have hosted IFIP meetings in an atmosphere which, in a world beset with political stresses and strains, has been remarkably free from politics.

Long may IFIP prosper!

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

IFIP Reminiscences: The second decade

Professor A S Douglas, FBCS, FIMA

Professor Emeritus London School of Economics
ICCC Representative to IFIP
Chairman, Specialist Information Services Ltd
Southbank House, Black Prince Road
London SE1 7SJ, England

1. First Contacts

Others who were more deeply involved have described elsewhere the inception and formation of IFIP. Like most other 'professionals' at the time, I was aware of the events leading up to its formation and, indeed, attended the 1959 Paris meeting at UNESCO, when the idea was first made public. In 1960 I joined C-E-I-R (now SCICON) and was so busy with its affairs that I could not go to Munich in 1962, although several of my staff did. So my first IFIP Conference was in New York in 1965. I well remember being greeted there by the late Antonin Svoboda, who had recently emigrated from Czechoslovakia, and whom I had met last over lunch in Warsaw some two years earlier. At the time I was working for the I.L.O. on a project to instal a computer in Warsaw, and the Polish technician involved was Wladyslaw Turski, with whom I struck up a friendship that has lasted to this day, continuously renewed through our contacts within IFIP, in the development of which he has also played, since then, an important part.

My first involvement with IFIP affairs in a more official capacity began as a member of Council of the British Computer Society when negotiating the arrangements for the Edinburgh Conference in 1968. We regarded the IFIP team as very tough negotiators, as I recall.

Apart from Isaac Auerbach, I cannot now remember who came to see us, but it no doubt included Ed Harder. Some years later I had the finances of IFIP explained to me by Ed whilst walking in the snow around the Lake of Bled in Yugoslavia. It is a lesson I have never forgotten. The careful attention which was paid to this by the founders, in deriving a successful formula, has been an important factor in IFIP's growth and extension of influence over the years.

Shortly after that Conference, the late Dr Stanley Gill, who was at that time the UK representative on IFIP, decided to leave the Universities and go into industry, whilst I left industry and went to the London School Economics. Anticipating these events, Stan asked me to take over from him as UK representative, and the BCS endorsed the arrangement by accepting my nomination. I became UK representative in 1969, but too late to go to Prague, so my first General Assembly meeting was in Amsterdam in 1970. Earlier that year I had been at the Spring Joint Computer Conference in Atlantic City, and had the opportunity to meet Isaac Auerbach, who told me about his own successor, Dick Tanaka, and indicated his hope that we would both join the

Council and help to drive forward the progress of IFIP. I was happy to assure him of my willingness to work for the organisation in any capacity that seemed appropriate, of course.

Isaac was himself present in Amsterdam and helped me to interpret the political scene as we shared a taxi to the airport. Academician Dorodnycin was President and amongst the business was the election of Heinz Zemanek as President - Elect. I seem to remember we kept him waiting quite a long time outside the door whilst some points of protocol were discussed - there never was any doubt he would be elected, naturally. Afficionados of the General Assembly will no doubt recognise this as 'par for the course' - the rapid despatch of business has never been one of our distinguishing characteristics! Later on, Dick Tanaka and I were duly elected to Council, and I remained on Council until 1977, whilst Dick went on to higher things. So began an important period in the development of IFIP, in which I was privileged to play a significant role.

The composition of IFIP in 1970

When I joined the General Assembly, IFIP had 3 old-established Technical Committees and one Special Interest Group, with the formation of further TCs under consideration - specifically TC4 in Medical Informatics and TC5. The General Assembly was comparatively small, and the Chairmen of TCs were mostly themselves GA members. Indeed, TC1 on Terminology was chaired by A. van Wijngaarden and was, at the time, just completing its major task of producing a multi-lingual dictionary under the editorship of Ian Gould. The BCS was early active on terminology in co-operation with the British Standards Institute and, indeed, the English part of the dictionary was based on the work of a Committee of the BSI on which I had served under the Chairmanship of Colonel Reading. Subseauent work had been done by a Committee of the BCS under Geoff Tootill , of which and Ian Gould was Secretary. Thus I knew a good deal of the background. However, it soon became evident that little further was to be gained by pursuing terminology questions within IFIP and a year or two later the TC was formally wound up. Nevertheless the number (and the area of study) remained on the record and may yet be revived.

TC2 on Programming was regarded as central to the interests of the GA at that time, and, indeed, its work on the inception and development of ALGOL 60 was already internationally acknowledged. Unfortunately future development had not gone so smoothly and the question of ALGOL 68 was just becoming something of a 'cause celebre', with one group willing to go ahead and standardise it and those who were regarded as the 'fathers' of ALGOL 60, including Peter Naur, actively opposing this. The standardisation was forced through by Art van Wijngaarden but caused a group to resign from WG2.2 and form a new Working Group WG2.3. The debate reached the GA, as, in those days, technical matters tended to be discussed in a way that would be impossible with today's larger body. Moreover most members of the GA were themselves more involved with technology than they are now, and felt they had points-of-view to contribute, and did so - sometimes at length and with heat! Most of the debate was in Europe, of course, and did not, at that time, significantly touch the US, which was FORTRAN and COBOL oriented. The Chairman of TC2, Tom Steel, was thus drawn reluctantly into the debate, and had his own business and personal problems at the time, otherwise perhaps, rather less heat and more light might have been generated. Undoubtedly this contributed to the formation of Review Committees, a practice now being regularised on an ongoing basis, on the first of which related to TC2 I served.

This experience pointed out, I feel, one of the aspects of IFIP's role, namely that it is not a standardising body either 'de facto' or 'de jure', but can nevertheless by publication of the results of work done in Working Groups have a profound effect on the industry. The only 'de facto' standards are those endorsed by manufacturers - e.g. IBM or, maybe, ECMA. 'De jure' standards must come through a voluntary international process, and take so long to establish as to have been of little use in the industry. However, some efforts by e.g. ANSI, the BSI, and CCITT, and the ISO through its technical reports, designed to contribute to an eventual international standard, have had important effects when adopted by users and manufacturers - one can cite, for example, ANSI FORTRAN and COBOL standards and the X25, 26 and 27 protocols. The work on ALGOL 60 was valuable in this sense, and the subsequent work which resulted in PASCAL. The latter has turned out to be more valuable than ALGOL 68, which has never been used much as a standard by either users or manufacturers, although that was the declared aim of its sponsors. It is interesting to note that the ALGOL/PASCAL work has had an important impact on other Working Groups, notably WG5.5, the industrial working group on standardisation under Nicholas Malagardis, which in turn had a considerable influence on the development of the ADA language, itself the subject of discussion with TC2.

TC3 on Education was the other TC already in existence and its affairs form the subject of a memoire by Dick Buckingham, who led it for many years. During my time on the GA, it attracted attention mainly for the initiation of the World Conference on Computer Education, now a biennial event. The first WCCE was a successful Conference, I believe, although I was unable to attend, but somewhat strained relationships with the Treasurer!

The major topic of my early GA meetings were the affairs of our one Special Interest Group, the Institute for Administrative Data Processing (IAG) in Amsterdam. Accession to IFIP had taken place a year or two earlier, and the terms of the arrangements appeared to leave the Institute free to go in any direction it liked and pass the bill to IFIP via its budget, which we could approve or reject, but not modify, it seemed. Much GA time was taken up in attempting to achieve more control over this situation by agreement.

This proved difficult since the objectives of its management and those of IFIP were to some degree incompatible, a fact that was not assisted by misunderstandings in the use of English on both sides. Indeed, the matter has only recently finally disappeard from the agenda!

New directions

The formation of TC4, the Medical Informatics group, went ahead very rapdily and successfully under the Chairmanship of François Grémy, and the Secretaryship of Malcolm Forsythe. New working groups seemed to appear at each Council meeting, and it was not long before the TC began to see that it might possibly tap money available from the drug companies as well as from Health Authorities the World over, and from the W.H.O. However, to do this it was felt that support would be more readily forthcoming for an 'independent' body rather than the general coffers of IFIP. Pressure therefore arose for the formation of what is now IMIA, which has replaced the IAG at IFIP's only Special Interest Group and Associate Member. The IFIP Council wasn't too keen on this, after the IAG experience, and also felt, after some financial arguments regarding an early TC4 conference, that the group might not be fully ready to operate independently, being so recently formed.

Possibly the arguments for separation were not all that strong, but the tide of sentiment on the part of the people involved was clear. It fell to me, as 'cognisant officer' of the executive body to attend a TC4 meeting in Madrid to put the Council's point of view. The matter was extensively discussed. I naturally reported on the view of the TC to Council and the rearrangement was subsequently set in motion and concluded, satisfactorily as I hope, to all parties.

At much the same time as this, TC5 was being formed under the Chairmanship of the redoubtable Ted Williams. Ted ran its affairs from Purdue, and immediately incorporated one of his local initiatives into a Working Group. This WG was unique in IFIP for having both a US and a European subgroup which, so far as I know, never met as a single unit, but had some common membership. The TC was soon flourishing and involving itself with Shipbuilding and Ship Operation Conferences which were organised jointly with other bodies.

This joint involvement caused a few problems and can serve as a lead in to an area where I was strongly active during the decade, namely IFIP relationships with other professional bodies, with the UN and, ultimately, with developing countries.

Foreign Affairs

From the first, of course, UNESCO took an interest in IFIP, and it became a Non-Governmental Organisation under the UNESCO Charter. There are three levels of NGOs recognised by UNESCO, roughly corresponding to a) those who are consulted as of right on general scientific matters, the leading body being the International Council of Scientific Unions, embracing a wide range of subject NGOs, such as the International Union of Mathematicians, the International Union of Crystallography, and so on, covering physics, chemistry and the 'hard' sciences, b) those who would have a right to be consulted when their specific topic was being considered and c) those in the category 'don't call us, we'll call you', which covered a vast range of subjects on which consultation might take place on UNESCO initiative.

IFIP fell into category c), but aspired to rise in importance. Discussions with UNESCO were mainly conducted through Dr Malecki of the Science Policy Division at that time, and he indicated that a higher category could only be accorded if the body concerned could be seen to be the dominant body in the subject. He felt that IFIP could not claim that status, since both IFAC (the International Federation of Automatic Control) and IFORS (the International Federation of Operational Research Societies) had significant computer elements, and, moreover, IFAC at least was well established inside UNESCO for historical reasons.

It was therefore resolved to take limited steps towards the formation of an 'umbrella' body with whom UNESCO would be more comfortable dealing in status b). The result was the formation of the Five International Associations Consultative Committee (FIACC), along with IFAC, IFORS, IMEKO, and MAC, all of whom had computer interests. I have already mentioned above that the formation of TC5 had caused problems. Specifically these related to a Committee of IFAC with which some overlap existed, chaired by Janos Gertler. One of FIACC's first activities was to bring the parties together, and this was facilitated by the fact that Tibor Vamos, a Hungarian already known to me from work at the UN, was Vice President of IFAC. The matter was speedily resolved, and FIACC went on to draw up concordats on Conference sponsorship which are still followed and which facilitate publicity and support arrangements where a mutual interest exists.

It was clear that somebody in IFIP ought to be responsible for liaising with other professional bodies, and also with the various UN agencies with whom we were in contact - TC4, for example, had brought us an involvement with W.H.O. The result was to form the IFIP Committee on International Liaison of which I was for some years, Chairman and which included such internationally-minded people as the late Dov Chevion and John Bennett, who were able to contribute a world-wide perspective through their regional interests.

Since all members were on the G.A. it was usually possible to hold meetings at least once a year and sometimes more often, and a wide range of topics was discussed. Among other things we latterly gave some thought to the possible development of regional operations, and to the future of the main IFIP conference in this context. These were matters, of course, which primarily concerned other IFIP organs, such as the Activities Planning Committee, but, within our remit, we needed to place such developments in perspective against the activities of outside bodies and were thus able to contribute usefully to the collective wisdom, as well as developing responses for IFIP to make when approached by those bodies. Moreover, our membership ensured that much was known about the internal professional structures in countries not yet in IFIP, and it was natural for us to turn our attention to such matters as the formation of SEARCC, in which several of us were informally involved, since no other suitably contacted IFIP organ existed at that time.

The Committee later, under Dick Tanaka, developed a wider remit concerned with developing countries, sponsored the foundation of the IFIP Committee for International Development in Computing (ICID), and arranged to connect its work with external funding.

Another important activity of ICIL concerned the IBI. The International Computing Centre was formed in the 1950s as an agency under UN auspices and was set up in Rome, with France and Italy as its two main members. I remember going to a Conference on Numerical Analysis there in 1960, when it was under the direction of a distinguished French analyst, Claude Berge. In the late 1960s it very nearly 'died' and was only rescued by Italian intervention (in the person of an ex-student of mine, Enzo Aparo, who became Acting Director for some 6 months).

When Fermin Bernasconi was appointed Director, there was a substantial deficit, and a staff of secretaries, but no professionals. IFIP was invited to send a representative to attend an Annual General Meeting, and I was designated by Council to do so. I was impressed by Bernasconi's enthusiasm and by the fact that the Italians indicated their full support for his efforts. I decided to recommend that we co-operated with the 'new' International Bureau for Informatics (IBI/ICC), especially as Bernasconi appeared to be offering us a special status within their revised constitution and proposed to consult with Isaac Auerbach formally, in order further to reinforce the relationship. I arranged for him to meet with Isaac, who came to Europe about that time for the First Jerusalem Conference. Whatever may have been the arrangements I thought IFIP was going to make with the IBI/ICC, it soon became apparent that the direction the IBI was taking was not consistent with IFIPs objectives, and matters were not improved when our President, Heinz Zemanek, was misled into arriving for an airport meeting which never took place.

Since those days the IBI has grown to afford a technical secretariat and to undertake a role vis-a-vis some developing countries of a kind of broker in computing technology, as well as an organiser of events on an international scale. Relationships are at present, so far as I know, cordial, but it remains true that there is a competitive element in those relationships, as there is between the IBI and some of the UNESCO divisions, which is not necessarily of benefit to computer professionals in developing countries. It remains to be seen, of course, what problems will be encountered in IBI due to the withdrawal of France, and in UNESCO from the withdrawal of the US and, possibly, the UK. Perhaps it will serve to enhance the role IFIP can play in the future, perhaps not.

More new directions

Hard on the heels of the formation of TC4 and 5 came TC 6, 7, 8 and 9, covering Communications, Optimisation, Information Systems and Social Implications respectively. I was not at that time closely connected with either of the first two. Indeed Stan Gill had thrown himself enthusiastically into the former and helped to organise the Stockholm ICCC meeting, so that I tended to leave even UK developments in that area to him. TC8, however, covers an area where my University Department has great interest, and my colleague Professor Frank Land was already closely associated with curriculum development in that area within TC3.

I had, therefore, an especial reason for interest in its affairs and found myself designated as its 'cognisant officer' at a particularly critical point in its affairs. Professor Borje Langefors had chaired the Committee which set it up and became its first Chairman. However, he was, by then, too heavily absorbed in the development of the subject to find time for the effort needed to push the Committee forward. After considerable discussion with him and others concerned, I prevailed on Alex Verrijn Stuart to take on the Chairmanship and was able to persuade Bill Olle to act as UK representative. Frank Land and others of my staff were already active in the Working Group and I have been happy to note the satisfactory progress made since.

Whilst I was present at the first Human Choice and Computer Conference in Vienna, when TC9 was launched, I played a little part in it and have not had the time to do so since, somewhat to my regret. What I remember best about the Conference was a conversation with Blagov Sendov regarding a conference planned for Bulgaria on factory automation, which ended with his offering me a two-hour lecture on dialectical materialism, which I failed to accept. I am sure it would have been rewarding!

The human side of IFIP

The formal side of IFIPs activities are, of course, those which are publicly seen. But there is another, less formal side which plays a great part in its affairs, namely the human contacts which result from involvement in them. Remove the formalities and what remains of a General Assembly or Council meeting?

Ed Harder beside a lake in Bled; buying salami in Moscow for breakfast with Heinz Zemanek; sitting beside a swimming pool drinking malt whisky with Sverre Sem-Sandberg in Rio; plunging into the frozen Baltic after a Sauna with Jussi Tuori near Helsinki; drinking wine from teapots in Uzbekistan; discovering Anatoli Dorodnycin is also a numismatist; the bubbling enthusiasm of Sergio Beltran in Sofia (my wife remembers rather the stage collapsing during an opera she went to there); going to a restaurant in Tokyo with Philippe Renard guided only by a box of matches he had kept from a previous visit - luckily the taxi driver knew the place; the - sometimes barbed - wit of Dick Tanaka and the occasional frankness of Pierre Bobillier; standing for two hours, unrefreshed, in a room in Laxenburg Palace near Vienna whilst an enthusiastic Howard Raiffa and his staff described the activities of the new International Institute for Advanced Systems Analysis, hoping that he would soon allow us to get at the drinks in the next room; being given a treatise on software engineering set around the design of a pitchfork by Fritz Bauer, who then drew little men on it; eating, drinking, and occasionally dancing in innumerable restaurants with every sort of cuisine, always with attentive, helpful, and often delightful locals.

Mention should also be made of that most important event, the 'outing' on the afternoon of the middle day of the General Assembly. This is usually a coach or river trip and serves both to break up the formal meeting and to allow informal exchanges. From time to time it has served to allow voting intentions to be explored and compromises to be reached. Always there is enjoyment to be had in meeting old friends or making new ones. Invitations are issued and accepted to give talks, chair sessions, or serve on panels at national and international events. Wives are met for the first time, introduced by another GA member or by one's own wife, if she is there, having been met on the 'ladies' programme'.

I cannot end this trip down memory lane without referring to one person in particular whose involvement with IFIP has given me a constant source of pleasure, my old friend, Professor John Bennett (well known to many of you). We first met in Cambridge in 1950, when we were both doing research on the EDSAC. Subsequently we met occasionally in the course of brief visits to one anothers' countries. It was only from 1970, when we each represented our countries on IFIP, that we met on a regular six-monthly basis, with occasional meetings in between on other business. Since that time our wives have become friends and our children, who are of similar ages, have had two homes and have visited regularly both of them. Indeed on one occasion when I was visiting John and my daughter came up from Tasmania, we were both there to meet her at Sydney airport. Her greeting began 'Ooh! **Two** daddies!'. Whilst I do not suppose that IFIP can always be responsible for bringing families together in quite this way, I do believe that the contacts it offers to those who are prepared to participate fully in its affairs can contribute not only to professional discourse but also to bring the peoples of the World closer together.

Long may it continue to do so.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

IFIP AND CHINA

P.X. Guo

Chinese Institute of Electronics
Beijing.

The representative of China describes
the entry of his country into IFIP.

China started research and development of computer science and technology in the year 1956 and announced the first vacuum tube computer in 1958. Due to a long period not selecting the open policy for the outside world, we had not much opportunity for contacts with international organizations of information science and technology, and also we had no chance to exchange technical points of view with foreign countries.

After 1978 China announced the open policy, IEEE sent a delegation to China and the Chinese Institute of Electronics (CIE) sent a delegation to pay a visit to the United States. After some time, on an invitation from the CIE to the first president of IFIP, Mr. I. L. Auerbach and Mrs. Auerbach paid a visit to China from April 17 to May 7, 1979 for technical exchanges and sightseeing. He introduced to CIE the organization and the activities of IFIP and discussed with CIE members China's participation in IFIP.

In this year 1979, the CIE Council voted in favour of participation in IFIP and appointed Professor P.X. Guo as observer to attend the general assembly meeting 21 to 24 September in London.

Mr. Sun Junren, vicepresident (now president) and secretary general of the CIE sent a letter to IFIP president Professor P.A. Bobillier:

> *Mr. Auerbach introduced to the CIE the organization and the activities of IFIP and discussed with CIE members China's participation in IFIP. The CIE is a national professional technical organization in the People's Republic of China. In the field of information processing and electronic computer technology it is the only scientific and technical organization representing the PRC. Its activities are consistent with those of IFIP. The CIE consists of various professional societies, including a computer society and an information theory society. On behalf of the CIE, I have the pleasure to request the admission to IFIP of the CIE.*

Of this letter, Professor R. Narasimhan, Chairman of the IFIP admissions committee Mr. I.L. Auerbach and the IFIP secretariat were copied.

Mr. Bobillier wrote a reply to Mr. Sun, agreeing to Professor P.X. Guo as observer at the London General Assembly meeting. At this meeting, Professor Narasimhan said that it was very forunate that an observer representing the CIE was in attendance and that he would call upon him for comments. He added that Mr. Auerbach had been instrumental, due to initial contact and discussions, in making it possible for the CIE to submit its application. Professor Guo said he was extremely glad to be attending the meeting and it was hoped that the CIE would be accepted as a Full Member by 1st January 1980. He felt that CIE had been very well described in document AC-1 and confirmed that it was the only scientific and technical organization representing the PRC in the field of information processing. After the discussion, Professor R. Narasimhan recommended on behalf of the admissions committee to admit the PRC, represented by the CIE, to Full Membership.

Organization and Activities of the Chinese Institute of Electronics

The CIE was founded in April 1962. It was a national massive organization in the field of electronic science and technology. It is directed by the Chinese National Association of Science and Technology and supported by the Fourth Ministry of Machine Building (now Ministry of Electronic Industry) and other departments concerned. The constituent units of the CIE are Working Commiittes, Professional Societies and Regional Chapters. There are 25 Professional Societies at present, including a Computer Society and an Information Theory Society, and two more are planned to be established. In most of the provinces, numicipalities or autonomous regions there are regional electronic chapters constituting the branches of the CIE.

Every Professional Society or Regional Chapter holds technical discussions, exchanges of ideas and seminars in a planned and formal manner.

Internationally, the CIE organizes the participation of Chinese scientists and engineers in various international symposia and the visits of foreign scientists and engineers for academic activities and technical exchanges in China.

The CIE has the following nation-wide publications,

advanced: *Electronic Review* (quarterly)
Computer Review (quarterly)
middle level: *Electronics Science and Technology*
Computer Applications
Software Engineering
Microcomputers (all monthly)
popular science: *Electronic World* (monthly)
Computer World (weekly)

Membership: CIE has currently more than 10 000 members. There are two types of membership: Member and Honorary Member.

Finances: CIE is financed primarily by the Chinese Government. Its other incomes are from membership dues and from royalties of publications.

Officers: CIE has a President, seven Vicepresidents, a Secretary General and a Director of Office.

Address: The address of CIE is P.O.B. 139, Beijing, PRC.

Admission of CIE in IFIP

At the General Assembly of IFIP 1980 in London CIE was admitted to IFIP by a unanimous vote. When the president welcomed CIE as the new Full Member of IFIP, there was a big applause.

The Participation of CIE in IFIP's Work

Since the PRC is a Full Member of IFIP, the CIE enthusiastically responds to the activities of IFIP. The CIE does everything possible to attend the congresses, conferences and symposia organized by IFIP and its TC's and WG's or IFIP's Associate Members or Affiliated Members. There should be mentioned:

IFIP Congress 1980 in Tokyo and Melbourne: more than 30 participants.
IFIP Congress 1983 in Paris
3rd World Conference on Medical Informatics MEDINFO 80 in Tokyo.
4th World Conference on Medical Informatics MEDINFO 83 in Amsterdam. In this year, the Chinese Medical Informatics Association (CMIA) was admitted as the national member to IMIA.
3rd World Conference on Computers in Eeducation WCCE in Lausanne 1981.
CAPE 83 in Amsterdam.

With much pleasure, a Joint Conference sponsored by the International Federation of Automatic Control (IFAC) and the Chinese Institute of Automatic Control was held in Beijing in 1984.

Finally, the CIE has sent delegates to the

- International Symposium on Networking in Office Automation sponsored by IFIP TC6 in Sofia, Bulgaria, in 1984 and the
- SEARCC-84 Conference in Hong-Kong 1984.

IFIP Council Meeting in China

The CIE was honoured to arrange the IFIP Council Meeting from 21 to 23 March 1983 in Beijing.

President P.A. Bobillier opened the Council Meeting and greeted all participants. He sincerely thanked the CIE being a fairly new member of the IFIP family for inviting the Council to China and expressed his appreciation to Professor Guo who had recently been elected IFIP trustee. Furthermore, Mr. Bobillier thanked the Secretariat and Mr. Yuan, Ms. Zhou and Ms. Li for the local arrangements.

Professor Guo, in his capacity as the Executive Director of the Board of the CIE, extended a warm welcome to the council participants on behalf of the CIE which was proud to be the host and would do its best to make the meeting successful and every-one's stay in China pleasant. Professor Guo felt that holding the meeting in China would promote mutual understanding and friednship.

On the evening of 21 March, the CIE gave a formal banquet at the Great Hall of 'People's Congress' for all the participants of the council meeting. And in the afternoon of March 23, *Vice Prime Minister Wan-Li* and *Minister of Electronic Industry Jong Ze-Ming* met with all participants of the council meeting at the guest pavilion of the Great Hall of 'People's Congress' and a photograph was taken with all participants. A cordial and friendly conversation was carried on, discussing the activities of information technologies. Both sides agreed that information technology is rapidly changing our lives and that we are moving ever closer to becoming an information-based society.

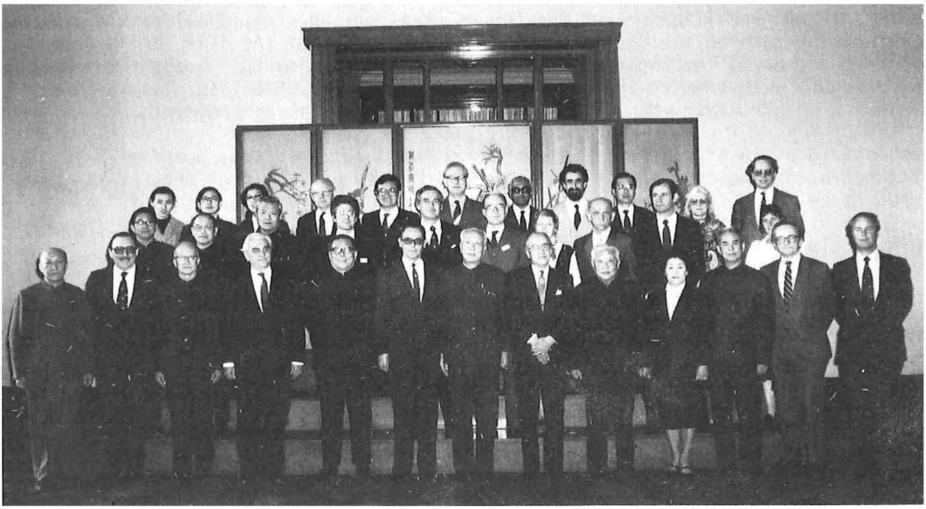
After the Council Meeting the CIE arranged a sightseeing tour of Beijing including the Imperial Palace, the Summer Palace and several other architectural jewels of the city. An excursion to the Great Wall, one of the seven wonders of the world, which was built from about 500 BC on and has a lenght of 5000 km, was very much enjoyed by the participants. When they ascended to top of the highest watch tower, somebody told them a Chinese poem: *There is no hero who has not been to the Great Wall.*

Some participants accepted the invitation to a longer trip through China. They went first to the ancient Western capital Xian and visited the famous tomb of the first Chinese emperors with the army of 7000 warriers of baked clay. In Shanghai, they saw the old city and the Yu garden and visited a commune on the country side. By railway they went to Hangzhou and the wonderful West Lake, went by boat to the pagoda of the six harmonies and saw a Chinese opera. The classical boat trip on the river Li presented them the unique sugar loaf mountains of Guilin. In Canton, they visited the Sun-Ya-Tsen memorial and the home-work cottage - paper cuts, carving etc. - of Foshan. They left the country by train to Hong-Kong.

> Remark of the Editor: The group enjoyed this trip extraordinarily. It was well organized and displayed Chinese hospitality at its best. On behalf of all of us I want to thank Professor Guo and the CIE for the arrangement and the excellent guide, Mr. Yang Hunghsing.

Concluding Remark

Now China faces the challenge of an information revolution, but this is also an opportunity to apply information technology for a reformation of the conventional industry. CIE, consequently, is truly interested in much closer relations with IFIP.



IFIP COUNCIL 1983 Peking

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

A HANDFUL OF RECOLLECTIONS ABOUT IFIP PEOPLE

Leon Lukaszewicz

Polish Academy of Sciences
Warsaw
Poland

Six IFIP presidents as seen by the representative of Poland - from Auerbach to Bobillier.

Chance, or fate, perhaps, made me join my fortunes, for more than a quarter of a century, with IFIP.

At the beginning of the year 1959, the Polish Academy of Sciences was notified by UNESCO that plans were being made to form an international organization dealing with computers. It was decided to hold the first session on the project during a UNESCO congress on data processing. A certain official from the Academy was appointed as delegate to the session but, since he knew nothing about computers, he decided to take me with him in view of the fact that I had already constructed a small computer and was head of the only computation center then in Poland.

And so it happened that in June 1959 I took part in the first meeting in establishing a data processing federation which was finally called IFIP. On that occasion I became acquainted with several people whom I was destined to meet again and again for years. The man who impressed me most was Isaac Auerbach, obviously the chief promotor of the federation. He fervently stressed the need for founding it, specified its most important aims and outlined its organization scheme. In the ensuing discussion he readily answered a multitude of questions posed by scientists and experts, lawyers and financiers. It was clear that Mr. Auerbach hat thought out everything and it remained to push the necessary buttons to call the federation into being.

When the meeting was over, I no longer gave it much thought, being overwhelmed by the impressions which the congress itself made upon me. I saw then a great many computers which I had only known from descriptions. I was able to observe the work of Fortran at the Paris branch of IBM. I took part in a meeting at which the project that later became Algol 60 was discussed.

A few months after my return from Paris I was informed that the federation had been established, that Poland would be represented in it by the Polish Academy of Sciences and that I had been appointed its permanent representative in the federation. Thus, the year 1960 marked the beginning of my long and still continuing participation in the General Assemblies of IFIP.

It was of course Ike Auerbach who was elected the first president of IFIP. His chairing of our sessions proved invaluable in my struggles to follow the discussions. English was the third successive language which I and many of my contemporaries in Poland had to learn, and although I understood my teachers in Warsaw fairly well, it cost me a great deal of effort to catch up with the swift flow of speeches. Fortunately, Ike paid attention to poor fellows like me so that I could always understand his every sentence and every thought. Moreover, he usually gave his own summary of the more intricate utterances, or made their meaning fairly clear by the answers he gave to the speakers. I was quick to observe that in order to grasp everything it was often enough just to listen carefully to Ike.

And so I listened to him holding my breath, the more so as I was simply fascinated by him - I admired his energy and common sense, the breadth of his ideas and his pragmatism. In my imagination I was comparing him with some of the characters of American literature which I used to read with considerable enjoyment - some of the enterprising and straightforward builders of that country. This is why, when I now think of the early General Assemblies of IFIP, the image of Ike is uppermost in my memory - I still see his friendly smile and hear his clear voice.

In the initial period of its existence there was no shortage of other strong personalities in IFIP. One of the was unquestionably Aad van Wijngaarden. Officially he was the representative of Holland but for me he stood above all for the international community of mathematicians. At our sessions he spared no efforts to see that our rules and resolutions were as rigorous and complete as possible. He was a master at spotting gaps and flaws in the preliminary versions of our resolutions, such as the possibility of different interpretations or failure to account for some case which, at least theoretically, might occur. Searching for precision prolonged our debates - which made some of the disputants impatient - but for me the confrontation of the theoretical and the practical approach to various matters reflected in the discussions of Aad and Ike was always extremely interesting. Fortunately, Aad was tolerant towards some imperfections of our projects so that they were finally agreed upon.

On other occasions, however, Aad was adamant. His name, as we all know, is connected with the Algol 68 programming language, probably the best known achievement of IFIP working groups. He was not only head of the Algol 68 inner group but also the initiator of that language, the man who gave it shape and infused life in it. I had an opportunity to observe him as he was presiding over one of the meetings of the Algol 68 group in Warsaw. On that occasion rigour, coherence of ideas and orthogonality (a concept invented by Aad) ruled absolutely, and it was obvious that Aad would rather go to the stake than renounce his principles. There were those who complained of his obstinacy, but in my opinion it was just that which ensured that Algol 68 has not turned out to be a conglomerate of brilliant but incoherent ideas - a frequent result of projects worked out by committees - but has become a harmonious whole. It is my strong impression that if the propagation of programming languages were in the hands of mathematicians and not of pragmatists, Algol 68 would be the most widely used language today. In any case, it became a model and a source of inspiration for the designers of all subsequent languages of similar kind; for example, it was adopted as one of the three recommended baes for the now prominent language Ada.

Another man who absorbed my attention from the very beginning was Ambros Speiser, the representative of Switzerland and the first Secretary-Treasurer of IFIP. In my eyes he was a personification of solidity and order which I had associated with Switzerland since my childhood. My mother had been brought up, before the first world war, in a strict Swiss boarding school for young ladies, and I heard from her again and again how her friends and relations in Warsaw, not excepting me, deviated from those excellent old Swiss standards. I still remember, for example, with what disdain she spoke of one of my aunts at whose table a bowl marked *Pepper* had happened to contain salt. I soon found that nothing of the kind could happen to Ambros. I secretely watched him for any slight inaccuracy which would reduce, if only by a fraction, the distance between us, but all in vain; he invariably conducted all our affairs with admirable reliability and orderliness. I was not the only one to be impressed by those qualities and since, in addition, he aroused general liking, we elected him the second president of IFIP. I was somewhat apprehensive about his ability to cope with this difficult role, since it was by no means easy to take over the presidency after Ike. However, everything went smoothly because our new president soon showed himself to be a man of initiative and imagination. IFIP gained further impetus and our sessions were conducted in a style which, although different from Ike's, was no less perfect. I had no doubts that at last I had met an ideal of my mother.

I have been meeting Anatoli Dorodnicyn again and again for more than thirty years, sometimes in the East and sometimes in the West. I read his papers on oscillation theory when I was still a young assistant and my first personal contact with him took place at a congress on computers held in Moscow in 1956. I also met there Lubomir Iliev from Bulgaria and N.J. Lehmann from the German Democratic Republic, subsequently representatives of their countries in IFIP. Our cooperation, initiated at that time, has continued up to the present day. From the very first, Anatoli showed himself to be a gifted raconteur; many of his numerous and always brilliant anecdotes contained some profound worldly wisdom, exposed the paradoxicality of some accepted notions or pointed out the absurdity of certain situations. His anecdotes were symptomatic of his way of looking upon a great many problems - serenely and from a philosophical distance. This attitude of life influenced us all at that time; it made our cooperation enjoyable and greatly facilitated reaching compromise decisions. Anatoli's style was soon perceived and appreciated within IFIP; it is no wonder, therefore, that he was elected our third president. Holding the post was not an easy task for him since a great many rules and customs obligatory in IFIP differed from those to which we were accustomed in the Eastern European countries. Anatoli, however, was able to cope with everything. His sagacity and experience, and his skill in reconciling different attitudes proved more important than knowledge of local rules and customs.

One of my most dramatic experiences connected with IFIP involved Dick Tanaka. About ten years ago, our Academy decided to organize a scientific conference of IFIP in Poland - it was to be called INFOPOL 76 and its aim was to cover a number of topics connected with data processing which particularly interested the developing countries. I was appointed chairman of the Organizing Committee of the conference and one of my most important tasks was to secure the necessary grant from IFIP. Unfortunately, time was short and it was evident that in view of our splendid, rigorous and complete IFIP rules the required procedure could not be got through in time. As a last resort, therefore, I decided to approach Dick, then the president of IFIP, and I had a good chance of doing so because I was just temporarily working at one of the Californian universities not far from Dick's place in Anaheim. I made an appointment with him for a certain afternoon and, in order to forget about my troubles for a while, I decided to spend the morning of that day visiting the famous Disneyland in Anaheim. I came early and left my car in the middle of a vast and still empty parking lot. When it was time to go back, I went out into the parking lot and saw a sea of cars among which I could not find my own. I was terrified at the perspective of being late for my appointment with our president (what would my mother have said about it?); such apparent unreliability must ruin, I was sure, my chances of obtaining the grant. It took me an hour to find my car so that, when entering somewhat delayed the president's study, I expected the worst. However, it was wonderful surprise. The question of the grant was dealt with satisfactorily within a few minutes. Dick simply said to me that he took as his mission a properous development of IFIP and not adherence to regulations; he considered the proposed conference useful and thus was ready to endorse the grant even if it were to cost him his presidency - but he did not expect things to take such a bad turn. When the matter had been attended to, he invited me to a local Japanese restaurant where we spent a delightful evening; he told me a great deal about himself, his company and many other interesting things. On coming home I was still excited by the experiences of the day and in the night I dreamt of all kinds of evil spirits which Tanaka, the good spirit, drove away.

When organizing INFOPOL I also had some experiences involving Heinz Zemanek, who, as a former and very successful president of IFIP, supervised that conference. I sent our proposals concerning the organization and the programme of the conference and received an answer full of critical remarks, expressed in much sharper terms than I had expected. I was considerably upset and went for advice to an old uncle of mine, an experienced officer who had started his career in the old Austrian monarchy. He assured me that there was nothing to worry about because it often happens to a client to be treated harshly on his first application. For centuries, he added, sovereigns were advised to show themselves severe at the very beginning of their rule. Accordingly, I promptly answered Heinz's letter assuring him that we all agreed with his remarks and indeed from then on everything went smoothly, the more so as Heinz, being in fact very gentle, could not long pretend to be severe. I should also add that afterwards Heinz helped us a great deal in preparing and then running the conference, by which he contributed essentially to its final success. On that occasion I spent with Heinz and his wife many happy moments in Warsaw, and since then I have regarded him, just as many others, as a very dear friend.

A person with whom I had particularly close ties was Dov Chevion. At every General Assembly of IFIP we always managed to spend a few hours talking about general matters and about IFIP and of course we talked Polish since Dov had been born and brought up in Poland. Dov had always been a very active member of IFIP, deeply involved in its affairs. He was particularly interested in people - he liked to know as much as possible about a man: to guess his intentions, to find out his strong and weak points, to discover what conditioned his actions and what he really thought. With all this, I was always struck by his invariably friendly attitude towards everybody. Before the meeting and in the intervals he used to come up to me and make prognoses, usually accurate, as to what matters would be brought up, by whom and with what results, which motions would go through smoothly and which would be opposed, who would be voted in and who would not, and so on. Thanks to his inside information I understood much more fully what was going on at our meetings and I saw them in much more vivid colours; some seemingly trivial matters on the agenda acquired features of Shakespearian dramas, which we then talked over with Dov. Now I miss him at every IFIP meeting; without him they no longer seem to me the same as they were before.

In my more recent memories of IFIP the person of Pierre Bobillier stands out more and more prominently. Just as Ambros Speiser many years before, he was the representative of Switzerland, started his activity at IFIP as secretary and then, for many years, was our president. Pierre did not dominate our sessions - his weapons were tact and civility, a gift for winning people over and a way of subtly suggesting to the Assembly solutions which we accepted in the belief that we thought them out ourselves. His activity was not so spectacular and in order to appreciate it fully some reflection is needed; an attempt must be made to answer the question who has made the affairs of IFIP run so smoothly in recent years, just as if they were rolling on rails laid by an invisible hand. Puzzling over this question, I have finally realized that the solution lay in the painstaking everyday work of our secretariat and, in particular, in the extraordinary abilities of Pierre.

I have of course many more noteworthy memories connected with IFIP people than could be pushed into these short reflections. In particular, I could see how the good will of all these people enabled us to solve problems, not always easy, arising in the cooperation of several countries within one international federation. All that enriched my life in an essential way, and I am grateful to chance, or perhaps providence, for making me join my fortunes with IFIP a quarter of a century ago.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

REMINISCENCES OF IFIP

Gerrit D. van der Veer

Chief Executive
South African Airways
Johannesburg
Republic of South Africa

Normally, when one has to write an article of this nature it is courteous to play down the difficulties or frustrations of the past and to emphasize the moments of delight and the achievements. Recalling my early experiences with IFIP differs from this premise as my memories only contain happy moments, humorous incidents and the realization that IFIP has contributed towards my own personal growth and to the development of my country.

It was a warm spring evening in November 1971, in the garden of a Johannesburg suburban home that I first met Heinz Zemanek. It was the first visit of an IFIP President to our country and his enthusiasm and personality quickly convinced us all that IFIP was a worthwhile cause. We also knew that active participation was essential if the local benefits of the recently acquired IFIP membership for the Computer Society of South Africa were to be realised.

This meeting was the start of a most interesting IFIP career which was to take me to many foreign places. International relationships of great significance were cemented and the resulting benefits were of immense value to the Computer Society of South Africa and its members.

The CSSA, being small at that time (less than 2000 members) and financially weak, decided that IFIP participation should be limited to only those areas that would be of direct interest and benefit to its members. However, those activities, once selected, would be pursued whole-heartedly.

Flowing from this decision and particularly due to my deep involvement with the development of the South African Railways SARNET on-line real time message and data switching network for some 2000 terminals and being Chairman of the Data Communications Co-ordination Comitee for South Africa, it was my privilege to be appointed the TC6 Data Communications representative.

TC6, having just been created with only a handfull of representatives, was lead by an enthusiastic Alex Curran. Its first meeting was held in München and that set the pattern for the successful operation of TC6 which was to follow. As TC6 promptly incorporated the very active International Networking Group (INWG) as its first working group, activities started immediately in the form of networking workshops.

It was during a NATO-networking Seminar in September 1973, to which all TC6 members were invited, that the importance and value of networks and international co-operation through activities such as IFIP and its Technical Committee struck me forceably. It was organized by Donald Davies of National Physical Laboratories, Teddington and of "packet-switching" fame.

The seminar was held at the University of Sussex in Brighton, England. One evening, at approximately 22h00, Bob Metcalfe of the ARPA networking group, demonstrated the capabilities and facilities of the ARPA network to which some 32 computing centres had been interconnected. By means of an on-line terminal, of which the TV picture was relayed to two large TV monitors in the auditorium, Bob held some 100 of us absolutely spellbound. With his expertise he effectively accessed a number of computer systems, demonstrated the letter box concept and power of instantaneous data communications, and tranferred files between various centres and even continents.

The highlight of the evening, which left an indelible impression on me, was when he accessed and signed into the Associated Press International (API) news computer in California. First we enquired into the happenings on the political scene in Chili, which was in turmoil, and the computer and network promptly supplied us with the necessary details of developments. He then enquired as to the latest news from Britain and a message flashed on the screen stating that the Brighton Station in England had just been closed due to a bombscare... Here we were only some 6 miles away from Brighton Station and totally unaware of the event, but a computer some 5000 miles away was!

I resolved there and then that the ARPA demo had fantastic public persuasibility and could be very useful in not only demonstrating data network's future possibilities, but also act as an invaluable aid in convincing public telecommunication undertakings of the power and developments to come in networking. This was particularly so in that ARPA was not being pushed or sold by any single computer company, but in fact was a non-commercialized joint network. Furthermore, I had, since joining IFIP, become more and more convinced of the need for IFIP to spread its wealth of knowledge amongst its many participants. You only had to realize that, particularly in the rapidly developing data communications field, no text books or only limited printed information existed and one had to rely heavily for latest developments on personal contacts and seminars.

However, due to the workshop orientated activities of IFIP, limiting participation largely to the experts, as well as the fact that most seminars were conducted in Europe and America (mostly inaccessible due to prohibitive travelling costs) individual members in smaller centres had great difficulty in keeping up to date.

After explaining these problems and proposing possible solutions, the TC6 "Travelling Show" was born and I was charged with arranging the first "performance" in Johannesburg in September 1974.

The concept was simple. As a TC6 meeting would take place and a large number of experts were therefore readily available, a Data Communications Networking Conference would be arranged by the local Computer Society to succeed the TC6 meeting. TC6 members would form the backbone of the proceedings and some overseas and leading local speakers would be invited. The ARPA network demostration would be one of the main items. In addition to the above, TC6 members would form discussion panels on a number of subjects.

This first conference was a resounding success and proved the feasibility of the concept. Some 340 people attended and a profit exceeding R10 000 was shown. In addition, some of the TC6 member's travel expences were subsidized while the cost of the accommodation and the TC6 meetings were fully covered by the proceeds.

As expected, the ARPA demonstration proved to be the main attraction. With the assistance of Keith Uncapher, Alex Curran and Vint Cerff, the arrangements were made well in advance. Alex provided the first modem, Keith opened a special ARPA demo account on his computer complex at UCLA and the South African Post Office, the telephone line. Together with Koos Koen, preliminary experiments were performed until late at night. At last, on the great day, Vint conducted the demonstration perfectly.

The results of this effort in South Africa ended in the South African Post Office committing itself to establish a public Data Communication Network. The South African Post Office also decided to allow the conveyance of third party data traffic over private networks until such time as a public network could be established, as it did not want to slow down development in this field. To the best of my knowledge the SAPO is the only government PTT that has ever allowed such third party concessions.

It is important to note that South Africa today has a very advanced public data switching network offering both switched circuit and packed switching. Without the IFIP TC6 efforts this would not have happened so soon.

The TC6 "roadshow" was off! The next year it was Brazil, then Australia, Hungary and India, and TC6 has kept it up ever since. An update seminar with similar satisfying results was again held in Johannesburg in 1982.

An important by-product of the ARPA demonstration was the creation of the Club of the Broken Switch - consisting of only 14 members. They were the people who battled directly with the technicalities of arranging ARPA demos in remote parts of the world. The club was decided upon and named after a particularly difficult demo in SAO PAULO when Vint found that someone had inadvertently stepped on a small switch causing the most intermittent problem in any demo I have ever experienced!

The years with TC6 were most rewarding also in a personal sense. I remember being with some of the TC6 members and their wives in the Kruger National Park and sitting on a hill on the banks of the Elephants River enjoying barbecued Impala steaks complemented with a glass of superb wine and listening to the night sounds of the wild animals. As Keith then said, - , who would ever have imagined that data communications could be that enjoyable!

My first exposure to that austere body, GA, was in Rio where I attended as an observer. For two, three year terms thereafter, it was my privilege to serve on GA and to represent my society. Many a time one's actions were rewarded and provided much satisfaction, at other times one experienced deep frustration when matters did not advance as expedient as they should have. Due to the international nature of IFIP, and therefore GA, a consensus approach was followed as far as possible on all matters. Although IFIP is a professional group, national differences, due to the very diverse circumstances prevalent in membership countries, could not always be avoided.

It was therefore, not surprising that I particularly admired the diplomacy and tact often displayed by the Presidents (Dick and Pierre) in conducting the affairs of GA. It could not have been an easy task.

GA is a small replica of the United Nations. It provides a fascinating learning ground for interpersonal and international relationships. It is a tribute to all of us that GA functions at all and I believe that the unifying force in GA is a love for the art of computing and auxilary fields, voluntary participation and above all a strong sense of professionalism. Only if IFIP abides by this strict professional approach will it survive in a most difficult international world.

This approach was particularly reinforced when GA unanimously accepted at Oslo, the International Council for Scientific Unions (ICSU) resolution on the free movement of scientists.

Acceptance of this resolution guaranteeing visas to representatives from all countries attending international seminars by the host country was carried after I, as the South African representative, had been refused entry into Russia and hence was prevented from attending the Tashkent GA in 1976.

Only if IFIP stays professional and scientific and abstains from allowing politics to interfere in its activities, will it continue to prosper and be of benefit to all members.

Now that I have left the active fold of IFIP, can I stand back and try to evaluate. I can only come to the conclusion that it is the personal relationships that are the real core of IFIP and that they should be treasured most of all. IFIP is people, many people from all corners of the earth, - , each with his own needs, views and background. Each one contributes his knowledge and receives much more in return which he then can apply in this own particular circumstances for all to benefit from. That is why I believe IFIP has fulfilled a most important role during its first 25 years of existence; and that is why IFIP will have a continuous task to perform in time to come.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

Invited Opening Address

The Role of Professor A. van Wijngaarden in the History of IFIP

Heinz Zemanek

University of Technology, Vienna, Austria

Speaking of the role of Professor van Wijngaarden means speaking of the European history of computing and of programming languages from EDSAC to the present day. It also means speaking about the history of IFIP. It is impossible to separate these subjects.

It is, however, equally impossible for me to treat this compound as a whole or tell the entire Van Wijngaarden story. I would never dare to embark on such a giant enterprise. What I can do and what I have been asked to do is to give a description of what I have seen and experienced in 25 years of my acquaintance with him and leave out the formal, the seriously scientific part, which is much better reflected by the symphony of papers that is to follow in this week. My personal view will resemble a shadow showing the contours, but never acquiring the full splendour of a portrait painted in colours.

Before 1959

I am not entirely sure about when our relationship began, but I believe that I first met Professor van Wijngaarden in Darmstadt at the first European computer conference with some international flavour which I had an opportunity to assist. From the very beginning I have sensed the dual character of his unique personality: the large mind which has always extended beyond my horizon, and the sharp brain that can suddenly focus on the smallest detail, but will illustrate by it some general aspect; the

Reprinted from: Algorithmic Languages, edited by J.W. de Bakker and J.C. van Vliet, IFIP, North-Holland Publishing Company, 1981, pp. 1 – 28.

'generalizer' who generalized even a general purpose programming language, and the 'specializer' whose production of sentences and questions has often reminded me of a pencil sharpener.

At the Darmstadt GAMM-NTG-Fachtagung in October 1955 on *Electronic Digital Computers and Information Processing,* organized by Professor Alwin Walther, Professor van Wijngaarden gave a survey on *Scientific computing in The Netherlands* [1]. It started with the observation made by someone during the conference that the per capita number of computers in The Netherlands was astonishingly high, maybe the highest – at that time – in Europe. Professor van Wijngaarden left some doubts whether this was really true, but he stressed the vivid activity in computer research in his country.

Apart from a Ferranti computer in the Shell Laboratories, there were at that time four computers that had been developed by and realized for research in The Netherlands as well as several others still in planning stage, and in all these cases – he himself did not say that clearly – he and his students played a leading role: there was PTERA in PTT, which had been developed by Kosten and Van der Poel and was running already for some years, and there was ARRA, an electronic replacement of the earlier relay computer of the same name, at the Mathematisch Centrum. This institution had cooperated with Fokker to copy this machine for them – it was then called FERTA – and a second, faster machine, ARMAC. The paper included many slides of all those computers.

Two years later we met again in Cambridge, MA, at Howard Aiken's conference of 1957 where Professor van Wijngaarden's paper was on *The state of computer circuits containing memory elements* [2], giving his version of sequential switching algebra and elementary automata theory.

Another two years later we were together at the ALGOL conference in Copenhagen in February 1959, which was devoted to the exchange of ideas and experiences with this new language. The prehistory is the following. After the Darmstadt Fachtagung GAMM established a committee for programming, and when in April 1958 they compared their work with the results of a similar committee of ACM, they found that there was a lot in common. It was therefore easy for both sides to accept cooperation. A joint ACM-GAMM Committee was appointed and met in Zurich in May 1958. They formulated a preliminary report on an *International Algorithmic Language* [10], first abbreviated by IAL and later called ALGOL (58). The members of the Joint Committee were, for ACM,

D. Arden, J. Backus, P. Desilets, D.C. Evans, R. Goodman, S. Gorn, H. Huskey, C. Katz, J. McCarthy, A. Orden, A.J. Perlis, R. Rich, S. Rosen, W. Turanski and J.H. Wegstein, and for GAMM, F.L. Bauer, H. Bottenbruch, P. Graeff, P. Läuchli, M. Paul, F. Penzlin, H. Rutishauser and K. Samelson.

As an ACM-GAMM-creation, ALGOL was an achievement of two sub-societies of the later IFIP member organizations AFIPS and DARA, and since the 13 ALGOL fathers decided to bring ALGOL under the umbrella of IFIP, ALGOL is a keyword of this paper, in particular because Professor van Wijngaarden is the father of ALGOL 68. I will come back later to this stream of events.

1959: ICIP

The meetings I have so far mentioned can be seen today as events leading to the big bang in international information processing: to ICIP, the International Conference on Information Processing organized under the auspices and at the headquarters of UNESCO in Paris, in August 1959. Professor van Wijngaarden was a leading figure in this extremely important gathering, not only because he had the honouring title Vicepresident of the Congress, but mainly because of his contributions to the congress organization and programme. It is impossible to evaluate or estimate the number of acquaintances, friendships, events and developments which this first large-scale international computer conference initiated. It is fascinating to read today, 22 years later, the proceedings of that conference, including the paper by Backus on the definition of ALGOL syntax by production rules, a paper by Bauer and Samelson on ALGOL (58) and a paper with the famous title *Processing data in bits and pieces* by Brooks, Blaauw and Buchholz. It is equally impressive to read the list of participants; hardly any name famous in our field is missing.

1960: IFIP

The main consequence of the UNESCO Congress was the foundation of

IFIP, the International Federation of Information Processing, which had been prepared in parallel and completed in 1960 by essentially the same group of people, with I.L. Auerbach of the U.S.A. and J.A. Mussard of UNESCO as the main driving forces. IFIP should not only continue to organize international computer congresses, it should become the basis of international cooperation in all fields of information processing and the clearinghouse of ideas and activities. In 1959 nobody in Paris would have dared to predict that within 20 years IFIP would have 40 member nations, 10 Technical Committees, 30 Working Groups and half a thousand members making up all those committees. This is certainly no reason to congratulate ourselves, and critical judgement does not only come from the outside – IFIP is well aware of its shortcomings and is continuously reviewing its structure and its activities, its policies and motivations.

Sometimes critical remarks and reorganization proposals have been unrealistic or naive. IFIP is largely *bound* by the nature and quality of its member organizations and by the delegates commissioned by them; IFIP can hardly be better than the sum or the average of its constituents. IFIP has lost less time and effort by fruitless political discussions than any other similar organization I know. It would be a good thing to cut down on its administration and to have fewer non-scientific and more scientific and technical meetings. But it is easier to propose such a reduction than to realize it without any damage to positive work. The people who installed IFIP, and Professor van Wijngaarden is one of them, knew very well to balance administrative needs and technical work and to build up a high level and a climate of mutual confidence which are not easy to improve. In a universe of increasing diversification of information processing, of reduced resources in funds and manpower, of less support for events and travelling, it is not easy to maintain the standard of the past, when increasing duties and more problems call for increasing scopes and achievements. IFIP needs the contributions and the sympathy of everyone in the field. Professor van Wijngaarden is an admirable example for all of us; in a seafaring country like Holland you might be reminded of a ship's figurehead, a smiling, mythical beauty who is constantly ahead of the crew and the passengers buried in the entrails of the ship.

Professor van Wijngaarden was not simply the representative of The Netherlands in the IFIP Council and later in the General Assembly. In the early years of IFIP he assumed almost all possible positions and participated in nearly all events, not with the intention to obtain fame and

Table 1
Professor van Wijngaarden in IFIP

ICIP 59: Congress Vicepresident

IFIP COUNCIL/GENERAL ASSEMBLY: Member 1960–1971
IFIP Vice-President: 1962–1964
IFIP Trustee (elected COUNCIL member): 1967–1970
CHAIRMAN TC 1: 1967–1974 → hibernated
Member WG 1.1: 1967–1974 → hibernated
Member TC 2: 1962–1971 → Koffeman
Member WG 2.1: since 1962
Member WG 2.2: since 1965
CHAIRMAN Future Policy Committee: 1963–1967
CHAIRMAN Publications Committee: 1965–1969
Finance Committee, Member: 1961–1962
Statutes and Bylaws Committee: 1969–1971
Member Congress Programme Committee: 1962
Member Working Conference Organizing Committee 1963/64
Chairman and Organizer IFIP 10 Years Anniversary 1969/70
SILVERCORE Recipient 1974

Table 2
Professor van Wijngaarden at IFIP events (and before)
Explanations:
[1] Paper read and published; see literature.
[76] Report of the Mathematisch Centrum, distributed before or at WG 2.1 meetings; see literature.
[::] Paper read but not published.
[Ω] Excused at that meeting – only 3 meetings!

OCT	1955	DARMSTADT	GAMM-NTG-Tagung	[1]
APR	1957	CAMBRIDGE MA	Aiken Conference	[2]
FEB	1959	COPENHAGEN	ALGOL Conference	
AUG	1959	PARIS	ICIP 59	
NOV	1959	PARIS	ALGOL Conference	
JAN	1960	PARIS	ALGOL 60 Conference	
JUN	1960	ROME	1st IFIP COUNCIL	[Ω]
FEB	1961	DARMSTADT	2nd IFIP COUNCIL	
OCT	1961	COPENHAGEN	3rd IFIP COUNCIL	
FEB	1962	SUNNYVALE CA	Aiken Conference	[3]
MAR	1962	MUNICH-FELDAFING	1st TC 2 Meeting	
MAR	1962	MUNICH-FELDAFING	4th IFIP COUNCIL	
MAR	1962	ROME	ICC Conference	[4]
AUG	1962	MUNICH	1st WG 2.1 Meeting	
AUG	1962	MUNICH	2nd TC 2 Meeting	

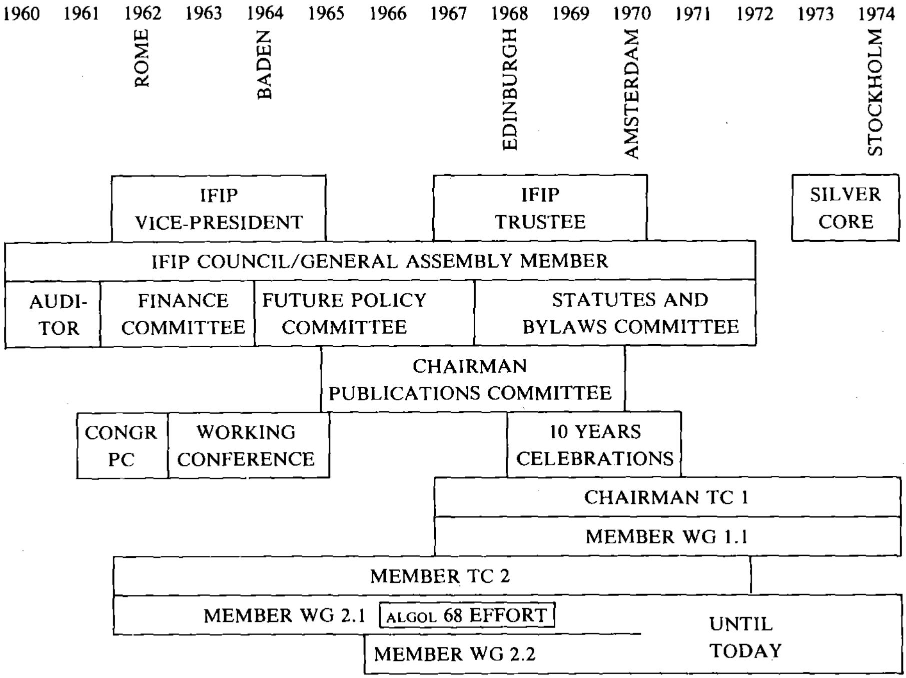
AUG	1962	MUNICH	5th IFIP COUNCIL	
AUG	1962	MUNICH	2nd IFIP CONGRESS	
SEP	1963	DELFT	2nd IFIP WG 2.1	
SEP	1963	OSLO	3rd TC 2 MEETING	
SEP	1963	OSLO-GOLA	6th IFIP COUNCIL	
MAR	1964	MUNICH-TUTZING	3rd WG 2.1 Meeting	
MAY	1964	PRAGUE-LIBLICE	4th TC 2 Meeting	
MAY	1964	PRAGUE-LIBLICE	7th IFIP COUNCIL	
SEP	1964	VIENNA-BADEN	4th WG 2.1 Meeting	
SEP	1964	VIENNA-BADEN	1st IFIP WORKING CONFERENCE	[5]
NOV	1964	ROME	8th IFIP COUNCIL	
MAY	1965	PRINCETON NJ	5th WG 2.1 Meeting	
MAY	1965	NEW YORK CITY	5th TC 2 Meeting	
MAY	1965	NEW YORK CITY	9th IFIP COUNCIL	
MAY	1965	NEW YORK CITY	3rd IFIP CONGRESS	
OCT	1965	St. PIERRE	6th WG 2.1 Meeting	[76]
NOV	1965	NICE	10th IFIP COUNCIL/GENERAL ASSEMBLY	
APR	1966	KOOTWIJK	Subcommittee Meeting	
APR	1966	LONDON	7th TC 2 Meeting	[Ω]
APR	1966	LONDON	10.5 IFIP COUNCIL	[Ω]
JUN	1966	PISA	2nd IFIP WORKING CONFERENCE	
OCT	1966	WARSAW	7th WG 2.1 Meeting	
NOV	1966	JERUSALEM	11th IFIP GENERAL ASSEMBLY	
APR	1967	MADRID	11.5 IFIP COUNCIL	
APR	1967	ZANDVOORT	8th WG 2.1 Meeting	[88]
MAY	1967	OSLO	8th TC 2 Meeting	
MAY	1967	OSLO	3rd TC 2 WORKING CONFERENCE	
SEP	1967	ALGHERO SARDINIA	1st WG 2.2 Meeting	
OCT	1967	MEXICO CITY	12th IFIP GENERAL ASSEMBLY	
APR	1968	TBILISI USSR	12.5 IFIP COUNCIL	
JUN	1968	ZURICH	ALGOL 10 YEARS Anniversary	
JUN	1968	PISA-TIRRENIA	9th WG 2.1 Meeting	[93]
JUL	1968	COPENHAGEN-VEDBAEK	2nd WG 2.2 Meeting	
JUL	1968	NORTH BERWICK	10th WG 2.1 Meeting	[95]
AUG	1968	EDINBURGH	2nd WG 1.1 Meeting	
AUG	1968	EDINBURGH	1st TC 1 Meeting	
AUG	1968	EDINBURGH	9th TC 2 Meeting	
AUG	1968	EDINBURGH	13th IFIP GENERAL ASSEMBLY	
AUG	1968	EDINBURGH	4th IFIP CONGRESS	[::]
DEC	1968	MUNICH	11th WG 2.1 Meeting	[100]
JAN	1969	LONDON-GUILDFORD	10th TC 2 Meeting	
MAR	1969	BRUSSELS	13.5 IFIP COUNCIL	[Ω]
APR	1969	HILVERSUM	3rd WG 1.1 Meeting	
APR	1969	HILVERSUM	2nd TC 1 Meeting	
SEP	1969	CALGARY-BANFF	13th WG 2.1 Meeting	
OCT	1969	PRAGUE	11th TC 2 Meeting	
OCT	1969	PRAGUE	14th IFIP GENERAL ASSEMBLY	
JAN	1970	LONDON	4th WG 1.1 Meeting	
MAY	1970	ATLANTIC CITY NJ	14.5 IFIP COUNCIL	
JUN	1970	MUNICH	4th TC 2 WORKING CONFERENCE ALGOL 68	

JUL	1970	HABAY-LA-NEUVE	13th WG 2.1 Meeting	
AUG	1970	EINDHOVEN	12th TC 2 Meeting	
SEP	1970	NEW HAVEN	5th WG 2.2 Meeting	
OCT	1970	AMSTERDAM	15th IFIP GENERAL ASSEMBLY	
OCT	1970	AMSTERDAM	IFIP 10 YEARS Celebrations	[::]

Table 3
25 Years of Professor van Wijngaarden: 1955–1980

1955	DARMSTADT	GAMM-NTG-Fachtagung	[1]
1956			
1957	CAMBRIDGE MA	Aiken Conference	[2]
1958			
1959	PARIS	ICIP 59	
1960	ROME	1st IFIP COUNCIL	
1961		1st TC 2 Meeting	
1962		1st WG 2.1 Meeting, IFIP Vice-President	
	ROME	Paper on Generalized ALGOL	[4]
1963	GOLA	Chairman of Future Policy Committee	
1964	VIENNA-BADEN	1st IFIP Working Conference	[5]
1965	PRINCETON	ALGOL X begins	
	NEW YORK CITY	Chairman of Publications Committee till 1968: hard development work	
1966			
1967		Chairman TC 1	
1968	EDINBURGH	ALGOL 68 lecture at 4th IFIP Congress	
1969		Chairman of Statutes and Bylaws Committee	
1970	AMSTERDAM	10 YEARS ANNIVERSARY CELEBRATIONS	
1971		Resignation from General Assembly and TC 2	
1972			
1973		Resignation from TC 1 and WG 1.1	
1974	STOCKHOLM	SILVERCORE at 6th IFIP Congress	
1975		Revised ALGOL 68 Report	
1976			
1977			
1978			
1979	URGENCH	Lecture at Symposium on Algorithms	
1980			
1981	AMSTERDAM	Honored by Symposium	

Table 4
Professor van Wijngaarden and IFIP



honours, but working hard to make his contributions worthwhile. Tables 1 and 2 show the quasi syntactical size of his efforts in the form of a list of positions and a list of events in which he participated. The semantical size of his contributions is not so easy to show, but I will try. When I wrote this paper, I realized very soon that I should have started a year ago on a full research project including interviews with people all over the world; thus I might have done a really good job. But I doubt that Professor van Wijngaarden would like such an enterprise and I hope that he prefers my imperfect achievements and will forgive me for everything I do not know or forget to mention.

Professor van Wijngaarden was IFIP Vicepresident from 1962 to 1964, IFIP Trustee (i.e. an elected Council member) from 1967 to 1970, and he served on many IFIP committees. His first job was that of an auditor for the first IFIP accounts, and his second was in the IFIP Finance Committee. He chaired the first IFIP Future Policy Committee, then called Committee for Future Operations and Policies, and there he laid the foundation for all future planning activities.

In those early days the IFIP family was much smaller and each national representative was a kind of general-purpose officer. The programme for IFIP Congress 62 was made up much along the same lines as it is being done today, but the Programme Committee consisted mainly of Council members. Since I had also been included – although Austria was not yet an IFIP member – Van Wijngaarden and I met in Copenhagen in October 1961, where the final programme was established, and we met of course at the Munich IFIP Congress 62. This was the first real IFIP congress, but still got the number '2' (the ICIP congress was considered number 1). This made it possible to go in parallel with our sister organizations – IFAC, IFORS, IMEKO and (then) AICA, which were later coordinated by FIACC, the Five International Organizations Coordinating Committee – which all accepted the 3-year cycle and have the same counting within one cycle as IFIP. Naturally we met again at the congresses in New York City in 1965 and in Edinburgh 1968 – the General Assembly is always held in the week before the congress and there are often committee meetings arranged at the same time in order to save on travel expenses.

1962: Rome and TC 2

This is the point to turn back to the stream of ALGOL events, since 1962 was a key year for both ALGOL and Professor van Wijngaarden. That year we first met in Sunnyvale, CA, where Howard Aiken had organized a conference on *Switching Theory in Space Technology* – but actually it had not too much to do with space travelling, Aiken had simply found a way to gather computer people in California with the remarkable support of the local industry. Professor van Wijngaarden read a paper on *Switching and programming* [3] which began as follows:

In switching theory much attention has been paid to the analysis and simplification of circuits and systems, and to properties of networks. The objective has been to provide network structures using rather simple components.

In the programs for automatic computers, similar structures are found, although on another scale. These programs consist of sequences of statements performing certain operations and are connected by transfers *of control into a complicated network. Executing the statement means moving along the paths of the circuits, seemingly completely different structures may be more or less the same functionally, and the problem of simplification arises immediately.*

This was not simply an argumentation to make a paper on programming fit into a conference on switching, this was the indication of a path and the discovery of an equivalence the use and advantages of which have not yet been fully recognized today. We are all too preoccupied with daily work to dig deeper into such proposals and so were we in those days.

Already one month later we met again in Feldafing near Munich in order to start IFIP TC 2.

ALGOL, as I have already mentioned, was originally an ACM-GAMM creation, but after the publication of the Preliminary Report, the interest went up very steeply. Professor van Wijngaarden joined the enterprise in 1959, after an, in ALGOL 68 terminology, lengthened to **long** stay in Scotland. After the Copenhagen meeting in February there was another one in Paris in November, and after the ICIP Congress in Paris the last preparations were made for the Paris Conference in January 1960, where the *Report on the Algorithmic Language ALGOL* 60 [11] worked out by a committee originally planned to consist of seven ACM and seven GAMM members, but since William Turanski was killed in a car accident shortly before the conference, the number of 13 ALGOL fathers emerged: J.W. Backus, F.L. Bauer, J. Green, C. Katz, J. McCarthy, P. Naur (editor), A.J. Perlis, H. Rutishauser, K. Samelson, B. Vauquois, J.H. Wegstein, A. van Wijngaarden and M. Woodger. Thus Professor van Wijngaarden is one of the 13 ALGOL fathers and Peter Naur will describe his contributions to ALGOL 60 in the course of this symposium.

The best way to follow the development is to study the ALGOL Bulletin, which was founded by Peter Naur at the Paris conference in February 1959 and was later taken over with ALGOL under the IFIP umbrella. Professor van Wijngaarden, by the way, not only supported the Bulletin over long periods in general and by special contributions, but also gave substantial aid to its production and distribution.

Practically all the ALGOL authors (fathers) who were interested in the continuation of the work suggested to transfer the responsibility for the language to IFIP, which means to the Federation of National Computer Societies. And it was clear that the work should continue. To make this possible, IFIP had to create the necessary structure. After many discussions the idea was presented and then realized in order to better match the ALGOL crew with its rather unequal national composition to the IFIP Council which necessarily was nationally structured. A two-level solution was found: a Technical Committee, into which each member society, i.e. each nation, could delegate one and only one member, and a Working Group, formally reporting to the Technical Committee, where membership was personal, only based on competency and the interest to cooperate, but accepted only in concordance with the TC, if necessary by a vote.

Naturally, there were also personal difficulties – the nomination or election of the two chairmen was a delicate problem. The solution was a diplomatic compromise. It was proposed that I chair TC 2, even if Austria was not yet an IFIP member, and Professor W.L. van der Poel was to chair WG 2.1. Thus the two bodies started work, TC 2 in Feldafing near Munich in March 1962, and WG 2.1 in Munich in August 1962; Professor van Wijngaarden was a member of both. TC 2 and WG 2.1 not only fulfilled their ALGOL 60 duties by producing and forwarding to ISO (which had also requested them) one proposal for ALGOL 60 Input/Output and one proposal for an ALGOL 60 subset, both published in 1964 [12]. A revised ALGOL 60 report was passed and published in 1963 [13]. Then work on the successor language was started. The working names were ALGOL X for the future programming language and ALGOL Y for the metalanguage. I will come back to this development a little later.

A few days after the March meeting in Germany, the IFIP programming language crew met again in Rome, where the International Computing Center – today the Intergovernmental Bureau for Informatics, IBI – had organized a symposium on *Symbolic Languages in Data Processing*. There Professor van Wijngaarden presented his famous paper on *Generalized ALGOL* [4], which contained most of the basic ideas he later incorporated in ALGOL X, which became ALGOL 68. Let me quote a paragraph of the introduction to this paper, a paragraph which those people who criticized ALGOL 68 later on – although they had been members of WG 2.1 – should have read more carefully. It is a kind of scientific programme of Professor van Wijngaarden's language work, his philosophy of programming, implemented by ALGOL 68 and crowned by his US paper 1981 [18].

The title "Generalized ALGOL" of this paper needs an explanation. The word ALGOL is used because of the fact that many of the concepts of the language to be described can be found, partially at least, in ALGOL. On the *other hand, the generalization goes to such an extent that the connection with* ALGOL *can only be appreciated by those who know* ALGOL *quite well.*

Thus a certain alienation is clearly announced and declared to belong to the development programme. The introduction continues:

The main idea in constructing a general language, I think, is that the language should not be burdened by syntactical rules which define meaningful texts. On the contrary, the definition of the language should be the description of an automatism, a set of axioms, a machine or whatever one likes to call it, that reads and interprets a text or a program, any text for that matter, i.e. produces during the reading another text, called the value of the text so far read. This value is a text which changes continuously during the process of reading and intermediate states are just as important to know as the final value. Indeed this final value may be empty.

In order that such a language be powerful and elegant, it should not contain many concepts and it should not be defined with many words. On the contrary, by saying less one can say more, at least say more general things. Each definition in the language may restrict the set of meaningful texts. Without any definitions, however, one can only be silent in full generality. Of course, some compromise must be made in practice. This compromise has been made in ALGOL *in a certain way. There are other ways, however, by which a better defined and more general language can be obtained using fewer concepts.*

The paper continues with a discussion of the description of *such a syntax-free language.* It is seen as a machine M0 the working of which is described on the lid of the machine so that the user can easily find out how the language is used. If he should have doubts, he can open the machine and inspect its precise working. To his surprise, he finds that there are actually two machines inside, a preprocessor P1 and a more basic machine M1 – and so it goes on. Each machine P*i* and M*i* may again be made up of a preprocessor and a processor. This continues until the user finally finds a machine that cannot be opened, which is the most primitive machine for which there is no better explanation than the wording on the lid.

It is a systems theory of programming languages, elegant, general and powerful, but obviously at a certain price. Not everyone is ready to pay this price, as the course of history has shown.

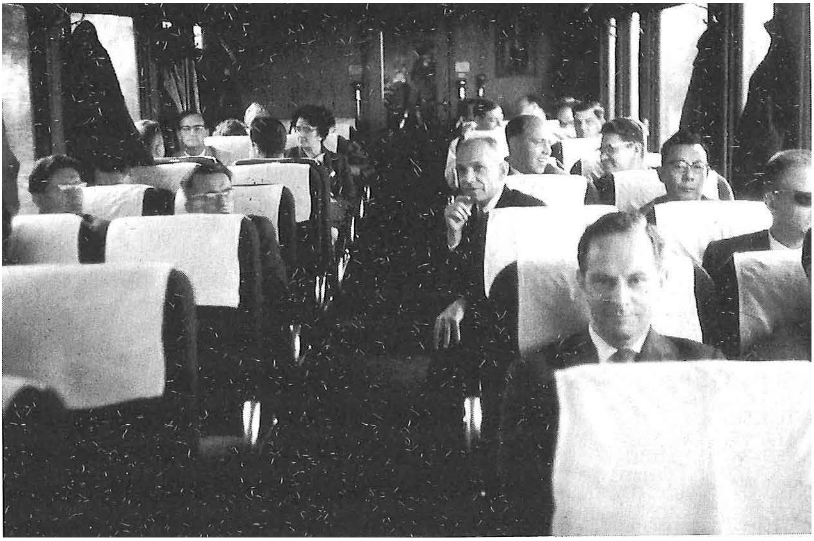
1963 and 1964

In 1963, there was only one IFIP Council meeting which took place in Norway, but no spring meeting. TC 2 met in downtown Oslo, but the Council took place in the country at Gola, a typical Norwegian summer and winter resort. After a reception in Oslo the delegates went by train via Lillehammer to Harpefoss and continued by bus to the meeting place. Our Norwegian delegate, Jan Garwick, had come in his own Citroen car and took Professor van Wijngaarden, Academician Dorodnicyn and me for a ride through the beautiful, slightly rough countryside. When you compare Norway to Austria you will find that a mountain region of a certain character that might be placed, say, at 2000 m in Austria, will be found in Norway 1000 m lower, though the gulf stream makes up for much of the northern latitude. We enjoyed our ride thoroughly and had an amusing adventure.

As may happen to the best driver when he gives a lot of explanations instead of concentrating on the way he is going, Jan Garwick got lost. Since we could not loose too much time in order to reach our group again, Jan stopped at the first person we saw – there are not many in that region – and asked how we could best get back to the road to Oslo. It was not difficult to understand that obvious question in Norwegian. "You go straight ahead for a mile and then turn right," said the farmer – and pointed with his finger to the left. None of us doubted that left was the right direction. One easily says the opposite word to the one you want to say, but one rarely makes the opposite gesture. I like to tell this story to all those computer enthusiasts who propose to turn to oral input without making sure that the computer also registers the accompanying gestures.

In that year 1963, Professor van Wijngaarden joined me in a venture which should become the most frequently used model in IFIP. On the instigation of TC 2 the IFIP Council of Gola had approved the first Working Conference on *Formal Language Definition Languages*. The model envisaged that a TC should work out a list of some 50 to 80 specialists working in a field that was still new and yet developed enough for many people to work in it and to make it possible for discussions and working conferences to bring progress and consensus. In order to establish the vocabulary and to base the discussions on solid ground, there should be about 20 invited papers, distributed to the participants before or during the meeting, which constituted the essence of the proceedings. At this first

IFIP COUNCIL 1963 Gola



In the train from Oslo to Gola
seated on right : S. Gill

Gola - the resort building where the Council Meeting took place.

conference we also included the publication of the discussions. For this purpose there were a number of portable tape recorders in addition to the master tape on which the speakers were recorded; whoever wanted to contribute to the discussion had to wait for one of the conference assistants to come up with the recorder. That assistant pronounced the name of the speaker so that all names were recorded without exception. The auxiliary tapes were then copied onto the master tape which was then sent to the Rand Corporation in Santa Monica, where Tom Steel Jr. headed the job of transcription and editing. The proceedings appeared in 1966 and a large number was sold.

This proves the success of this first IFIP Working Conference. It is not easy to judge how much the participants profited from it. For the collaborators of the Vienna IBM Laboratory it was, however, a magnificent opportunity to meet all the people active in the field of formal definition. The contents of the papers (of course some more than others) were the basis for the development of the Vienna Definition Method to be applied for the formal definition of PL/I, not only the syntax, but also the semantics.

Professor van Wijngaarden's paper at the first IFIP Working Conference had the title *Recursive definition of syntax and sematics* [5]. Recursion was a key issue at that time and we teased him by proposing to him the title and official address *His high recursivity Professor van Wijngaarden*. Actually, the paper did not once use the word *recursive* except in the title. The paper was a kind of elaboration of an aspect of the Rome Paper on *Generalized ALGOL* and its notion of an interpreting machine consisting of preprocessor and processor, an investigation and a closer definition of their properties and their power to reduce the many concepts usually included in ALGOL-like languages to a few basic ones. *ALGOL-like*, by the way, was also a word that became a fashion at and through this conference with the culminating proposal or joke – the distinction between proposal and joke was not always clear in WG 2.1 and TC 2 – that *ALGOL was not an ALGOL-like language.*

A characteristic trait of the mood and spirit of WG 2.1 was the famous extension of the voting possibilities – I am of course not submitting that it was Professor van Wijngaarden's invention – from yes, no and abstention to a fourth choice: *I did not understand the question,* the semantics of which was essentially that the voting member for tactical reasons pretended not to understand the subject of the vote.

WG 2.1 and TC 2 were both a crew of old friends and enemies who enjoyed meeting and fighting and who gained, everyone from everyone, a lot from the official and inofficial discussions. You have only to read Fraser Duncan's closing banquet talk of the Working Conference which the editor, Tom Steel, very appropriately included in the proceedings. It had the title: *Our ultimate metalanguage*, which was a quotation from a paper by Peter Naur. This ultimate metalanguage is of course English, the computer language and the IFIP language. The Fraser talk was composed of a series of witty remarks on the subject and on the conference, out of which I quote only one sentence: *"Is your Chomsky really necessary?"*

From 1965 to 1968 the main work of both WG 2.1 and TC 2 was the development of the ALGOL successor language, first called ALGOL X, once ALGOL 67 [88], and finally ALGOL 68. It is not my intention to treat here the history of ALGOL 68. Let me proceed in comfortable disorder.

Princeton and St. Pierre

This summer the chairman of a TC 3 Working Conference in Vienna explained that they choose their meeting places according to certain parameters of which the most important were culture and food. Looking at the list of TC 2 and WG 2.1 meetings I find retrospectively that Professor van der Poel and I must have used similar parameters – restricted later by the Van Wijngaarden principle (a principle which he had submitted in IFIP several times and which said that there should never be a meeting in a place more than one hour's driving away from the next international airport). Maybe it was Princeton that he found too far away, maybe it was St. Pierre de Chartreuse, the two WG 2.1 places of 1965. For many other parameters they were fine places. Princeton recommended itself by its University and the Institute for Advanced Studies, while St. Pierre offered the opportunity to visit the distillery of the Chartreuse monks where we learned, among other things, that only four monks were introduced at one time into the secret of which and how many plants to use in the production of the Chartreuse essence from which the yellow, the green and the 72-degree Chartreuse liqueurs are made.

St. Pierre was also the starting point for another adventure with Professor van Wijngaarden.

The St. Pierre meeting was immediately prior to the last old-style

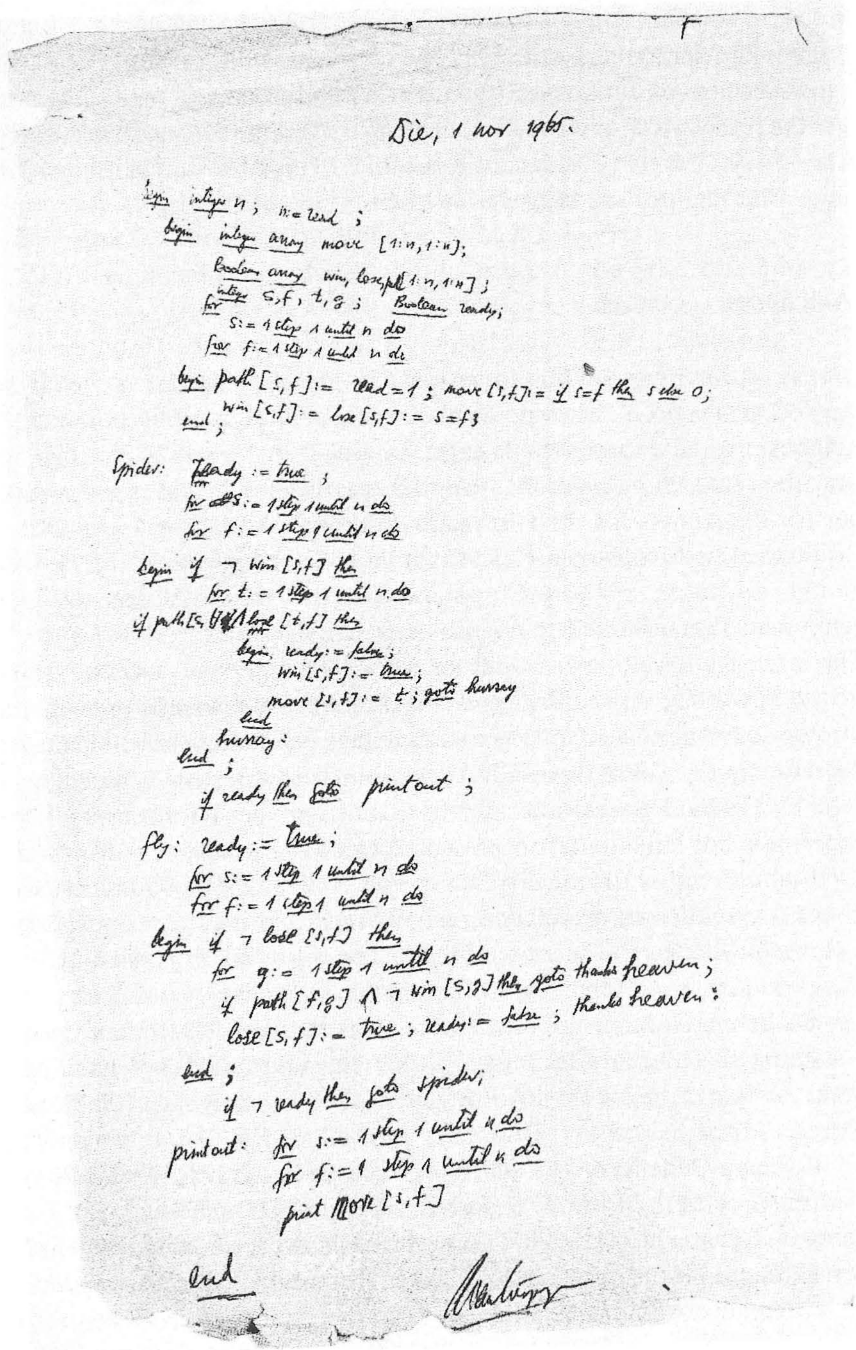
Council (from then on the spring IFIP meeting was only the Council meeting, i.e. Executive Body plus a number of trustees, while in autumn both the Council and the General Assembly had their meetings). The General Assembly was scheduled for Nice – and St. Pierre certainly did not correspond to the van Wijngaarden principle. I turned the disadvantage into an advantage: I flew to Nice and rented a car of the make I have owned since I first got a car – a Citroen. In that car I drove from Nice to Grenoble and spent 2 days with vacationing and sightseeing; I visited the Dames Coiffees, bizarre rocks, and the small town of Barcelonette and took in much of the landscape described by the French writer Jean Giono, which is the valley of the Durance. I stayed in a hotel down in Grenoble and drove up to St. Pierre several times. This, of course, was noticed by some WG 2.1 members and Aad van Wijngaarden and Fritz Bauer proposed to me to go together from St. Pierre to Nice to the General Assembly. I told them that I wanted to visit Avignon, the city of the popes, which I had never seen before. They quite agreed to this and said they would come along, if only we went together to Nice. Can you resist such a cordial invitation? No, you cannot. And with two mathematicians you cannot start off at six in the morning, as I had intended, but at 9:30, which is the proper time, and not in the middle of the night. Thus I picked them up at St. Pierre on October 30, the Saturday before a long weekend – November 1 (which was a Monday) being a holiday in France, which will be important for my story – and we headed for Avignon.

We went down the main road to the Rhone valley and again and again passed signposts indicating the roads to passes which are called 'col' in Southern France. "Let us go up to one col," Bauer and Van Wijngaarden said. "I want to go to Avignon," I answered, "and a detour will cost a lot of time." "Alright, alright," they tried to calm me, "but a little detour will not take that much time." They consulted a map and saw that one of the next cols would permit us to continue our way to Avignon in a relatively straight line. Who was I to point out that the map did not show the minor details such as bends and gradients? We turned left and mounted to the col. The weather was fine, the air was clear, the view was splendid. We collected alpine plants and had a coffee after we had passed the tunnel at the top.

But at the first bend on our way downwards a red light appeared on the dashboard of the Citroen: hydraulic trouble. It disappeared, but reappeared again after some time. When we had negotiated half the way down it was more often on than off and steering became harder and harder. Being in France, the hope of finding a Citroen repairshop was a logical one, and indeed we saw a sign directing us to a repairshop in a town called Die – which was not really in our direction, but was it not better to aim for the nearest mechanic? The red light was on all the time, but our luck held and we not only found Die but also the repairshop immediately. "It can't be anything serious, please help us as fast as you can, because we want to reach Avignon in time," we asked him. The face of the man indicated delay. At that moment Aad gave a cry: he had seen the hydraulic liquid escape in a stream as thick as a finger. "No chance," said the mechanic. "And there is a long weekend to come. My son has already gone and I will close in five minutes. We will start on the car on Tuesday morning." All our entreaties did not help. We left the car at the shop and started looking for a hotel room. I must explain that Die owes its fame to the single fact that it is the place where Hannibal started out on his treck across the Alps. Nothing spectacular has happened since then and thus the hotel situation is somewhat unlike Grenoble or Nice; the few inns we found were practically sold out. Only by extraordinary good luck and with the help of the mechanic we finally got a single and a double room. Can you imagine how happy I was? No more hope to see Avignon, and perhaps we would even be too late for a part of the meetings. I was furious and apathetic at the same time. This was the moment when Van Wijngaarden showed his strength. He gave me a three-sentence lecture after which I was neither furious nor apathetic any more – all the three of us were ready for a nice weekend in Die. We visited the ruins dating back to Hannibal's time, drank wine called Clairette de Die, and had a fine dinner. The next morning, Professor van Wijngaarden developed the algorithm for the Fly and the Spider on the paper cover of the breakfast table – a copy is shown on the next page.

Then we walked back to our mechanic and with a lot of good words we could convince him to start working on the car despite the holiday and without his son.

Avignon was lost for me, and I have not seen it to the present day, but we drove gaily down to Nice, that is with the exception of one incident. Bauer – being also a Citroen fan – wanted to drive for a while, not to Van Wijngaarden's pleasure, by the way. Suddenly Bauer was stopped by a policeman who wanted to give him a ticket; he said that Bauer would have passed another car, hadn't he seen the gendarme at the very last moment.



Die, 1 nov 1965.

```
begin integer n; n:= read ;
  begin integer array move [1:n, 1:n];
        Boolean array win, lose, path [1:n, 1:n] ;
        integer s, f, t, g ;   Boolean ready;
     for s:= 1 step 1 until n do
     for f:= 1 step 1 until n do
    begin path [s,f]:= read = 1 ; move [s,f]:= if s=f then s else 0;
          win [s,f]:= lose [s,f]:= s=f
    end ;

spider:  ready := true ;
    for s:= 1 step 1 until n do
    for f:= 1 step 1 until n do
  begin if ¬ win [s,f] then
        for t:= 1 step 1 until n do
  if path [s,t] ∧ lose [t,f] then
          begin ready:= false ;
                win [s,f]:= true ;
             move [s,f]:= t ; goto hurray
          end
        hurray:
    end ;
      if ready then goto printout ;

fly:  ready:= true ;
    for s:= 1 step 1 until n do
    for f:= 1 step 1 until n do
  begin if ¬ lose [s,f] then
        for g:= 1 step 1 until n do
        if path [f,g] ∧ ¬ win [s,g] then goto thanks heaven ;
        lose [s,f]:= true ; ready:= false ; thanks heaven :
    end ;
      if ¬ ready then goto spider;

printout:  for s:= 1 step 1 until n do
           for f:= 1 step 1 until n do
             print move [s,f]

end
```

AvWijngaarden

Then he started to grumble over the car papers. This was the point where I joined the discussion. "You shut up", I was told by the gendarme. "But it is I who has rented the car," I retorted, and with carefully selected Austrian arguments I managed to convince him in my very best French to forget the ticket. And so we arrived in Nice in due time for the first evening gathering. At this IFIP General Assembly Professor van Wijngaarden became Chairman of the IFIP Publications Committee.

1965 to 1969: ALGOL 68

I must repeat: it is not the intention of this paper to give a technical history of ALGOL 68. This would be a scientific project of quite some extent – a job somebody should undertake, however, before it is too late to collect the material completely (I invite you to submit a comprehensive paper for the Annals for the History of Computing).

Professor Turski will revisit ALGOL 68 in his closing lecture and he will certainly do more than only paraphrase the thin skeleton of the development I intend to sketch here.

The intensive development work of ALGOL 68 extended over the years from 1965 to 1969. At the Princeton meeting of WG 2.1 in May 1965, an invitation for written descriptions of a language proposal was extended. At the meeting in St. Pierre three full descriptions were presented, by Niklaus Wirth, by Gerhard Seegmüller and by Professor van Wijngaarden [76]. Tony Hoare and Niklaus Wirth presented significant papers. A four-man subcommittee consisting of Professor van Wijngaarden, Tony Hoare, Gerhard Seegmüller and Peter Naur was charged to bring the proposal into one common shape. The subcommittee met at Kootwijk in April and WG 2.1 in Warsaw in October, but the balance they had wanted was not achieved. From 1967 onwards it became clear that the Amsterdam group was gaining the absolute leadership, with one of the reasons being the amount of work they were investing into the new language. They had prepared a draft proposal for the May meeting in Zandvoort [88] which was followed by a next version distributed in November [92]. 1968 brought the culmination both of the work and of the number of meetings. The June meeting in Tirrenia near Pisa had an Amsterdam draft of January [93], the July meeting in North Berwick its follower from July [95], and in October the Mathematisch Centrum issued already the next version [99]; on the table of the December meeting in Munich the final version was presented [100]. Only those who participated in this giant effort can judge the intensity and strain of the work. But at the same time criticism and tension spread, there was more fighting than agreement, and it was easy to predict that the December meeting in Munich would be a decisive and shaken event. In a circular letter to TC 2 and WG 2.1 of October 18 I tried to point out very clearly the situation and the responsibilities of the two bodies. I indicated the choices I saw for the Munich meeting:

(1) The language produced and described in the MRs would have to be the next ALGOL, or else WG 2.1 would have to decide that the editor and the authors had essentially failed to carry out their commission;

(2) WG 2.1 might decide that the editor and the authors had carried out their commission, but that the whole enterprise had become a failure;

(3) WG 2.1 might decide that the content of the language was acceptable, but that its description was unacceptable. In that case, another description would have to be produced;

(4) WG 2.1 might decide that the final document of the editor was a first edition and that a further edition should appear;

(5) WG 2.1 might decide that the final document of the editor was without any restriction the report on the new ALGOL.

These choices indicate the controversy within WG 2.1 and the criticism from outside. WG 2.1 in Munich accepted ALGOL 68, but there was an opposing minority report and TC 2 presented the language to IFIP for acceptance with an extremely carefully worded cover letter. This letter appreciated the magnitude and difficulty of the task, but mentioned the minority report and added that the language was submitted to IFIP for publication as one of the possible approaches to the subject rather than a final answer; it said, however, that the work had reached the proper stage for submission to the crucial tests of implementation and subsequent use by the computing community. With this cover letter ALGOL 68 became official, but the group split. WG 2.1 continued to take care of ALGOL 68. In June 1970 TC 2 and WG 2.1 set up a Working Conference on ALGOL 68 Implementation [7], and a few years later WG 2.1 presented a revised edition of the ALGOL 68 Report [8] it had produced, again under the leadership of Professor van Wijngaarden. The WG 2.1 dissidents formed, in response to an invitation of TC 2, Working Group 2.3, constituted under the chairmanship of Mike Woodger in 1969 with the name of *Programming Methodology* and with the scope *Support and Tools for Program Composition.*

At the spring Council a paper on ALGOL 68 was invited for the Edinburgh Congress 68, and this lecture by Professor van Wijngaarden found so much interest that more people had to go away than found room in the lecture hall.

What had happened in the late fifties, namely that the programming community was split into the FORTRAN and ALGOL cultures, and later in addition into the COBOL culture – in a simplified manner one might speak of the industrial, academic and commercial subfields of programming in spite of the considerable overlaps – was repeated within the university community and today we have ALGOL 60, ALGOL 68 and PASCAL in parallel (with unequal shares).

The story of the Babylonian language confusion is as contemporary as can be. It is a basic law of human thinking that giant enterprises – and computer programming is a giant enterprise – develop different mentalities which in turn and in feedback lead to the development of different languages. This multitude is a fact of life. We must accept the diversity. Every language must be judged by its merits. It is beyond doubt that ALGOL 68 has, in certain aspects, more power than any other language. Why ALGOL 68 did not have the impetus of ALGOL 60 will be judged – in appropriate distance – by history. The unique and outstanding role of Professor van Wijngaarden, the incredibly concentrated and immense amount of work done by him and his collaborators at the Mathematisch Centrum, with Professor Peck, Professor Mailloux and other Canadian 'guest workers', has already now filled many pages in the books of history.

1967: TC 1 and WG 1.1

In 1967 Professor van Wijngaarden took over TC 1, which – under the chairmanship of G. Tootill and A.R. Wilde – had tried since 1962 to carry out what had looked like a superidea of Ike Auerbach: the compilation of a multilingual glossary for information processing systems and related subjects. The proposal was that a collection of definitions and concepts and terms should be produced, the keywords being arranged in a kind of decimal classification. Then, for the different languages, it was simply necessary to establish the translations of the keywords and so the information processing community would soon and easily have a multilingual, well-defined dictionary. It would be sufficient to buy the

English glossary and the keyword translations for, say Spanish and Hungarian, to get the correct translation of technical texts [14].

It was indeed very astonishing that this idea should proceed so slowly, in particular in the early years, where the number of terms was not yet as large as it is today, and where not very many specialized dictionaries were on the market. The member societies obviously did not support the project strongly enough, only very few attempts of translations of keywords became known, and most of them did not follow the rules. North-Holland have only one non-English dictionary on their list, the German Fachwörterbuch of 1968 [15].

Thus it seemed a reasonable step that a General Assembly member that had chaired the Publications Committee should try to save the enterprise. Professor van Wijngaarden let himself be convinced to do it, although he realized how bad the situation was. He separated the Technical Committee and its general scope from the direct definition work and for the latter purpose created WG 1.1.

But in spite of his efforts, the situation did not improve. In 1973 he submitted the following letter of resignation to the General Assembly:

TC 1 *Terminology*

Since the General Assembly Meeting in Sofia in October 1972, the progress in the translation, by national groups, of the terms in the 2nd Volume of the IFIP Guide to Concepts and Terms in Data Processing has been regrettably small. Although a request has been sent out to all national representatives of IFIP and to all TC 1 members to supply TC 1 with the translations of the terms, so far only the translations into Finnish, Dutch, Swedish, Czech, French and Slovak have been received. Obviously, with languages as German, Italian, Russian, Spanish, and so on, missing, Volume 2 cannot appear.

Since the chairman of TC 1 obviously has failed to raise sufficient cooperation in IFIP circles he offers his resignation as such.

A. van Wijngaarden

In order to check on its own operations, IFIP had set up review committees for its various bodies, and at that time it happened that such a committee was reviewing TC 1. In its report to the next IFIP Council, Professor van Wijngaarden's proposal to *hibernate* both TC 1 and WG 1.1, that is to inactivate them, but keep them in the lists so that they might be revived when needed, was brought forward. Unfortunately, the General Assembly in Stockholm did not follow this proposal; the bodies were discontinued. IFIP would now need a new edition of the glossary. If they had followed Professor van Wijngaarden's proposal they might simply dehibernate TC 1 and WG 1.1 and the work would probably proceed much faster.

Professor van Wijngaarden, just to mention this, was also in the Site Selection Committee for IFIP Congresses that recommended Stockholm as the site for Congress 74.

1970: 10 Years of IFIP

Dov Chevion considers it his duty to remind IFIP of its anniversaries; he brought up the proposal to celebrate the 10th anniversary and he put the 20th on the agenda. The real job, however, is to find somebody to organize the celebration, which is long and hard work. For the 20th anniversary IFIP failed to find a volunteer; and in view of the extraordinary event of 1980, namely the 8th Congress which was carried through as a Pacific event in two hemispheres, in two seasons, on two continents and in two big countries, it was decided not to insist too strongly on the anniversary idea and rather to celebrate the 25th anniversary. A volunteer has been found in the meantime: Professor Bauer in Munich.

The volunteer for 1970 was Professor van Wijngaarden, the location was Amsterdam, and the time a day during the General Assembly 1970.

What Professor van Wijngaarden achieved was an event of national and international importance, impressive and a model for the future. The programme included two opening addresses by representatives of the United Nations, Mr. Malecki of UNESCO and Mr. Gresford of UN New York, seven papers by active or past IFIP officers and two papers by representative managers of the industry.

Academician Dorodnicyn gave an overview over the first 10 years of IFIP and then announced the election of I.L. Auerbach, the first IFIP President, as IFIP Honorary Member.

The six other IFIP speakers were Professor Speiser, second IFIP President, Dov Chevion, Professor Bauer, E.L. Harder, Professor van

Wijngaarden and myself. The outside papers were by G.E. Jones, Senior Vicepresident of IBM, and by Professor Casimir of Philips.

Almost all the papers have been published in the volume *The Skyline of Information Processing* [16], so I need not describe their contents. But I want to add two remarks. One is a quotation from Professor Speiser's paper which seems to me as worth of being quoted as often as possible. He mentioned the blackout which in 1965 deprived the entire North-East of the United States of electricity for several hours. *The sequence of events which led to the disaster has been reconstructed with great accuracy. In the course of these studies it was learned that in systems of this high degree of complexity there can occur conditions of instability, even under perfectly normal operating circumstances, in which an almost arbitrarily small perturbation can have catastrophic effects* [16, p. 32]. The second remark is also concerned with a perturbation. Into my own contribution on *Some philosophical aspects* I should have invested a lot of the effort I put into it afterwards before the lecture. The main effect of such a state of affairs is, of course, that your manuscript becomes much too long: all of you know the excuse – I had not the time to write a short letter, so you get a long one. The General Assembly is more than a full-time job for the members of the Executive Body, and there was no chance to do in Amsterdam what I should have done in Vienna. Knowing all this, I fell into the second of the two alternatives that wait for the speaker: to fly above the manuscript, or to swim behind it. I did not only swim, I drowned. In doing so I lagged hopelessly behind the speaking time allotted to me, and upset Professor van Wijngaarden, his speech (which came next), and his time schedule completely.

Eleven years later, I apologize once more and regret my imperfection. And since I have embarked on apologies, I want to generalize them on behalf of IFIP: we are all imperfect and on many occasions we have made our distinguished member and friend Professor van Wijngaarden angry. This is the opportunity to present our apologies to him. But I am sure he will wave them aside. Not only because he realizes that he, too, has occasionally upset others, but mainly because he forgives immediately.

1979: Urgench

This account started with conferences outside the range of IFIP. Let me begin also the last chapter with a conference outside IFIP, the last one where we met before this symposium. It was the meeting on *Algorithms in Modern Mathematics and its Applications, dedicated to al-Khorezmi*, in Urgench, the capital of Khorezm, a region in Uzbekistan. The place was chosen because the Arab mathematician al-Khorezmi, from whose name the term algorithm was derived, was of Khorezmian origin. You can be sure that it is only the absolute time limit that prevents me from summarizing my speech on al-Khorezmi and his country, which I gave in Urgench; the countryside is spectacular and the city of Khiva near Urgench is the most impressive and best-preserved Central Asian town (we saw it during an excursion in the course of the symposium). Fortunately, the proceedings of the Urgench conference will appear soon, and thus you cannot only read my paper but also that of Professor van Wijngaarden [17]* which he read at that conference and which I consider just as important as his paper on *Generalized* ALGOL, although it was more a sketch than a completed paper (which I hope to see in not too distant a future).

The basic idea of the Urgench paper was that by a further step of generalization one and the same, but highly general language structure permits not only, like Generalized ALGOL, the formulation of the problem and the *gestaltung* of the language in which one wants to formulate the problem – choosing, of course, the best formulation and language one can think of within the general structure, but also forming the automaton, the particular computing structure, on which the given problem is processed – again matched to the optimum.

In this latest step of intellectual development of a computer pioneer, one can recognize the superpower of generalization, but also the disadvantage by which one has to buy extreme generalization. The computer, whether we like it or not, has also the contrary tendency to particularize, to save the user from what a generalizer of the academic strength of Professor van Wijngaarden considers the essence of computing work: the narrowing down from the most general possibilities of the general purpose computer to the particular language, algorithm and computer, which finally carries out the job. In the daily life of today people expect the computer to even press the button for them which starts the execution of the job.

If ALGOL 60 was a programming language for computer professors, ALGOL 68 was a language for language professors and the latest proposal

* *Note*: The paper referred to here will not appear in ref. [17] but in ref. [18].

of highest generality is a language for generalization professors, a very small class, of which Professor van Wijngaarden is one of the most prominent representatives. Progress in science has never come from particularization, but from generalization, from the recognition of common and general properties and laws, from reduction to the ultimate invariables. All his life Professor van Wijngaarden has contributed to this progress, by hard work in many more fields than IFIP, of which I have described here only what I was able to see and remember.

Professor van Wijngaarden

I am extremely proud that the Silvercore, the symbol of recognition and service award of IFIP, bestowed on Professor van Wijngaarden in 1974, carries my signature. The plaque is certainly very modest, an all too modest sign compared to everything Professor van Wijngaarden has done for IFIP, for the examples he has set, for the model and challenge his presence and contributions in the many IFIP bodies have meant for all of us.

All abstraction and formalization that finally make up the body of science and technology separate themselves from the people who have created them. Maybe that a name remains attached to a law or a language – after less than one generation, the name is not much more than a keyword. The real importance, however, of human life and its incorporation in a field of science and technology, is not on the abstract and formal side, but in the personal style and accent, in the human and heartfelt involvement which distinguishes, for example, a teacher from a teaching machine. The next generation cannot find this dimension in the papers and programs, in the minutes and protocols. But the friends and students know it better than they can ever express: they are aware of a distributed monument of Professor van Wijngaarden which no sculpture in front of the Amsterdam railway station or the Schiphol airport building can bring to light.

This symposium is part of the distributed abstract monument just as well as the many documents and publications he has produced and by which he has influenced IFIP.

Professor van Wijngaarden can look back at a giant lifework extending far beyond the IFIP universe I have described. There are the mathematical contributions and there is the Mathematisch Centrum with its industrial impact. There are the many people, students, friends and readers whose thoughts and achievements he has influenced, coined and sped on. All descriptions must remain behind reality, all words imperfect.

And yet it is appropriate to use this opportunity to express on behalf of IFIP as well as on my own behalf the infinite thanks and appreciation to a man of the first hour, and of 22 subsequent years in IFIP, to enumerate once more his contributions and to wish him a pleasant and successful evening of his life.

Retirement from a position or job for Professor van Wijngaarden has never been transition to inactivity, and will never be inactivity.

We are looking forward at this meeting to all the things by which he will continue to surprise us.

References

[1] A. van Wijngaarden, Moderne Rechenautomaten in den Niederlanden (Auszug aus dem Vortrag), Nachrichtentechnische Fachberichte 4 (1956) 60–61.

[2] A. van Wijngaarden, The state of computer circuits containing memory elements, in: H. Aiken (Ed.), Proc. Int. Symp. on the Theory of Switching, Cambridge, MA, 2–5 April 1957. Annals of the Computation Laboratory, Vol. XXX (Harvard University Press, Cambridge, MA, 1959) pp. 213–224.

[3] A. van Wijngaarden, Switching and programming, in: H. Aiken and W.F. Main (Eds.), Switching Theory in Space Technology (Stanford University Press, Stanford, CA, 1963) pp. 275–283.

[4] A. van Wijngaarden, Generalized ALGOL, in: Symbolic Languages in Data Processing. Proceedings of the Symposium organized and edited by the International Computation Center Rome, March 26–31, 1962 (Gordon and Breach, New York, 1962) pp. 409–419.

[5] A. van Wijngaarden, Recursive definition of syntax and semantics, in: T.B. Steel Jr. (Ed.), Formal Language Description Languages for Computer Programming, Proceedings of the IFIP Working Conference (North-Holland, Amsterdam, 1966) pp. 13–24.

[6] A. van Wijngaarden (Ed.), B.J. Mailloux, J.E.L. Peck and C.H.A. Koster, Report on the algorithmic language ALGOL 68, Numer. Math. 14 (1969) 79–218.

[7] J.E.L. Peck (Ed.), ALGOL 68 implementation, Proceedings of the IFIP Working Conference in Munich, July 20–24, 1970 (North-Holland, Amsterdam, 1971) 375 pp.

[8] A. van Wijngaarden et al. (Eds.), Revised report on the algorithmic language ALGOL 68, Techn. Rep. TR 74-3. (March 1974) 226 pp. Dept of Computer Science, The University of Alberta, Edmonton, Alb.; Acta Informatica 5 (1975) in parts 1 through 3; ALGOL Bull. Supplement No. 36; as book: (Springer-Verlag, Berlin, 1976) 236 pp.

[9] C.H. Lindsey and S.G. van der Meulen, Informal Introduction to ALGOL 68 (North Holland, Amsterdam, 1971) 382 pp. (Revised Edition 1977).

[10] A.J. Perlis and K. Samelson (Eds.), Preliminary report – International algebraic language, Comm. ACM 1 (12) (1958) 8–22; Numer. Math. 1 (1959) 41–60.

[11] P. Naur (Ed.), Report on the algorithmic language ALGOL 60, ALGOL Bull. Suppl. No. 2 (March 1960), Numer. Math. 2 (1960) 106–136; Comm. ACM 3 (5) (1960) 299–314.

[12] Report on Subset ALGOL 60 (IFIP); Report on Input-Output-Procedure for ALGOL 60; both in: Comm. ACM 6 (1963) 626 ff; Numer. Math. 6 (1964) 454–462.

[13] P. Naur (Ed.): Revised Report on the Algorithmic Language ALGOL 60. –
In: Numerische Mathematik 4 (1963); pp. 420–453.
Comm. ACM 6 (1963), No. 1, pp. 1–17.
The Computer Journal 5 (1963), pp. 349–367.

[14] IFIP/ICC Vocabulary of Information Processing (North-Holland, Amsterdam, 1966) (Third Edition 1968) 208 pp. I.H. Gould (Ed.), IFIP Guide to Concepts and Terms in Data Processing (North-Holland, Amsterdam, 1971) 161 pp.

[15] IFIP Fachwörterbuch der Informationsverarbeitung (North-Holland, Amsterdam, 1968) 296 pp.

[16] H. Zemanek (Ed.), The skyline of information processing, Proceedings of the 10th Anniversary Celebrations of IFIP, Amsterdam, October 25, 1970 (North-Holland, Amsterdam, 1972) 146 pp.

[17] A.P. Ershov and D. Knuth (Eds.), Proc. Int. Symp. in Urgench, Khorezm (Uzbek SSR), September 1979, Springer Lecture Notes in Information Processing (Springer-Verlag, Heidelberg, 1981).

[18] A. van Wijngaarden, Languageless programming, in: Relationship between numerical computation and programming languages, Proc. IFIP WG 2.5, working conference, Boulder, CO, U.S.A. (August 1981), North-Holland, Amsterdam, to appear.

[76] A. van Wijngaarden, Orthogonal design and description of a formal language, Mathematisch Centrum, Amsterdam, MR 76 (October 1965).

[88] A. van Wijngaarden, B.J. Mailloux and J.E.L. Peck, A draft proposal for the algorithmic language ALGOL 67, Mathematisch Centrum, Amsterdam, MR 88 (May 1967).

[92] A. van Wijngaarden, B.J. Mailloux and J.E.L. Peck, A draft proposal for the algorithmic language ALGOL 68, Mathematisch Centrum, Amsterdam, MR 92 (November 1967).

[93] A. van Wijngaarden (Ed.), B.J. Mailloux, J.E.L. Peck and C.H.A. Koster, Draft report on the algorithmic Language ALGOL 68, Supplement to ALGOL Bulletin 26, Mathematisch Centrum, Amsterdam, MR 93 (January 1968).

[95] A. van Wijngaarden (Ed.), B.J. Mailloux, J.E.L. Peck and C.H.A. Koster, Working document on the algorithmic language ALGOL 68, Mathematisch Centrum, Amsterdam, MR 95 (July 1968).

[99] A. van Wijngaarden (Ed.), B.J. Mailloux, J.E.L. Peck and C.H.A. Koster, Penultimate draft report on the algorithmic language ALGOL 68, Mathematisch Centrum, Amsterdam, MR 99 (October 1968).

[100] A. van Wijngaarden (Ed.), B.J. Mailloux, J.E.L. Peck and C.H.A. Koster, Final draft report on the algorithmic language ALGOL 68, Mathematisch Centrum, Amsterdam, MR 100 (December 1968).

[101] A. van Wijngaarden (Ed.), B.J. Mailloux, J.E.L. Peck and C.H.A. Koster, Report on the algorithmic language ALGOL 68, Mathematisch Centrum, Amsterdam, MR 101 (October 1969).

TECHNICAL PAPERS
TECHNICAL COMMITTEES

IFIP COUNCIL MEETING 1969 Prague   Executive Body and TC Chairmen
From left to right: H. Zemanek, A.A. Dorodnicyn, D. Chevion, M. Linsman, N.I. Bech, A.P. Speiser, J. Carteron, T.B. Steel, Jr., A. van Wijngaarden, F. Grémy, I. Plander.

1974 TC Chairmen
From left to right: T.J. Williams (TC5), A.V. Balakrishnan (TC 7), T.B. Steel, Jr. (TC2), D.H. Wolbers (TC3), A. van Wijngaarden (TC1), J. Roukens (TC4), A. Curran (TC6), P.J. Dixon (IAG).

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

FINANCING IFIP

"The Things We Can Do Together That We Can't Do Separately"

E. L. HARDER,

IFIP Treasurer, 1969 to 1972

The IFIP Treasurer who built up the IFIP finances and their documentation describes his philosophy and where it lead.

One of the greatest devices for advancing our profession, and the industry in which we all contribute and make our livelihood, is the professional technical interchange provided by our technical societies. Here each advance is brought to the attention of our peers, is discussed, criticized, added to, and soon inspires the next advance. Here we meet friends, though possibly competitors in industry, and share in the advance of our profession.

In the various countries of the world this interchange is provided by member societies, the member dues largely financing the operation. However in the international federations of societies, such as IFIP, ways have also been found to finance an international professional interchange, for the benefit of the whole world. The secret lies partly in the fact that a tremendous international interchange can be effectively organized and carried out at a tiny fraction of the total cost of travel, time, and services provided by all the participants. That small cost can be provided for by very carefully managed budgets, with the limited income from national dues, congress and conference surpluses, and royalties from publications. This income provides "seed money" (advances or grants) for organizing conferences and congresses, limited expenses of committees and officers, and small headquarters expenses. Travel expense is necessarily limited to "hardship cases", where plane fare may be paid. But the majority of all travel is a contribution of the participants and their affiliations - repaid many times over by the benefits of the professional technical interchange, and the broad international acquaintance provided - in short, by being an intimate part of the world-wide developments in the field.

In the first three years of IFIP UNESCO also made an annual contribution, without which the first IFIP Congress in Munich in 1962 could hardly have been undertaken. It turned out to be financially successful, as well as such an outstanding technical success as to assure the continuation of triennial congresses in New York, Edinburgh, Ljubljana, and so on.

At first technical committees and working conference were limited to basic developments urgently needed in spreading the effective use of the computer more widely in the world. These were the Multilingual Glossaries (so we could talk together), the basic work on Programming Languages (including ALGOL), and Computer Education (with special help for developing countries). Only in 1967 (the seventh year) was the Special Interest Group, IAG, established to serve the specific needs of the Administrative Data Processing community, and the fourth technical committee formed to organize the international interchange in the highly important applications of computers in medicine. The fifth technical committee, for applications in technology, was established in 1970, and now accounts for a substantial sector of IFIP. Additional technical committees have been added during the ensuing years to fill specific needs. Until now there are nine active, with one special interst group. An IFIP activity occurs nearly every week in the year in some part of the world.

Income has grown somewhat in proportion and a surplus has been built up, averaging about 450 000 Swiss Francs in the years 1970 to 1973 and about 1 000 000 Swiss Fr in 1985. This just about covers inflation. However more importantly it now provides a substantial additional source of income in the form of interests. The triennial congresses must necessarily be planned several years in advance and it is always possible that one would coincide with a world-wide recession, and have no surplus. The IFIP surplus is an endowment left by the present generation to insure the future viability of IFIP even in the event of such a misfortune.

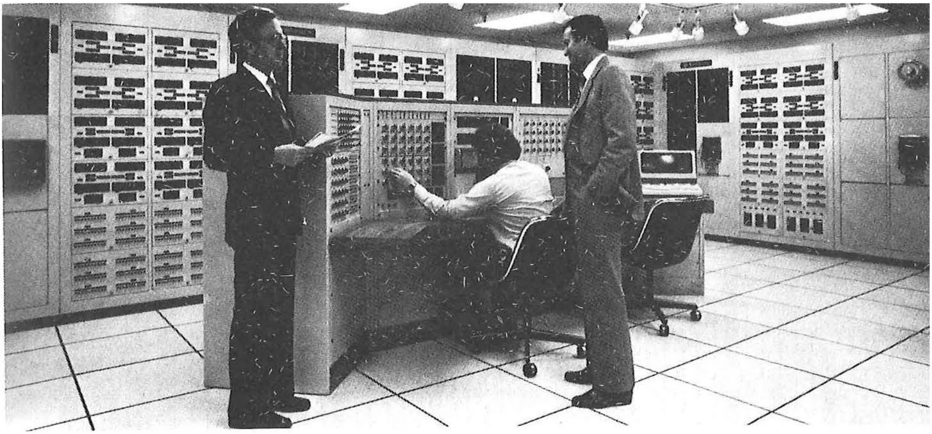
It should be pointed out that an IFIP author at any conference or congress makes a dual contribution. In addition to his technical contribution he is contributing a certain royalty income which in total helps greatly to support the IFIP activity. About 125 000 Sw Fr were received in royalties during the first ten years, and at present they are about 100 000 Sw Fr each year: with the tremendous growth in information processing by computer over the last fifteen years, IFIP publications have expanded commensurately (15 books in 1984) and are now in great demand throughout the world.

Much credit for the financial success of IFIP is due to the Secretary running the headquarters office with only secretarial help and having promoted a well chosen secretary to an Administrative Manager of high quality. When it was tried to have a fully paid administrator of a professional company (in 1971), the expense substantially exceeded income. This confirms the general observation of your past treasurer: most of the vitality of IFIP stems from unstinting volonteer efforts and contributions of its officers and members.

IFIP finance has hed its "interesting" moments. In the early years the Treasurer's accounts were audited annually by a committee appointed in the Council. On one occasion the Chairman of the Auditing Committee was a certain Dutchman by the name of Professor van Wijngaarden. The Secretary-Treasurer was a certain Swiss by the name of Professor Ambrose Speiser.

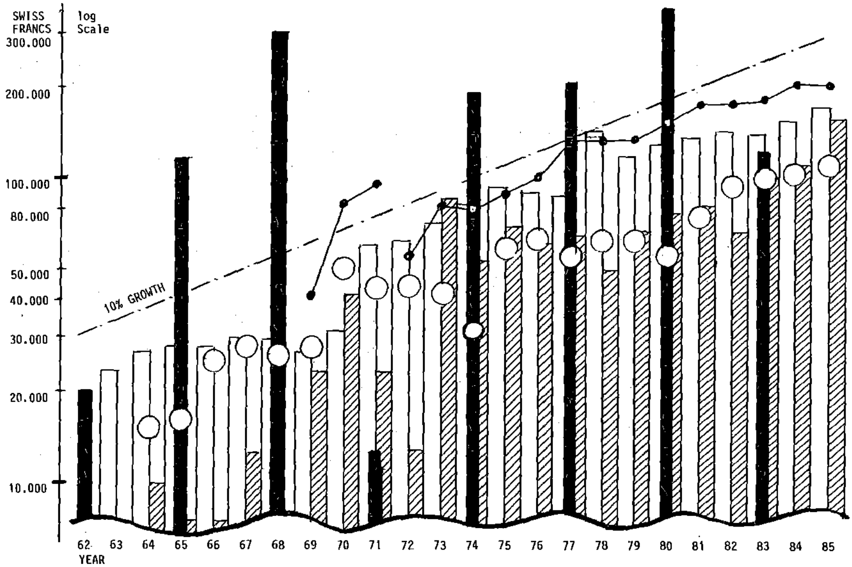
After due deliberation the Chairman of the Auditing Committee announced that the accounts were wrong - with no explanation. There was dead silence in the room. For anyone to challenge the integrity and honor of a Swiss Treasurer, and particularly such a meticulous treasurer as Dr. Speiser, was surely an international incident of the first water. I expected a duel at the very least.

Very stern glances were interchanged, but very few words. Some fifteen minutes later we were able to dig out of a certain stubborn Dutchman the fact that the discrepancy was a matter of three cents in calculating foreign exchange. It was very clear that a certain Swiss did not greatly appreciate this form of humor. Nonetheless when I reminded Professor van Wijngaarden of this incident many years later, he wrote back claiming to be still "persona grata" in Switzerland, in spite of the "international incident".



The world's first large-scale, general-purpose, analog computer, called the ANACOM, was completed in 1948 at the Westinghouse Electric Corp. in E.Pittsburgh, PA, under the direction of E.L. Harder. A second soon followed at California Institute of Technology, the parts being supplied by Westinghouse, a third one was delivered by Westinghouse to Northwestern University a few years later. Many more were built, for the United States and elsewhere.

The original ANACOM is still in use, with digital input and output added and some other additions and substraction, but with the same internals and main connections as in 1948. It may be the oldest computer in continuous use. Many of the problems for which the ANACOM was designed are now better solved on digital computers, but the performance of large power systems under the conditions of lightning or switching transients is still more economically determined on the ANACOM.

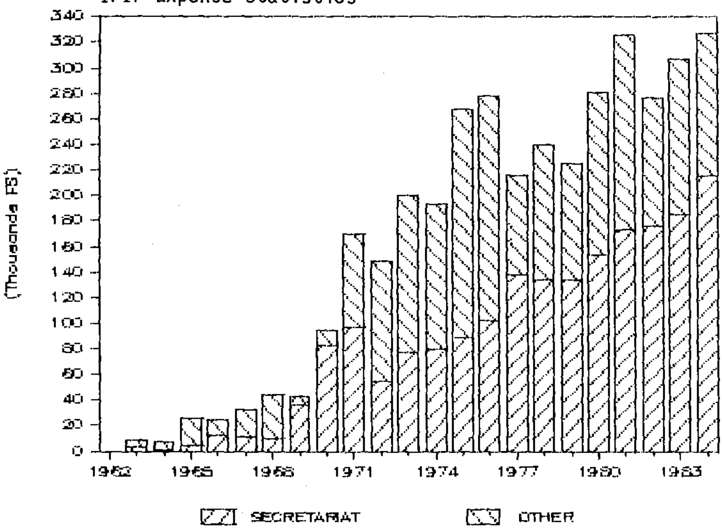


IFIP FINANCES 1962 to 1985

in Swiss Francs and with logarithmic scale so that exponential (natural) growth appears linear - 10 growth is indicated

BLACK BARS:	CONGRESS SURPLUS
WHITE BARS:	DUES
STRIPED BARS:	ROYALTIES
BLACK DOTS:	SECRETARIAT EXPENSES The policy is that secretariat expenses are about covered by the dues The years 1969 to 1971 show that hired services are more expensive than a carefully run own secretariat
WHITE DOTS:	NET WORTH (divided by ten) approximately accumulated congress surplus interests are an additional plus entry (not shown)

IFIP Expense Statistics



A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

THE FIRST TEN YEARS OF TC-10 IN IFIP

D Aspinall Chairman, TC-10

PRELIMINARY TASK FORCE

It is appropriate that the twenty-fifth anniversary of IFIP should present an opportunity to write a review of the first ten years of its activities in the area of Digital Systems Design. It all began in the IFIP Council meeting in Tokyo during March 1975 at which a Task Force on Computer Systems Architecture was established. This was following a recommendation from the Activity Planning Committee under the Chairmanship of Mr Renard. The Task Force was established under the Chairmanship of Professor Piloty. After two meetings, the Task Force reported to the General Assembly in 1976 and recommendations were made which led to the foundation of the Technical Committee on Digital Systems Design, TC-10. Professor Piloty was requested to continue as Task Force Chairman and to coordinate the drawing up of a list of those countries wishing to nominate members of TC-10. By the General Assembly in Toronto in 1977, it was possible to report that there were eight countries nominating representatives on Technical Committee TC-10, Digital Systems Design. The nine representatives invited to attend the first meeting of TC-10 in Darmstadt in December 1977 are listed in the Appendix.

INAUGURAL MEETING

The Technical Committee found that much of its work had already been carried out by the earlier Task Force and it began to consider the basic recommendations of the Task Force which are set out in the Appendix to this paper. At this formal meeting, it was decided to nominate Professor Piloty as Chairman of TC-10, Professor Aspinall as Secretary and Dr Ando as Cognisant Officer. The meeting spent much time considering the aims and scope not only of TC-10 but also of the three proposed Working Groups.

ESTABLISHMENT OF WORKING GROUPS

Following the second meeting of TC-10 in May 1978 in Lille, France, the General Assembly in Oslo in 1978 formally approved the establishment of the three Working Groups. An inaugural meeting of the Working Groups was held at Toulouse during February 1979. This was a very crucial meeting for the future of TC-10. At this, the members of the individual Working Groups discussed the aims and scope and elected Chairmen, Vice-Chairmen and Secretaries to enable the future development of their Working Group activities. The inaugural Chairmen of the Working Groups are listed in the Appendix. At this meeting, the subject of a Working Group to cover Reliable Computing and Fault Tolerance was discussed and it was agreed that Professor Avizienis, who was the prime mover in this initiative, should be invited to call a Working Conference of interested parties to coincide with the Euro-IFIP in London in September 1979. If at that Working Conference sufficient support for a Working Group could be defined, then it would be considered favourably by Technical Committee TC-10. A successful Working Conference was held and suitable aims and scope for a Working Group 10.4 were established and approved by General Assembly in Melbourne in 1980. At its next

TC-10 meeting in April 1981 at the University of Trondheim in Norway, the Committee considered the problems of VLSI and decided to form its own Task Force to investigate the way it should handle this important area of development. By the General Assembly in Dublin in 1981, it was possible to make a firm proposal that there should be a Working Group 10.5, VLSI. This proposal was accepted and this Working Group has proved to be one of the most successful of them all and has grown at a rapid rate in recent years.

STEADY STATE

At the General Assembly in Melbourne in 1980, Professor D Aspinall was appointed to succeed Professor R Piloty, who would continue as Vice Chairman from 1 January 1981. TC-10 has settled into a reliable method of working in which it serves to coordinate the activities of the various Working Groups which come under its responsibility. The Technical Committee itself sees its role as monitoring the progress of the existing Working Groups and noting the need for any special initiatives as they come along. This has resulted in the development of the two latest Working Groups and the most recent initiative to be considered is the problem of coping with the so-called 'fifth generation' or 'new generation' of computer architectures. A Working Conference to discuss this important topic is to be held in July 1985 and it is a distinct possibility that this Conference will produce the aims and scope for a proposed Working Group 10.6 in the area of New Generation Computers.

APPENDIX

IFIP TASK FORCE
COMPUTER SYSTEMS ARCHITECTURE
FINAL REPORT
1976

The Task Force unanimously decided to recommend the formation of a new

TECHNICAL COMMITTEE
ON
DIGITAL SYSTEMS DESIGN

The aim of this Committee should be the promotion and coordination of information exchange on concepts, methodologies, evaluation methods and tools in the design of digital systems.

The scope of the Technical Committee should include:

a) System concepts, architecture and organisation.

b) Logical design.

c) Performance evaluation.

d) Specification and design methodology of computers, including microprocessor systems.

e) Microprogramming.

(Digital Systems) ARCHITECTURE AND STRUCTURE was considered by some members as an alternative title of this Technical Committee, but was discarded in favour of a designation of an activity (like programming rather than programs). However, should the Council feel strongly in favour of this second alternative, it is acceptable to the Task Force.

The reasons behind this recommendation are summarised as follows:

I. Digital Systems Design is one of the central activities within the information processing community. The development of more powerful, efficient, economic and easy-to-use computer systems is fundamental to the progress in the field of information processing and therefore needs constant attention from IFIP.

II. The dramatic reduction in hardware cost through LSI technology will make computing power available in areas where computers could not be used so far. Powerful modules in particular chip microprocessors and chip memory elements available at low prices will increase the number of those who deal directly with microprogrammable hardware components to tailor them to particular applications. This development will tie together component designers, hard- and software designers and system users at an unprecedented scale, making information exchange among these groups even more important than in the past.

III. Already at this preliminary stage of planning, at least three areas can be identified within the scope of the proposed Technical Committee, which require international cooperation:

a) Clarification of concepts and terms of reference to be used in the description and evaluation of digital systems for the groups mentioned in part 2.

b) Development of an international hardware and firmware description consensus language as basis for design automation and documentation systems and for system identification to its user.

c) Exploration of means to reduce software cost using innovative hardware structures based on low cost LSI technology to implement hardware/software interfaces closer to the user.

Accordingly, the Task Force suggests that the proposed Technical Committee starts its activity from the following three Working Groups:

WG10.1	Systems Concepts and Characteristics
WG10.2	Hardware Description Languages
WG10.3	Software/Hardware Interrelation

For each of these proposed Working Groups, a description of the aims, the scope and the motivation for its introduction is following.

WORKING GROUP 10.1 - SYSTEMS CONCEPTS AND CHARACTERISTICS

AIMS

The aims of the Working Group are to promote the exchange of information in the area of system architecture and structure and thereby to improve the understanding of the state of the art in this area.

SCOPE

The scope of the Working Group includes:

1. To make accessible accurate descriptions of the architecture and structure that are actually implemented in data processing systems.

2. To establish a list of architecture and structure features which are identical or similar.

3. To describe common characteristics of those features, respectively their differences.

The systems under consideration will extend from microprocessors up to large scale data processing systems.

MOTIVATION

It appears that architectural features of various types of data processing systems presently in use show many common characteristics. This commonalit is presently poorly understood, partially because the commonality is hidden between differences in the vocabulary used by each data processing system manufacturer.

The following is a sample of such architecture and structure characteristics: instruction and data formats, addressing, interrupt system, program status word, look aside mechanisms, microprogramming organisation, task control block, data control block, virtual memory addressing scheme, disk track formats, data set organisations, system and user catalogue, dispatching algorithms, memory protection features, disk control unit functions, parallelism, access conflicts, pipelining, distributed functions.

No effort shall be made to arrive at a comparative evaluation of the merits of various features.

To be successful, a Working Group will have to include members representing a majority of the major data processing system manufacturers, e.g. Burroughs, CII, Control Data, Data General, Digital Equipment, Fujitsu, Hitachi, Honeywell, IBM, International Computers, National Cash Register, Nippon Electric, Ryad, Siemens and Sperry Rand.

WORKING GROUP 10.2 - HARDWARE DESCRIPTION LANGUAGES

AIMS

Discussion, development and evaluation of a design language which allows the description of all phases of the design from complex system architecture down to the level of elementary boolean logical units in a consistent way.

SCOPE

The scope of the Working Group includes:

1. Preparation of a guideline document, establishing the goals and mandatory requirements of the design languages as well as the requirements for its presentation.

2. Selection of "benchmark" problems representative of the various areas and levels of digital design to be used in the evaluation of the proposed design language.

3. Development of one or more design languages based on the guidelines.

4. Evaluation and, if satisfactory, selection and publication of a design language.

MOTIVATION

At the first Workshop on Computer Hardware Description Languages at Rutgers University, New Brunswick, on 6/7 September 1973, a number of workers in the field agreed that there is a need for unified formal language to describe the structural and behavioural properties of digital systems and modules at various levels of detail and thus to enhance:

a) The unique specification of digital systems to users, production and maintenance personnel.

b) The clarity of the design process itself.

c) The development of consistent tools for the display, the documentation and the verification of the design process.

d) The ease with which digital design can be taught.

A Conference on Hardware Description Languages established itself, comprising sixty-five experts from the USA and Europe, to pursue this goal.

An Executive Committee, chaired by Professor Lipovski of the University of Florida, was authorised to guide the work of the Conference on Hardware Description Languages towards a Consensus Language framework and has begun its work. First results have been obtained in defining guidelines for the development of such a language.

The proposed Working Group on Hardware Description Languages is intended to institutionalise the well-established Executive Committee of the Conference on Hardware Description Languages as an IFIP group.

WORKING 10.3 - SOFTWARE/HARDWARE INTERRELATION

AIMS

This Working Group is directed towards the reduction of software cost by implementing suitable hardware functions and towards the evaluation of their importance on system architecture and structure.

SCOPE

The scope of the Working Group is:

1. Identification of problem areas pertaining to the interrelation between the hardware functions in systems ranging from microprocessor systems up to large scale data processing systems, and the software functions in systems such as supervisors, data management, language translators, I/O systems and user interfaces.

2. Evaluation of potential hardware functions that could reduce software cost.

MOTIVATION

Early digital computer systems were designed without much consideration for software, since the electronic engineers had a difficult time just to make the system work properly, reliably and economically. On the other hand, some of the latest computer systems were made specifically to minimise the software cost by making use of the existing software. This radical change from one extreme to the other in the digital system design is essentially due to the mounting increase in software cost. This Working Group is to probe into the interaction between the hardware and software and hopefully to seek out some relevant solutions to reduce the software cost drastically.

INAUGURAL MEMBERS OF TC-10
1st MEETING DARMSTADT
6/7 DECEMBER 1977

Australia	Dr D G Wong
Federal Republic of Germany	Professor R Piloty
Finland	Professor Otala
France	Professor V Cordonnier
Great Britain	Professor D Aspinall
Italy	Dr M G Sami
Netherlands	Professor G Blaauw
Poland	Dr R W Marczynski
United States of America	Professor Y Chu

INAUGURAL CHAIRMEN OF WORKING GROUPS

WG10.1	Professor G Blaauw	February 1979
WG10.2	Dr M R Barbacci	February 1979
WG10.3	Dr E D Jensen	February 1979
WG10.4	Professor A Avizienis	September 1980
WG10.5	Professor S Michaelson	September 1981

TC-10 (DIGITAL SYSTEMS DESIGN)

CURRENT MEMBERSHIP

CHAIRMAN

GB D Aspinall
Department of Computation
University of Manchester Institute of Science and Technology
P O Box 88
Sackville Street
MANCHESTER
M60 1QD
UK

VICE-CHAIRMAN

D R Piloty
Institut fur Datentechnik
Fachgebiet Rechnerorganisation
Technische Hochschule
Merckstrasse 25
D-6100 DARMSTADT
FRG

SECRETARY

GB P A Dewar
GenRad Ltd
Norreys Drive
MAIDENHEAD
Berkshire
SL6 4BP

COGNISANT OFFICER - G Glaser, Vice President

USA	B W Arden	SF	J Karjalainen	P	A Steiger-Garcao
H	M Bohus	N	O Landsverk	E	E Valderrama (Ms)
BG	B Borovski	PL	R W Marczynski	I	M Vanneschi
F	V Cordonnier	B	E Milgrom	AUS	D Wong
ZA	C H Hoogendorn	J	T Moto-oka		H F Vajda/EUROMICRO
IND	J R Isaac	NL	G L Reijns		

WORKING GROUP CHAIRMEN

WG10.1

W K Giloi
GMD FIRST
Franklinstrasse 28/29
FR 2-1
D-1000 BERLIN
FRG

WG10.2

M R Barbacci
Department of Computer Science
Carnegie-Mellon University
Schenley Park
PITTSBURGH
PA 15213
USA

WG10.3

G L Reijns
Delft University of Technol
Mekelweg 4
P O Box 5031
2600 GA DELFT
The Netherlands

WG10.4

A Avizienis
UCLA Computer Science Dept
Room 3731 D, Boelter Hall
University of California
LOS ANGELES
CA 90024
USA

WG10.5

S Michaelson
Department of Computer Science
James Clerk Maxwell Building
The King's Buildings
Mayfield Road
EDINBURGH
EH9 3JZ
UK

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

ON MODULARITY IN PROGRAMMING *)

Manfred Broy
Fakultät für Informatik
Universität Passau
Postfach 25 40
8390 Passau

The most essential concepts as found in nowadays programming languages are shortly isolated and critically analysed. As a consequence of these critiques a concept of a programming language for a highly modular design of program systems ("programming in the large") is suggested.

1. INTRODUCTION

Program languages and program notation are of great importance for the task of program development. The requirements for programming notations are manifold: easy readability, easy understandability, clear formal concepts, efficiency of implementations, adequacy for expressing algorithmic concepts and operational concepts, support of abstraction and modularity etc etc. Clearly some of these requirements are in conflict. Moreover depending on the application area these different aspects are of varying importance.

The distinct needs for notational support become especially apparent when comparing problems of "programming in the small" against problems concerning "programming in the large". Most programming notations are initially developed for programming in the small: they were designed for describing relatively short often rather tricky "single" algorithms. Those notations are not necessarily good candidates for being used for programming in the large. In programming in the large single algorithmic principles become less significant, but the skilful structuring of the system in subtasks becomes crucial.

In this paper a short overview over distinct programming notations and programming concepts is given. Then some critiques are formulated and an attempt is made towards a language concept that may be better suited for structured programming in the large.

The suggested language is based on the concept of hierarchical partial abstract types as developed in [CIP-L 85] and on the concept of data flow networks that are composed of stream-processing tasks (functions). Both the hierarchy concept for the types as well as the network concept (for which also a hierarchical decomposition is possible) provide support for modularity.

---

*) This work was partially sponsored by the Munich SFB 49 "Software Engineering" and the ESPRIT project METEOR.

2. DATA TYPES AND COMPUTATION STRUCTURES

In computations we have to find representations (models) for the objects we want to deal with. These objects have to represent the structure and information about parts of the real world. If the parts of the real world we want to deal with are rather complex then the data objects may of course be very complex, too. Then it is important that the objects can be structured adequately for the application. Throughout this paper we consequently try to ignore questions of syntactical representation and concentrate rather on semantic issues.

It is well-known that all kinds of objects can be represented by binary strings. However, it is also well-known that it is rather difficult to model everything by binary strings. Therefore it is widely accepted by now that in programming it is generally appropriate to deal with distinct, disjoint sets of objects (types, modes, sorts) and characteristic operations on them. This leads to adequate structures and structuring tools. This is why the concept of abstract data types (cf. [Guttag 75]) has found such wide attention. Here we introduce the concept of a computation structure with a particular signature. A signature $\Sigma = (S,F)$ consists of a set S of names for carrier sets called sorts and a set F of function symbols. Moreover we assume a function

$$\text{funct} : F \to S^+$$

that associates with every function symbol its functionality.

A Σ-algebra $A = (\{s^A\}_{s\in S}, \{f^A\}_{f\in F})$ consists of a family of carrier sets, i.e. for every sort $s\in S$ there exists a carrier set s^A, and of a family of mappings, i.e. for every $f\in F$ with $\text{funct}(f) = s_1 \ldots s_{n+1}$ there exists a function

$$f^A : s_1^A \times \ldots \times s_n^A \to s_{n+1}^A.$$

Depending on the particular application such a function f^A may be partial or total. In the latter case sometimes it is appropriate to work with carrier sets s^A that are complete partially ordered sets or complete metric spaces and continuous mappings f^A. Then we speak of continuous algebras. A computation structure is a Σ-algebra which is term-generated (i.e. every element in a carrier set s^A can be obtained by the interpretation of a closed term) or continuously generated (i.e. every element is least upper bound of certain sets of interpretations of terms). We deliberately do not go into the discussion how a computation structure can be specified most adequately.

3. PATTERNS OF COMPUTATIONS

Given a computation structure (may be written in a language formalism for defining computation structures) we are interested to define computations and further functions resp. in terms of the functions given in the computation structure. There are many different styles and formalisms for specifying additional functions for a computation structure. Some of them must be considered as pure specifications (if for instance full first order predicate logic is used), others can be seen as high level descriptions of algorithms and some can be found that are efficiency-oriented (machine-oriented) detailed descriptions of computations.

3.1. OPERATIONAL PRINCIPLES: THE QUEST FOR EFFICIENCY

Of course the operational principles of a programming language and how well they can be supported by the available hardware determine the efficiency of a program written in that language. Apart from exploiting (algebraic) properties that are due to the semantic properties of the underlying computation structure (and which cannot be effectively exploited auotmatically in general) time efficiency is gained by the following three techniques of operational semantics:

(1) Parts of the program that are not needed for the requested result should not be evaluated.

(2) The same computation (with the same input) should not be done more than once, but the result should be shared.

(3) A large object structure should not be copied or reconstructed completely, if only small parts of it are changed.

For gaining storage efficiency mainly the following technique of "up-dating" is applied.

(4) Data objects should not be stored longer than they are explicitly needed.

(5) For identical objects that can be accessed under distinct names only one physical representation should be used ("sharing").

Nowadays programming languages provide especially constructs for allowing the programmer to express in detail the application of these techniques. The technique (1) is mainly supported by conditionals in if-constructs and while-loops (explicit direction of control flow). The technique (2) is mainly supported by the concept of "value-assignment" (call-by-value principle) for program variables, object declarations, and parameter passing. The techniques (3) and (4) corresponds to selective and destructive updating and are mainly supported by assignment-oriented program variables and pointers or references. Pointers and references in particular support technique (5).

It is interesting to see that it is widely accepted by now that <u>goto</u>'s are harmful and should be (and can be) completely avoided in programming, whereas pointer and reference structures ("spaghetti") are still considered as being necessary for efficient programming styles. It can be expected that also the use of pointers and references will more and more disappear in programming (and will take place only behind the curtain of implementation) just like <u>goto</u>'s disappear more and more (and are only used implicitly, i.e. in the code produced by compilers). In particular, the concept of "infinite" objects can be used (and implemented by references).

Classifying operational principles concerning (1) and (2) we have to distinguish between control flow and data flow oriented evaluation concepts and concepts based on searching. In control flow oriented programming languages there are clear rules in which order which parts of the program are executed or evaluated. Most languages are based on sequential control flow: during the evaluation there is always (at most) one operation to be executed next.

It is important to see that such an "optimal sequential control flow" does only exist for sequential functions (in the sense of [Vuillemin 75]) but not for parallel functions such as "parallel and". In such nonsequential functions there does not exist a sequential order in which the arguments to be evaluated without being trapped in a nonterminating evaluation (the result of which might not be needed for the overall results). In some languages we find a parallel control flow or a parallel data flow oriented evaluation strategy. By these techniques even nonsequential functions can be evaluated. In the approach of logic programming the aspects of efficiency is much more considered as a secondary issue. Strictly speaking in logic programming the programmer must only state the basic logical connection, but not give any explicit commands for directing the flow of evaluation (unfortunately even languages like PROLOG nevertheless include "dirty", "efficiency-oriented", "procedural" features for allowing the programmer explicit instructions guiding the flow of evaluation).

3.2. A SHORT CLASSIFICATION OF PROGRAMMING STYLES

Now a very short overview over the main programming styles that are used for defining algorithms over some given computational structures is given (for a extended study of this issue see [Broy 84]).

3.2.1. APPLICATIVE LANGUAGES

The fundamental constructs of applicative languages are function abstraction, function application, conditional expressions and recursive definition (least fixed point definitions). Applicative programming languages are mainly influenced by λ-calculus (cf. [Church 41]) and the classical mathematical notation for function application.

3.2.2. FUNCTIONAL LANGUAGES

The style of writing function abstractions using bound identifiers (formal parameters) brings some technical difficulties such as α-conversion, the treatment of free and bound identifiers and the correct treatment of substitution (which is different from pure textual replacement). For avoiding these difficulties and avoiding the pitfalls of so-called object-level programming people propagated a more combinatroy logic (cf. [Schönfinkel 24]) oriented programming style. This style is based on the concepts of (sequential and/or parallel) functional composition and of recursion (cf. [Backus 78]).

3.2.3. ASSIGNMENT-ORIENTED LANGUAGES

Assignment-oriented languages arose from machine-instruction-sets. It took some time until a pure (machine-independent?) style of assignment-oriented programming evolved. However, still many computing scientist consider assignment-oriented languages as oriented towards von Neumann machines (linear store machines with a central processing unit) and therefore as efficiency-oriented. Vice versa the assignment-oriented programming style is also considered as the only existing really efficiency-oriented style of programming. Such a view is justified by a very operational view of assignment-oriented languages supporting destructive and selective updating. In its purest form (cf. [Hoare 69]) in assignment-oriented languages programs are built from assignment statements, sequential composition, conditional statements and while loops. From a very abstract (nonoperational) viewpoint assignment-oriented languages can be seen as a special form of functional programs operating on a special object space in form of a "state" (which is hidden to the user).

3.2.4. LOGIC PROGRAMMING

In the logic programming (cf. [Kowalski 79]) the programmer just gives a number of logical specifications ("Horn clauses", conditional equations) for the predicates, relations or functions that are to be defined over the given computation structure. Then a sophisticated search procedure (based on resolution and/or unification) searches the space of all deductions for the results.

4. COMMUNICATION-ORIENTED LANGUAGES

Communication is an important concept in programming. Communication is not only of interest for distributed programming systems, but also for dialog-oriented languages (communication between the user and the system) and for input/output concepts in sequential languages.

4.1. DIALOG-ORIENTED LANGUAGES

Most of the classical programming languages are still batch-oriented or at least heavily influenced by this concept. They have been designed following the idea that at first a complete program should be written down before the evaluation processes (generally strictly divided into several phases such as compilation, linking, loading and execution) takes place. Of course such views are not well-suited for an interactive use of machines. If program development is made into a process of stepwise design and execution (interpretation) mixing programming steps with steps of data input, mixing execution with verification and transformation steps (partial evaluation, symbolic execution), then such a proceeding needs additional language features.

4.2. OBJECT-ORIENTED LANGUAGES

Object-oriented languages consist of two basic concepts: data structure features ("classes", "abstract data types") and communication concepts. In early designs of those languages such as SMALLTALK (cf. [Goldberg, Kay 76]) the communication patterns still follow more conventional, less abstract, implementation-oriented views such as communication via update of shared memory (cf. "coroutine concepts"). Future designs in this area certainly will move away from the state-orientation towards more general forms of communication (message-passing) leading to very general process-oriented programming environments (process-oriented man-machine interfaces). Then an interface for a workstation can be seen as being defined by a system of processes with which the user may communicate. In addition, the user may introduce new processes into the system as well as delete old ones.

4.3. LANGUAGES FOR DISTRIBUTED SYSTEMS

Distributed systems generally include parallelism (in place as well as in time) and some way of interaction between the parallel components by synchronisation or communication. We give a short classification of the most important styles (for an extended classification cf. [Broy, Bauer 84]).

4.3.1. SHARED MEMORY BASED COMMUNICATION

Many practically used approaches to communication are based on shared memory (cf. [Hoare 72]). But sharing of memory between components of parallel systems rather seems as an implementation issue than a good design tool. The wide use of techniques of shared memory must be explained by historical reasons especially by inherently operational and machine-oriented views of parallel computations on multiprocessor architectures.

4.3.2. SYNCHRONOUS MESSAGE PASSING

A more abstract view of communication than shared memory leads to synchronous message passing. Those concepts have been developed by Milner (cf. [Milner 80]) and Hoare (cf. [Hoare 78]) and start to find their way now also in software production oriented languages such as Ada.

In its purest form parallel programs that communicate via synchronous message passing do not share any memory (do not share "space") but they share some actions ("handshake", "rendezvous", sharing points in abstract execution "time"). By those actions data objects (including simple "control tokens") may be exchanged between parallel processes. Although much more abstract than shared memory synchronous message passing still includes one severe problem: the communication partners have to be synchronized, they have to have possibilities to withdraw their willingness to communicate depending on the readiness of the partners. This leads to severe technical and theoretical problems that must have severe implications on the tractability of methodologies for those systems.

4.3.3. ASYNCHRONOUS MESSAGE PASSING: STREAM-PROCESSING

In contrast to control flow driven execution principles, where "artificial" control tokens (instruction counter) are introduced, in data flow driven execution principles the control flow is identical to the data flow. Essentially there are two principles of data flow computations: demand driven computation (lazy evaluation) and data driven computation (busy evaluation). Although the data flow principle can be applied for all kinds of languages (cf. single assignment languages [Tesler, Enea 68] and LUCID [Ashcroft, Wadge 77]), we concentrate here on a very particular style of data flow languages (cf. [Dennis 74]) based on stream processing functions (cf. [Kahn, MacQueen 77]).

Intuitively a stream is a finite or infinite sequence of atomic (data) objects that is processed from "left to right". Therefore there are the basic operations for stream s and an atom a:

<u>first</u> s

gives the leftmost element of s

<u>rest</u> s

gives the stream s without the first element and

a & s

adds a as first element to s.

In a stream-processing language programs consist of networks of functional units (corresponding to functions mapping tuples of streams to tuples of streams) that are connected by lines (corresponding to streams).

4.4. BASIC OBJECT SPACES OF PROGRAMMING LANGUAGES

Besides the features in nowadays programming languages for defining data structures and computation structures it is important to notice that generally every programming language uses some basic underlying data structure (the object space on which a program operates). This data structure has to be defined explicitly, when giving a denotational semantics to the language, and it has to be implemented, when implementing the language. For applicative programs the basic object spaces are "environments" (mappings associating with every defined identifier some object), for functional languages in the sense of Backus the basic object spaces are generalized trees, in stream processing languages the basic object spaces are (tuples of) streams. In assignment-oriented languages the basic object spaces are storage states, i.e.

mappings associating storage cells (addresses) with every identifier.

5. CRITICAL ASSESSMENT OF PROGRAMMING CONCEPTS

This section is an attempt to a critical analysis of several programming concepts towards the use for programming in the large.

5.1. A CRITIQUE OF BLOCK STRUCTURED LANGUAGES

For historical and technical reasons (stack-oriented memory management) most of the existing languages are consequently block-structured (cf. ALGOL 60, ALGOL 68, but also PASCAL, Ada etc.). Of course, block structure represents the valuable structuring principle of locality of declarations. However, block structures generally represent tree structures and if the blocks are - as general - sequentially composed the execution of the program corresponds to a "left-to-right" traversal through the tree including repetitions of traversals through subtrees. Both the flow of control, mode declarations, object declarations, and program variable declarations have to follow the block structure patterns. This forces the programmer often into unelegant solutions for expressing his/herself.

Of course the idea of a block as a scope for declarations is an important structuring tool. However, a program with a high nesting of blocks with unrestricted import rules (everything declared in the context of a block is declared there,too) cannot be called a well-structured program.

5.2. A CRITIQUE OF THE CONCEPTUAL DISTINCTION BETWEEN INTERFACES BETWEEN MODULES AND INPUT/OUTPUT

Input/Output concepts are awfully neglected not only in the design of many programming languages, but also in most of the work on program methodology. Interestingly most of the common assignment-oriented programming languages use completely distinct concepts for the interface between the basic building blocks and the interface to the outside world, i.e. to the user or the programs'environment. Input/output have to be considered as realized by <u>side-effects</u> of the program.

For most of the existing programming languages the most important concepts of modularization are procedures, i.e. procedures or subroutines form the basic "building blocks" of a program. Sementically the interface between a procedure and its environment as it is used in a procedure call consists of the "passing of states". By a call the state (or a subspace of the state) is passed to the procedure's body and the procedure passes back an updated state. So the interface between a procedure and its environment as established in a procedure call consists of two complementing actions of state-passing.

Of course input and output commands, although looking very similar to procedure calls follow a different paradigm: either the environment is updated by some output, or the program state (plus the environment) is updated by receiving some input. The interface between a program and its environment is generally not realized by passing the states of the programs but by passing messages (data). Not only for aesthetic reasons it seems important to get one uniform concept of interface both for the interface between programming modules and for the interface between the user and the program.

5.3. ON THE IMPACT OF COMPUTING SCIENCE ON LANGUAGE DESIGN

Although programming languages and programming notation are so significant for the software engineering task and although the last 30 years of computer science have brought a considerable growth in knowledge and understanding, the effective impact on the design and use of programming languages is rather small. Nothing can demonstrate this better than a look to the last monstrous product of commercialized language design: the programming language Ada. Nowadays at least the implementation phase of software production is still strictly determined by efficiency-oriented programming: a lot of energy is spent for making the final product more efficient (on nowadays hardware) and therefore at the same time more obscure, less readable, harder to understand, to port and to modify. Certainly the demand in efficiency will become less and less significant for many application areas.

However, not only the language designers are to blame for the poor standards of programming languages, also the computing scientists are responsible. Computer scientists show a considerable tendency to rather analysing and formally defining the often weird languages coming from commercialized language designs. Post-design formalisation is similar to post-mortem medicine. Computing scientists and formalists must take a much more active and creative role in the development of new programming concepts.

6. TOWARDS A PROGRAMMING LANGUAGE FOR MODULAR PROGRAM DESIGN

Based on the discussion presented so far now some thoughts on a general approach to a fully modular language formalism is given. This formalism is thought as a tool for programming in the large. We suggest to introduce two forms of basic programming units (basic building blocks)

- (data) types

- tasks

We do not go into the discussion of concrete syntax not even into the discussion how (by which language constructs) types and tasks should be defined but rather concentrate on the general semantic framework and use a syntax influenced by the design language CIP-L (cf. [CIP-L 85]).

6.1. TYPES

A type defines computation structures, i.e. a signature consisting of a family of sorts and a family of operations and determines a class of Σ-algebras. So types are definitional entities (passive entities). Types are specified in hierarchies (cf. [Wirsing et al. 83]). Sometimes it is even useful to consider parameterized types for allowing schematic design.

Note that it is completely irrelevant for our considerations which way a type defines (a class of) computation structures, whether it uses some model-oriented approach ("abstract modelling", VDM, recursive mode declaration etc.) or whether it uses axiomatic methods (equational specifications, assertion logic, relational specifications etc.).

An example for a hierarchy of (equationally specified) types reads as follows: (the type BOOL specifying the booleans and the type ATOM specifying some sort <u>atom</u> of atomic objects):

```
type LISPTREE ≡

   based on ATOM, BOOL,

   sort tree,

   funct (atom) tree make,
   funct (tree, tree) tree cons,
   funct (tree t : ¬ isatom (t)) tree left, right,
   funct (tree t : isatom (t)) atom atom,
   funct (tree) bool isatom,

   isatom(make(a)) = true,
   isatom(cons(t1, t2)) = false,
   left(cons(t1, t2)) = t1,
   right(cons(t1, t2)) = t2,
   atom(make(a)) = a

                                          end of type
```

The type LISPTREE specifies the computation structure of binary trees with labelled leaves. This is a fairly simple well-known computation structure. A less common computation structure is the structure of "contexts" of the binary tree. It reads as follows:

```
type LISPCONTEXT ≡

   based on    LISPTREE,

   sort context,

   funct context id,
   funct (context, tree) tree leftcon,
   funct (tree, context) tree rightcon,
   funct (context) bool isid, isleftcon, isrightcon,
   funct (context, tree) tree apply,
   funct (context, context) context compose,
   funct (context c : ¬ isid(c)) context restcon,

   isid(id) = true
   isid(leftcon(c,t)) = isid(rightcon(t,c)) = false,
   isleftcon(leftcon(c,t)) = true,
   isleftcon(id) = isleftcon(rightcon(t,c)) = false,
   isrightcon(rightcon(t,c)) = true,
   isrightcon(leftcon(c,t)) = isrightcon(id) = false,
   compose(id,c) = compose(c,id) = c,
   compose(leftcon(c1,t),c) = leftcon(compose(c1,c),t),
   compose(rightcon(t,c1),c) = rightcon(t,compose(c1,c)),
   restcon(leftcon(c,t)) = restcon(rightcon(t,c)) = c,
```

```
apply (id,t) = t,
apply (leftcon(c,t1),t)= cons(apply(c,t),t1),
apply (rightcon(t1,c),t) = cons(t1,apply(c,t))

                                        end of type
```

As it will be shown in the next section objects of sort context can be used to define binary trees with a marked position.

6.2. COMPOSITION OF TYPES

Types can be composed in hierarchies. In particular there are several general principles how to compose given types to types. In particular the following ways of composition may be envisaged:

- products of types
- union of types
- recursive definitions of types

These three constructions can be seen as generalizations of mode building constructs as found in many languages. A typical and interesting example of a form of a product of the two types LISPTREE and LISPCONTEXT is the type LISPPOSTITION.

```
type LISPPOSITION ≡

   based on LISPCONTEXT,

   sort pos,

   funct (context, tree) pos pos,
   funct (pos) tree tree,
   funct (pos) context context,
   funct (pos p : ¬ isatom(tree(p))) pos leftdown, rightdown,
   funct (pos p : ¬ isid(context(p))) pos up,
   leftdown (pos(c, cons(t1, t2))) =
                 pos(compose(c, leftcon(id, t2)), t1),
   rightdown (pos(c, cons(t1, t2))) =
                 pos(compose(c, rightcon(t1, id)), t2),
   ¬ isatom(tree(p)) ⇒ up(leftdown(p)) = p,
   ¬ isatom(tree(p)) ⇒ up(rightdown(p)) = p,
   tree (pos (c,t)) = t,
   context (pos (c, t)) = c
                                        end of type
```

Every object p of sort <u>pos</u> defines a object of sort <u>tree</u> by

apply (context (p), tree (p))

and a "position" in that tree, i.e. there exists a sequence of the selector functions left and right that is uniquely determined by context (p) and selects tree (p) from apply (context (p), tree (p)).

6.3. TASKS

Tasks specify functions between tuples of objects or streams of objects. A task is based on some hierarchy H of types. A task has associated with it two natural numbers n and m: n represents the number of input ports and m represents the number of output ports. Every input port or output port is sorted, i.e. it is associated with some sort s from the hierarchy H of types or with stream s where s is a sort from the hierarchy H of types.

Semantically a task defines (classes of) functions that map tuples of data objects or streams of data objects according to the sorts of the input ports onto tuples of data objects or streams of data objects according to the sorts of the output ports. The most simple example of a task is a n-ary function with functionality

$$\underline{\text{funct}}\ (\underline{s}_1, \ldots, \underline{s}_n)\ \underline{s}_{n+1}.$$

Such a function corresponds to a task with n input ports (of the sorts $s_1,\ldots,s_n$) and one output port (of sort s_{n+1}). But a task may also modell a module or monitor, i.e. an entity with permanent storage. We give a simple example. We start with the introduction of a type specifying "procedure calls" for the task.

```
type LISPMODULE ≡
   based on LISPPOSITION,
   sort pcall,
   funct pcall pup, pldown, prdown, pisatom, pisid, patom,
   funct (atom) pcall  addleft, addright, init,
   funct (pos, pcall) pos update,
   update (p, pup) = up (p),
   update (p, pldown) = leftdown (p),
   update (p, prdown) = rightdown (p),
   update (p, pisatom) = update (p, pisid) = update (p, patom) = p,
   update (p, addleft (a)) = pos (context (p), cons (tree (p) , make (a))),
   update (p, addright (a)) = pos (context (p), cons (make (a), tree (p))),
   update (p, init (a)) = pos (id, make (a))
                                                      end of type
```

Now a task may update a stream of position trees according to a stream of pcall-objects.

```
task update* ≡
   input stream pos p, stream pcall s,
   output stream pos r,
   r = update (first (p), first (s)) & update* (rest (p), rest (s))
                                                      end of task
```

Note that the *-operation is a general programming scheme: Every function f mapping objects of sort $s_1,\ldots,s_n$ onto objects of sort s_{n+1} can be generalized to a function f* mapping streams of objects of sorts $s_1,\ldots,s_n$ onto a stream of objects of sort s_{n+1} by elementwise application of f.

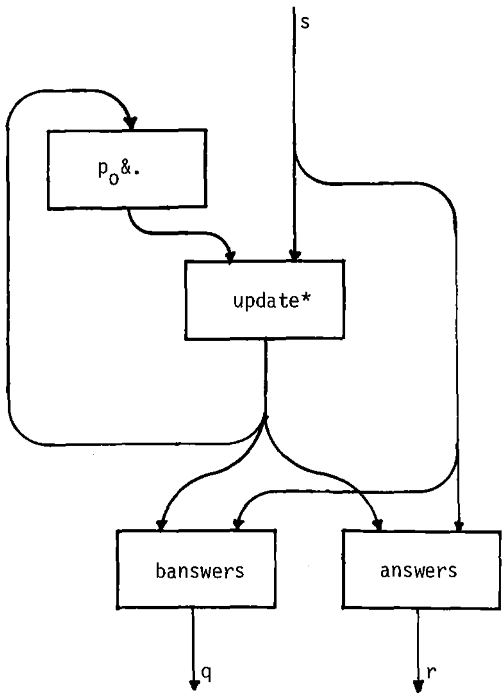
```
task banswers ≡
input stream pos p, stream pcall s,
output stream bool r,
first (s) = pisatom ⇒ r = isatom (tree (first (p))) &
                                    banswers (rest (p), rest (s)),
first (s) = pisid ⇒ r = isid (tree (first (p))) &
                                    banswers (rest (p), rest (s)),
first (s) ≠ pisatom ∧ first (s) ≠ pisid ⇒
                                    r = banswers (rest (p), rest (s))
                                                    end of task
```

Again this task follows a general scheme in stream processing that may be represented by a filter combined with elementwise application of predicates:

```
task answers ≡
input stream pos p, stream pcall s,
output stream atom r,
first (s) = patom ⇒ r = atom (tree (first (p))) &
                                    answers (rest (p), rest (s)),
first (s) ≠ patom ⇒ r = answers (rest (p), rest (s))
                                                    end of task
```

```
task positioned-lisptree ≡
input stream pcall s,
output stream bool q, stream atom r,
∃ stream pos p, pos p0:
p = update* (p0 & p,s),
q = banswers (p, s),
r = answers (p, s)                                  end of task
```

The task positioned-lisptree can be graphically represented by the data flow diagram:



Basically what we have obtained by this is a simple example for object-oriented programming where the positioned binary trees are the objects and the elements of sort <u>pcall</u> are the messages sent to the objects.

6.4. COMPOSITION OF TASKS

Basically there are three ways of composing tasks

- sequential composition: the output ports of the first task are connected to the input ports of the second task (here consistency of the resp. sort attributes is assumed).

- parallel composition: the new task contains all input ports of the given two tasks as input ports and all output ports of the given two tasks as output ports.

- feedback lines: a new task is obtained from an old one by feeding back the output on one output port to one of its input ports (here again consistency of the resp. sort attributes is assumed).

If tasks are composed by these three operations one obtains task expressions that can be interpreted as networks of tasks. Note that there are significant differences between control flow diagrams and networks representing data flow diagrams. In control flow diagrams only the (for programming in the large relatively uninteresting) information about the control flow is graphically represented, in data flow diagrams the much more significant data flow is graphically shown. The compositional properties can be applied in both directions:

- a task can be decomposed into a network of subtasks (divide and conquer),

- a network of subtasks can be abstracted into one task (black box principle),

This way a very flexible modular program structure can be obtained.

7. FINAL REMARKS

Most programming language under use are still mostly influenced by efficiency-oriented (control-flow-oriented) design objectives that have emerged from programming in the small. So they are well-suited for coding (writing efficient code) but not for designing. A programming language supporting programming in the large has mainly to be a design language and therefore it has to include features for supporting modularity and the flexible composition and decomposition of programming tasks.

ACKNOWLEDGEMENT

This work has certainly been influenced by discussions with Alfons Geser, Heinrich Hußmann and Thomas Pinegger.

REFERENCES

[Ashcroft, Wadge 77]

E.A. Ashcroft, W.W. Wadge: Lucid, a Non-procedural Language with Iteration. Comm. ACM 20:7, July 1977, 519-626

[Backus 78]

J. Backus: Can Programming be Liberated from the von Neumann Style? A Functional Style and its Algebra of Programs. Comm. ACM 21:8, August 1978, 613-641

[Bormann 83]

J. Bormann: Programming Languages and System Design. IFIP TC 2 Working Conference, Amsterdam-New York-Oxford: North Holland 1983

[Broy, Pepper 83]

M. Broy, P. Pepper: On the Coherence of Programming Languages and Programming Methodology. In: [Bormann 83] 41-53

[Broy 84a]

M. Broy: Algebraic Methods for Program Construction: The Project CIP. In [Pepper 84]

[Broy 84b]

M. Broy: What are the Differences between Applicative/Functional and Procedural/ Imperative Programming (Submitted for publication)

[Broy, Bauer 84]

M. Broy, F.L. Bauer: A Systematic Approach to Language Constructs for Concurrent Programs. Science of Computer Programming 4, (1984) 103-139

[Broy 85]

M. Broy: Specification and Top Down Design of Distributed Systems. Universität Passau, Fakultät für Mathematik und Informatik, MIP-8405. Also advanced seminar at the TAPSOFT 85

[CIP-L 85]

F.L. Bauer, R. Berghammer, M. Broy, W. Dosch, F. Geiselbrechtinger, R. Gnatz, E. Hangel, W. Hesse, B. Krieg-Brückner, A. Laut, T. Matzner, B. Möller, F. Nickl, H. Partsch, P. Pepper, K. Samelson, M. Wirsing, H. Wössner: The Munich Project CIP, Volume I: The Wide Spectrum Language CIP-L. Lecture Notes in Computer Science 183, Berlin-Heidelberg-New York- Tokyo: Springer 1985

[Church 41]

A. Church: The Calculi of Lambda-Conversion. Annuals of Mathematics Studies, Vol. 6, Princeton: Princeton University Press 1941

[Dennis 74]

J.B. Dennis: First version of a data flow procedure language, in: B. Robinet, Ed., Colloque sur la Programmation, Lecture Notes in Computer Science 19, Berlin: Springer 1974, 362-367

[Goldberg, Kay 76]

A. Goldberg, A. Kay (eds.): SMALLTALK-72 instruction manual. Palo Alto Research Center SSL 76-6, March 1976

[Guttag 75]

J.V. Guttag: The Specification and Application of Programming of Abstract Data Types. Ph. D. Th., Univ. of Toronto, Dept. of Comp. Sci., Rep. CSRG-59, 1975

[Hoare 69]

C.A.R. Hoare: An Axiomatic Basis for Computer Programming. Comm. ACM 12, 1969, 576-583

[Hoare 78]

C.A.R. Hoare: Communicating sequential processes, Comm. ACM 21, (8) 1978, 666-677

[Hoare 72]

C.A.R. Hoare: Towards a theory of parallel programming, in: C.A.R. Hoare and R.H. Perott, Eds., Operating Systems Techniques. Academic Press, New York, 1972, 61-71

[Kahn, MacQueen 77]

G. Kahn, D. MacQueen: Coroutines and Networks of Parallel Processes. In: B. Gilchrist (ed.): Information Processing 77, Proc. of the IFIP Congress 77, Amsterdam: North-Holland 1977, 994-998

[Kowalski 79]

R. Kowalski: Logic for Problem Solving. New York: North Holland Publishing 1979

[Milner 80]

R. Milner: A Calculus for Communicating Systems. Lecture Notes in Computer Science 92, Berlin: Springer 1980

[Pepper 84]

P. Pepper (ed.): Program Transformation and Programming Environments. Berlin-Heidelberg-New York-Tokyo: Springer 1984

[Schönfinkel 24]

M. Schönfinkel: Über die Bausteine Math. Logik. Math. Annalen 92, 1924, 305-316

[Tesler, Enea 68]

L.G. Tesler and H.J. Enea: A language design for concurrent processes. Spring Joint Computer Conference 1968, 403-408

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

TC3 - THE FIRST TEN YEARS

R. A. Buckingham

University of London

The Technical Committee for Education was formed early in the life of IFIP, in 1963, and was soon involved in organising a series of six-month seminars in ADP, primarily to assist developing countries. The first of these, in collaboration with ICC, was in Rome in 1965, and later seminars were in London, Budapest, Paris and Santiago. By 1968 two working groups had been formed, the first for secondary school education, the second to follow up the work on organising seminars. A valuable collaboration developed with the IFIP Administrative D.P. Group (IAG), leading to the first World Conference in Computer Education in 1970. Direct organisation of seminars was replaced by a major effort in curriculum development, particularly in the design of information systems.

INTRODUCTION

It was inevitable that education should come to the fore early in the development of IFIP. In the early 60's there was little formal education concerned with information processing; although the development of high-level languages was proceeding rapidly and courses in programming were widespread, the main educational thrust was still towards the use of computers for numerical computation. Teaching responsibility was mostly with mathematical departments. At the same time the great potential for data processing in a wider sense in business and administration was well understood. A few centres, such as the Automatic Information Processing Research Centre (AMBI) in Amsterdam, were already providing courses directed towards information processing and in the U.K., for example, plans for the training of junior computer personnel (programmers and operators) were beginning to take effect.

The decision to set up a Technical Committee for Education was made by the IFIP Council in 1962 and in August 1962 Niels Ivar Bech was appointed to lead it. Unfortunately because of illness he was unable to develop the work of the committee and at the meeting of Council in Gola, September 1963, it was agreed that R. A. Buckingham, then in charge of the University of London Computer Unit, should take over the chairmanship. A preliminary meeting of TC3 was held in Paris in February 1964 at which Belgium, Spain, U.K. and USA were represented, and attention was given to preparing a programme of activities which would most effectively achieve the aims set for the Committee. These aims were:

(a) to establish the guidelines for comprehensive training programmes and curricula in the science of information processing, with special consideration for the needs of developing countries and to encourage the implementation of these programmes
(b) to generate material to acquaint the general public with the computer and its impact on the various aspects of society
(c) to serve as a central clearing house for all educational material pertaining to the science of information processing.

In line with these objectives it was agreed that TC3 should focus attention on the broad field of information processing rather than on numerical processing which needed little stimulus.

Two further meetings followed in 1964, at Liblice (Czechoslovakia) in May and in Rome in November, by which time 14 members had been appointed. Dr. Mel Shader (USA) agreed to act as secretary for TC3, though it seemed likely that a second secretary from Europe might also be desirable. It was clear that for the committee to work effectively there must be national committees concerned with education in the member countries of IFIP, with whom links could be formed, and that there should also be liaison with other international bodies such as IFAC and OECD.

In one respect events were moving rapidly as in December 1963 a proposal had been received from Mr. A. Gertz, then acting director of the International Computation Centre in Rome, for an extended seminar in administrative data processing. The aim of this was to provide training in ADP which was urgently needed, especially for people from the developing world who might then be expected to train others in their own countries. It was quickly decided to set up a Joint ICC/IFIP Committee to develop and execute this project, which was to be the first major event of its kind on an international scale.

THE PILOT ADP SEMINAR

The Joint ICC/IFIP Committee for the ADP Project began its task in Paris in February 1964, when its members were R. A. Buckingham and Dr. Machgielis Euwe representing TC3, A. Gertz and Prof. J. L. Rigal representing ICC. Thereafter the committee was very active, with four more meetings in 1964 and five in 1965. Others who contributed substantially to its work were N. I. Bech (Denmark), Mel Shader (USA), Maurice Verhelst (Belgium) and Olle Dopping (Sweden); later in May 1965 when Claude Berge became Director of ICC he took the place of Mr. Gertz.

Mr. Dopping was responsible for preparing an outline teaching programme for the seminar, based upon training programmes at AMBI in Amsterdam and at the Swedish Computing Board. The following topics were to be covered during a 4-month teaching period:

A 1) ADP equipment and systems
  2) Techniques of programming
  3) Mathematical techniques of decision-making
B Basic concepts in information processing
C 1) Analysis and design of systems
  2) Management in ADP
D Educational methods

This was to be followed by a 2-month practical training period. The language of the seminar was English.

In May 1964 A. A. M. Veenhuis, who had had five years' experience at AMBI, was appointed as Seminar Director and subsequently took charge of the publicity and administrative arrangements. The plan for financing the seminar was first, that the main costs for its organisation and administration would be covered by a grant from the ICC; secondly that as far as possible the travel and living costs of participants would be provided by fellowships funded by other organisations including some computer manufacturers. This plan was effectively adhered to.

Although at one stage there was a proposal to hold the seminar in Liege, the final decision was that it would take place in Rome between 7 October 1964 and 5 April 1965, and this was aided by an additional grant from the Italian Government. The venue was 'Domus Pacis', a student hostel and conference centre in Rome. Many applications worldwide were received to attend, and eventually 19 participants were selected from 12 different countries in Europe, Middle East, Asia, Africa and Latin America. About one-third of the formal lectures were presented by lecturers from the Netherlands; the remainder by lecturers from Belgium, France, Italy, U.K. and USA.

The seminar itself developed very successfully under the skilful and considerate direction of Mr. Veenhuis, and likewise the practical work, most of which took place in the Netherlands, Belgium and Denmark. At the end all participants were subjected to an oral examination; on the basis of this and their overall achievement those considered by the examiners to have reached a satisfactory standard were awarded a certificate. 14 certificates were presented at the closing ceremony on 4 April 1965, and one more later.

The financial outcome of the seminar was satisfactory. Total expenditure amounted to US $53,365, to which ICC contributed nearly $31,000. Other contributions came from the Italian Government, IBM, Regnecentralen and Philips, Eindhoven. About $17,000 was distributed to students for travel and living costs. The ICC contribution was clearly crucial to this success.

DEVELOPMENT OF TC3 ACTIVITIES

The pilot ADP seminar was a project which came to the fore almost before TC3 was able to function as a Technical Committee and the further consequences of that will be described later. There was an initial period of adjustment during which the Committee collected information on the educational progress in many countries, built up links with national activities and encouraged the formation of national education committees. Some effort went into the dissemination of information and into a study of job specifications. The Congress 65 in New York provided an opportunity to present a special session on 'Education in information processing'.

The period 1965-73 was one of great activity for TC3 during which meetings were held in New York and Grenoble (1965), London and Jerusalem (1966), London and Mexico City (1967), Edinburgh (1968), London (Heathrow) and Vienna (1969), Atlantic City and Amsterdam (1970), Paris (1971), Vienna (1972) and Sofia (1973). As in all IFIP activities, the variety of these venues was particularly stimulating and productive. By 1973 the number of IFIP members represented on TC3 had risen to 23. During this period a number of Working Groups were formed, the first, following a decision at the Jerusalem Council in 1966, being WG 3.1 concerned with secondary school education. The seminar activity eventually led to the formation in 1968 of WG 3.2 for the organisation of seminars. Later, at Ljubljana in 1971 two further groups were approved: WG 3.3 for instructional uses of computers and WG 3.4 for vocational education and training. All of these are still active.

The early collaboration with the ICC is already apparent. When IAG - the IFIP Administrative Data Processing Group - was formed in 1967, a close liaison arose immediately between IAG and TC3 and many educational projects were then developed in cooperation. These included the first World Conference in 1970 and a programme of curriculum development in the design of information systems, to be described in more detail later.

It is appropriate here to recall some of the distinguished individuals who played an important role in the early days of TC3. In addition to Professor Euwe, already mentioned and for some years Director of AMBI, there were Jean Arsac (France), Sergio Beltran (Mexico), Dov Chevion (Israel), Paulo Ercoli (Italy), M. Linsman (Belgium), Zdenek Nenadal (Czechoslovakia), Boyan Penkov (Bulgaria), T. Pietrzykowski (Poland), J. G. Santesmases (Spain), and Hans J. Stetter (Austria). One should add also D. H. Wolbers (Netherlands) and J. Hebenstreit (France), each of whom later became chairman of TC3.

We shall now describe some of the important activities in more detail.

SECONDARY SCHOOL EDUCATION

At the time when TC3 was formed and in the years immediately following the problem of how best to extend education about computers to secondary schools was an important issue in many countries, and one which also received an impetus from the development of on-line computer systems. There were many pioneer efforts, typified by the work of Pat Suppes in California, Sylvia Charp in Philadelphia, W. R. Broderick in England, in developing CAI. Even earlier George Heller and others were exploring the programming ability of young children. National governments at this time generally contributed little and the initiative lay with enthusiastic school teachers, mainly in mathematics, who formed voluntary associations such as the Computer Education Group in the U.K. (1966).

A formal step was made when the 1966 IFIP General Assembly in Jerusalem agreed to the formation of WG 3.1 with Dov Chevion as chairman. This group first met in London in July 1967 but as Chevion was unable to participate the chairmanship devolved on Prof. Wm. F. Atchison from University of Maryland, and he took over at a second meeting in Edinburgh in August 1968. Under his leadership the group had a very active life and he remained as chairman until 1977.

The responsibilities of WG 3.1 included the very important areas of teacher training and CAI. From the start the impact of computers in secondary education was not narrowly interpreted but related to all the main disciplines taught at this level. It was clear that progress was greatly hampered by the lack of technical knowledge possessed by teachers and so, in addition to promoting the interchange of information among member countries, it was decided that a teachers' guide should be prepared. This was actively pursued in 1970 with the result that 'Computer Education in Secondary Schools - An outline guide for teachers' (familiarly known as the 'red book') was available at the first World Conference in August 1970. That was an occasion when WG 3.1 was able to generate considerable interest in its work. A revised version (the 'blue book') was printed in September 1971 and achieved quite a wide circulation, being translated into French, Russion, Danish and Spanish. At this stage there was a fruitful collaboration with the Centre for Educational Research and Innovation (CERI) set up by OECD; this continued for some time through joint meetings and workshops, with great benefit to WG 3.1 in the development of teaching syllabuses.

Some thought was given to developing and presenting a more detailed course for teachers, but this was replaced by a programme of 'topic booklets' pursued with vigour during the years 1971-75 by a dedicated group of teachers and educational administrators. Although the full range of booklets was never completed because of the difficulty of arranging frequent workshop meetings of people from several countries, those issued included 'Aims and objectives of teacher training' (1972), 'Information and information processing' (1974), 'Analyses and algorithms' (1974) and were widely distributed.

Towards the end of 1971 a separate working group WG 3.3 was formed with Sylvia Charp as chairman, to cover 'Instructional uses of computers', including CAI and CAL. A further booklet came from this group entitled 'Use of computers in learning and teaching', but the best potential of WG 3.3 was realised after the period now under review.

SEMINARS 1967-1972

Even whilst the Rome seminar was in progress proposals were made to extend the programme. There were very good reasons for giving priority to a similar seminar in the French language; at the same time it was important to produce a definitive documentation of the seminar in English and for this to be achieved well it was felt that a re-run exploiting the experience gained from the pilot seminar was very desirable. The Joint Committee decided that both projects should be followed up simultaneously though clearly the financial constraints on such a programme were severe. Separate committees were set up to explore the French and English options together with a committee to supervise and coordinate financial arrangements. Although the ICC Executive Committee was anxious to promote the programme and provide support from its budget, financial aid from other sources was essential.

This plan soon ran into difficulties. There were administrative and financial problems within ICC, and Mr. Bech soon withdrew from the financial committee for the seminars. The initial publicity for the seminars produced little response this time, especially for that in French, and postponement was inevitable. However, help for a second seminar in English soon came from another source. Early in 1967 the IFIP Administrative Data Processing Group was formed under the leadership of S. D. Duyverman and it was agreed that in educational matters IAG and TC3 should cooperate. With approval from the General Assembly in Jerusalem an organising board was established to promote a seminar in London, with members from the IFIP Council (Bech), TC3 (Buckingham, Wolbers) and IAG (Duyverman, Verhelst). By this time Henk Wolbers (Netherlands) had replaced Professor Euwe and became European secretary of TC3. There was also a strong Advisory Committee to provide technical support. The Board did its work quickly and the seminar was scheduled for the period 5 July - 14 December 1967 at the Institute of Computer Science in the University of London.

Mr. Veenhuis was again appointed as Seminar Director, and further administrative support was provided by the British Computer Society. The lecturing team was substantially the same as in the pilot seminar. 25 participants were enrolled from 13 countries. Relatively few changes were made in the programme, which ran very smoothly, including the dispersal of students to a wide variety of centres for their practical work, in the U.K. and Europe. Following the final examination 22 certificates were awarded.

Financially the seminar was also successful, being greatly helped by the U.K. Ministry of Overseas Development which provided 9 fellowships of US $2300. The seminar fund also received substantial donations from IBM (UK), ICT, Univac and the U.K. National Computing Centre. In total the budget amounted to about $56,000 including $3000 allocated to documentation of the seminar; IFIP provided an initial loan of $8000, of which 90% was later refunded.

Once the success of the London Seminar was assured thoughts turned to extending the programme to other centres. Areas which were thought to provide possible venues for a seminar included Latin America, Philippines, California, Hungary, France and Denmark. These ideas were brought forward at the 1967 General Assembly in Mexico City. The London Organising Board remained in being, temporarily renamed the TC3/IAG Coordinating Committee, but later transformed into a new working group of TC3: WG 3.2 with the title 'Organisation of educational seminars' and chairman R. A. Buckingham. The aims of WG 3.2 included the continuation of ADP seminars but, as will be seen later, were much wider in scope.

The first positive response to various invitations which were issued came from Hungary, where the John von Neumann Society offered to organise a seminar in Budapest during the second half of 1969, to be presented in English and based upon the earlier seminars. At this time the documentation of the London seminar had been published, in four volumes, by Swetz and Zeitlinger, and was therefore available. IFIP and WG 3.2 readily agreed to sponsor the Hungarian seminar on the basis that financial responsibility would be with the local organising committee led by Mr. Lajos Pesti. The Working Group and IAG provided technical help and a loan of $2700 which made it possible to invite a number of lecturers from W. Europe. In addition Veenhuis made no less than eight visits to Budapest between May and December 1969 to advise the seminar directors, Sandor Farago and Erwin Gombos, and ensure coordination with previous seminars.

The seminar began on 1 July 1969 with 24 participants from 7 countries, 15 from E. Europe and the remainder from outside Europe. The opening ceremony was attended by a delegation from TC3. In the opinion of examiners who assessed the results a good standard was achieved and all students received a certificate.

At long last the first French-speaking seminar took place in the first half of 1970. This followed lengthy negotiations but received strong support from the French Délégation Générale à l'Informatique and WG 3.2 was also able to provide a loan of $3000 for initial costs from its budget. The site chosen was the informatics centre CEPIA at Rocquencourt near Paris; the organising committee was headed by Prof. P. Namiam with IFIP represented by Veenhuis and Verhelst; the seminar director was René Malgloire. For this seminar, which followed closely the pattern set by earlier ones, there were 29 participants from 16 countries. The event was repeated annually for a number of years, with co-sponsorship by IFIP and ICC/IBI and continuing support from the French Government, so that it became a well-established international course.

Finally, during August - December 1972, a seminar was organised by the National Computation and Information Centre (ECOM) in Santiago, Chile, again with IFIP sponsorship but presented in Spanish. This attracted 19 participants from Latin American countries, 11 being from Chile itself. Dov Chevion took part in this seminar and evaluated it on IFIP's behalf.

This completed TC3's direct involvement with ADP seminars at this level. Although the net cost to IFIP was not great - probably less than $7000 up to 1972 - the burden imposed by organisation and supervision was considerable, and by this time there was a growing number of comparable courses available to students from developing countries. The resources of TC3 would therefore be better utilised in other ways.

THE FIRST WORLD CONFERENCE

From the time of the 1966 meetings in Jerusalem the need was recognised for a major conference in computer education at some suitable time, and when TC3 met in Edinburgh in 1968 this became explicit in a proposal prepared by Dov Chevion for a working symposium for 100 or so people, possibly in Israel, in 1970. After discussion a more ambitious plan was developed jointly by IAG and TC3 for a much larger conference, which was recommended to be held in Amsterdam in August 1970. The General Assembly agreed.

An important element of this plan was that the main conference should be preceded by three smaller symposia organised for 2-3 days on a regional basis to prepare the ground. These did indeed take place as follows:

W. European symposium, at Heathrow, London	March 1969
E. European symposium, at Lake Balaton, Hungary	September 1969
Mediterranean/Middle East symposium, at Rehovot, Israel	December 1969

The venue for the World Conference was the RAI Centre in Amsterdam. The organisation behind it was fourfold: first, a Foundation registered in the Netherlands to carry financial responsibility and establish guarantees. This was supported by a Steering Committee to control finance, with representatives from IAG, OECD and IBI/ICC; in addition, Organising and Programme Committees headed by M. van Accoleyen and D. H. Wolbers respectively.

The programme of the conference drew a clear distinction between 'Education about computers' and 'Use of computers in education' and this was reflected in the published proceedings, with two volumes devoted to papers in the areas mentioned and a third to invited papers. There were some supplementary publications also, such as a bibliography on computer education, a report on audio-visual media (ed. H.J. van der Aa) and a review of uses of computers in instruction (ed. K. L.

Zinn). An exhibition accompanied the conference and although this was disappointing in the display of equipment for education, the display of books was extensive and there were interesting demonstrations of the use of computers in secondary education. Opening and closing addresses on behalf of IFIP were given by Heinz Zemanek and Dov Chevion, and the keynote address on 'Computer education in the 1970's' by Borje Langefors. In somewhat unusual fashion the conference ended by producing a number of recommendations addressed to international and national bodies, education authorities and teachers, on the future of computer education.

Altogether, there were 866 registered participants from 40 countries, the largest international event of its kind at that time and appropriately staged during the UNESCO International Year for Education. It was judged a considerable success, aided by good facilities and excellent organisation, and the report to Council recommended that a second WCCE be held in 1975. When reviewed a year later this proposal was upheld, and in 1972 a steering committee was appointed with Dov Chevion as chairman, the host country being France. The later development is beyond the scope of this review, but one step taken by TC3 was to co-sponsor, with IBI/ICC and the Brazilian Academy of Science, the Rio Symposium on Computer Education for Developing Countries, held in August 1972 and to which TC3 members made a substantial contribution.

INFORMATION SYSTEM DESIGN

The formation of WG 3.2 was inspired in part by the need to look beyond the current ADP seminar programme to more advanced aspects of system design, particularly of information systems, which concerned both TC3 and IAG. Thus a task given to the working group when it first met in September 1968 was that of 'developing plans for pilot seminars at advanced level in systems analysis and design and in computer systems programming'. The Coordinating Committee had already addressed this problem in July and in the context of information system design devised a 3-stage approach to an advanced level seminar. This involved first, preliminary planning by a small working party, then a working conference for one week to develop the structure and substance of an advanced seminar, and finally a seminar of 2-3 months for teachers in I.S.D. and experienced analysts. Considerable emphasis was placed on documentation.

This plan developed rapidly, and the initial working party (consisting of the TC3 chairman, P. A. Tas, Malcolm H. Gotterer and Dan Teichrow) drew up a programme for a 'Workshop on a curriculum for systems design education'. This was held in January 1969 at the University of Fribourg with some 40 participants from 13 countries and proved to be a very valuable and constructive meeting. In its report the Workshop strongly supported the proposal for a pilot advanced seminar and stressed that it should cover the essential contribution to the knowledge of the system designer arising from (a) computer science (b) theory of management and organisation (c) analytical techniques, as well as the theory, design and working of information processing systems. It also called for a study of the respective roles of the information analyst and system designer.

Considerable effort was expended on the search for a suitable venue for a pilot seminar, and devising a scheme which would be self-financing, but this proved to be too difficult at a time when preparations for the World Conference were also in hand. At one time the University of Gent seemed a likely site. Eventually the plan was discarded in favour of a series of workshop meetings to develop an advanced curriculum along the lines proposed at Fribourg. In fact three such workshops were arranged, one at Gent in May 1971, and two (under the direction of Frank Land) at the Royal Military College of Science at Shrivenham, England. The latter were in September 1971 and December 1972, and the work was finally completed during 1973. Publication was arranged through IBB-ICC and 'An international curriculum for information system designers' (ed. J. N. G. Brittan) was widely distributed at Congress 74 in Stockholm. Now, ten years later, a comprehensive revision of the curriculum has been completed and will be featured at WCCE 85.

This account of the first ten years may be suitably ended by referring to a project brought forward by UNESCO in 1971. The request was for a study of the development of computer education, which was then implemented through a contract between IBI-ICC and IFIP, with TC3 providing the expert knowledge. A report on 'Objectives in computer education' was completed by the end of 1972. Thus the collaboration which began in 1964 with a joint ADP seminar was renewed in somewhat different circumstances eight years later.

PERSONALITIES

So many people contributed to the activities of TC3 during the early years that a proper acknowledgement is difficult; some have been mentioned in the foregoing account but many have not. From this large number I have selected four without whose unremitting support and cooperation the efforts of TC3 would have been greatly diminished.

Niels Ivar Bech, the Danish representative on the IFIP Council for many years, had an important and inspiring influence on the development of educational activities within IFIP, not only being the chairman first nominated for TC3 but as a member of the General Assembly giving support and encouragement to the educational programme, which to me was immensely helpful. His contribution was an active one, most particularly in the advance planning of the Rome ADP Seminar (and later seminars) and ensuring that the seminar programme received strong financial backing. This included generous support from Regnecentralen, the Danish computer firm with which he was associated.

Dov Chevion, the Israeli representative on TC3 during 1964-67 and 1971-80, and vice-president in charge during 1968-70, was a dominant figure in many of its discussions and activities. Always enthusiastic for education, always optimistic always energetic, he was a strong supporter of the first World Conference in Amsterdam and chaired the Steering Group for the second WCCE in Marseilles. Largely through his efforts the ADP seminar in Chile was achieved in 1972, and in the same year the Rio Symposium on Computer Education. I always gained a great deal from listening to his counsel.

S. D. Duyverman, the founder chairman of IAG and Director of the Studiecentrum in Amsterdam, was likewise very active in his support for the work of TC3. Through his influence the cooperation in educational matters between TC3 and IAG was fostered and sustained. This was most evident in the organisation of the first World Conference at the RAI Centre in 1970, and the later curriculum projects of TC3. I have most pleasant memories of his help and encouragement.

Finally, another Dutchman, A. A. M. (Ton) Veenhuis, already mentioned frequently. His contribution was notably concerned with the execution phase of many TC3 events - the ADP seminars (he was director of those in Rome and London, and closely associated with Budapest and CEPIA), WCCE 70, the Fribourg Workshop and the later ISD curriculum report. For a time he was a deputy director at IBI-ICC and facilitated cooperation with TC3. He was especially successful in the seminars for his informal but effective administration, and easy companionship with students from many countries. Thus throughout most of the first ten years the success of the TC3 programme owed much to his energy and enthusiasm.

CONCLUSIONS

The main content of this paper has been a factual and perhaps unexciting description of the work of TC3 during the first ten years or so. Such an account regrettably fails to record one important aspect - the human, intellectual and social interactions of a large number of individuals, and their dedication to what all believed to be essential, the unrestrained spread of knowledge and expertise in information processing. Even the lighter moments have gone unrecorded: thus a reference to 'chapter six' will bring back a joyful memory to many a member of WG 3.1. Within TC3 itself and its working groups there was, I believe, despite many arguments, a remarkable degree of unanimity and singleness of purpose, not always apparent in the world at large.

However, the facts having been set down there is an opportunity for a judgement. In retrospect the role of TC3 in this early period was properly one of innovation; the aim to start internationally activities which it was hoped could later be developed on a national scale. In that situation it was natural that some activities would start but then appear to tail off. Again, in that situation there were many alternative lines of action which might have been followed. Two events seem to me to have strongly influenced what actually occurred, the first being the letter from Mr. Gertz in December 1963 which set in train the seminar programme which persisted for so many years. Although the number of individuals touched by this may seem small in relation to the magnitude of the problem, the fact that knowledge was passed even in small measure to so many developing countries was bound to be beneficial and to multiply. It was beneficial also to IFIP. Secondly the various decisions taken at the Jerusalem meetings in 1966 led to a surge of other activity reaching a peak in the years 1968-71 - secondary education, world conference, curriculum development. Much more might have been attempted, but given the very limited resources of IFIP itself (though what was available was generously allocated) I believe that what was done was reasonably well done.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)
IFIP, 1986

SOME NOTES ON THE HISTORY OF ALGOL

W.L. van der Poel
University of Technology*
DELFT, The Netherlands

ABSTRACT

Some highlights of the history of ALGOL and the happenings in IFIP/WG 2.1 are discussed in an anecdotic style.

This lecture can only be an anecdotic approach to the history of ALGOL. Its full treatment possibly warrants a longer story than can be given in one hour. Furthermore this lecture is not pureley meant as a scientific effort to treat the history of ALGOL but as an attempt to lift the veil of what has happened in the Working Group 2.1 on ALGOL of the International Federation for Information Processing and for this occasion especially to talk about the rôle Van Wijngaarden has played in this group.
Let me first recall some of the basic facts of the early history of ALGOL. I shall not go into the period before 1962 when the ALGOL movement was purely an undertaking of a more or less well defined group of individuals. This resulted in the Report on the Algorithmic Language ALGOL 60 [1], written by 13 people under the editorship of Peter Naur. Shortly after its publication it became clear that there still were some gross errors left in addition to many more subtle ambiguities. In 1962 the original authors accepted that any collective responsibility which they might have with respect to the devolopment, specification, and refinement of the ALGOL language would be transferred to a newly formed Working Group, installed by the Technical Committee 2 of IFIP. The result of this meeting was also the issue of a Revised Report on the Algorithmic Language ALGOL 60 (Ed. P. Naur) [2]. But all this can be read much better in the introduction to the Revised Report.

The Rome meeting dit not count as a meeting of WG 2.1. This started in August, 1962 in Munich. After this a long and sometimes irregular series of meetings was held:

Sept. 1963 in Delft, The Netherlands. March 1964 in Tutzing, Germany.
Sept. 1964 in Baden, Austria in conjunction with a working conference on Formal Language Description Languages. May 1965 in Princeton, U.S.A..
Oct. 1965 in St. Pierre de Chartreuse near Grenoble, France. Oct. 1966 in Warsaw, Poland. May 1967 in Zandvoort, The Netherlands. June 1968 in Tirrenia near Pisa, Italy. August 1968 in North Berwick, Great Britain. December 1968 in Munich, Germany. Here the circle was closed and the Report on the Algorithmic Language ALGOL 68 was accepted for publication. After this further meetings have been held in Sept. 1969 in Banff, Canada. July 1970 in Habay-la-Neuve, Belgium. March 1971 in Manchester, Great Britain and the last one in August 1971 in Novosibirsk, USSR. Furthermore there was an informal but important meeting of a few people in spring 1966 in Kootwijk, The Netherlands.

This article was previously published in 25th year symposium, of the Mathematical Centre, Amsterdam (MC Tracts 37) and is reprinted unchanged with kind permission of the director of the the MC.

The period form 1962 to 1965 was devoted to defining a subset for ALGOL 60 and for defining some basic Input/Output procedures for ALGOL 60. Although I know that some people do not agree, this period is in my own opinion not the most glorious period of the Working Group. It was more a kind of cleaning up of previous things and getting acquainted with our way of working. This period has been covered mainly in the form of 194 quotations from letters collected by R.W. Bemer, A Politico-Social History of ALGOL [3]. Although Bemer has given an outside view on the inner workings of WG 2.1 and that period certainly merits the view of an insider, I shall not dwell any longer before 1965.

The meeting in 1965 was some kind of turning point in the actions of the WG. We had our hands freed from ALGOL 60 and we could think on a new ALGOL. As we did not know under which year the new ALGOL would appear it was informally termed ALGOL X. This was going to be the short term goal. Possibly another more extended language could result later, which very unofficially was termed ALGOL Y. Randell gave the following definition:

> ALGOL X is a language which could be described, if necessary, in such a way that entities comprising the text of a program are completely distinct from the entities whose significance can be changed by the program. ALGOL Y is a name for a suggested successor to ALGOL X in which this distincion may well be removed.

Some individuals could perhaps have had another understanding of X and Y but the Randell definition has always been adhered to in the WG.

This Princeton meeting was a kind of churn of ideas. Many new ideas were brought in and a lot of scattered ground work was done in subcommittees. Only one complete proposal of a language was on the table, i.e. EULER of N. Wirth [4]. In skimming through the papers I see the case clause emerging, I see fundamental proposals on operators, on the parameter mechanism, on basic concepts etc. But the chaotic state of affairs can perhaps be seen from a remark I made as chairman at that time:

> I am appalled at the lack of decisiveness of the committee. Having been present at the subcommittee meeting and previewing its report, there was a remarkable lack of decisions. Discussions centered around [many details followed here on samll points only]. It seems to me that taking the restricted view is putting the clock backward and we revert to an efficient FORTRAN kind of computer. Even PL/I goes further. We must seriously ask ourselves: what do we want to accomplish? Where are we going? Do we want to compete with PL/I or do we really want to make a breakthrough by providing something more powerful and better defined than before. We have a few excellent reports on the table and what we do is losing our time on a number of small, perhaps incompatible issues of which it is not even known whether they can be combined. We must seriously consider our course of action and I would recommend that we will adopt one complete proposal as the guiding principle and then try to fit in a number of details which are missing or which have not yet been considered. When we go on with fighting over details first and when the main lines of the issue of ALGOL X are not fixed in principle, then ALGOL X will always, like the camel, be a horse designed by a committee.

Between our discussions of serious matters we were very well aware of our sometimes silly behaviour as was jocularly expressed in "working rules" by P.Z. Ingerman in the following way:

1) Whenever a point shows a danger of being clear, it shall be referred to a committee.

2) A subcommittee shall prepare two or more contradictory clarifications of the point referred to it.
3) These clarifications shall be reported by the individual members of the committee, no committee report having seen achievable.
4) The clarifications shall be discussed until one of them is in danger of of being understood, at which point return to 1).

There was always some time devoted to discussion of ALGOL Y. As source of inspiration two articles of Van Wijngaarden were used. One was called Generalised Algol [5] and delivered at the Rome conference, the other was called Recursive Definition of Syntax and Semantics [6] and was given at the Baden conference. The EULER language can be considered as an outgrowth of these ideas, as Wirth was one of Van Wijngaarden's pupils in the time he spent at Berkeley. Let's recall a little discussion in Baden on ALGOL Y.

Bauer:	From Tutzing we agreed provisionally that vW's generalized ALGOL approach could do what we want in AY. Can it be unified with Böhm's lambda-calculus?
Van Wijng.:	I don't know. Don't know if the operations I allow myself can match.
Bauer:	How close are we to agreement?
V.d. Poel:	Wirth and vW. are very close.
Bauer:	Shall we exclude the lambda-calculus?
Garwick:	Hopefully AY will be simpler than A60. How many symbols are required to define A60?
Van Wijng.:	Don't know, but all would go on one sheet of paper.
Garwick:	Then you consider it practical?
Van Wijng.:	Yes.

Unfortunately there exist no informal minutes from the Princeton meeting, but one important decision was taken. Everybody was invited to write his approximation of a complete report for ALGOL X for the next meeting.

At the beginning of the St. Pierre of Chartreuse meeting we saw three volunteers who had done their job: the first was by Van Wijngaarden, Orthogonal design and description of a formal language [7]. Premature and preliminary edition, intended for use by IFIP WG 2.1 only it says on its cover. As only some 30 copies of it were produced this certainly is a collectors item nowadays. The second was from Niklaus Wirth, A Proposal for a Report on a Successor of ALGOL 60 [8]. This was also produced at the Mathematical Centre as Wirth was working there for some time. The third was from Gerhard Seegmüller, A Proposal for a basis for a report on a successor to ALGOL 60 [9].

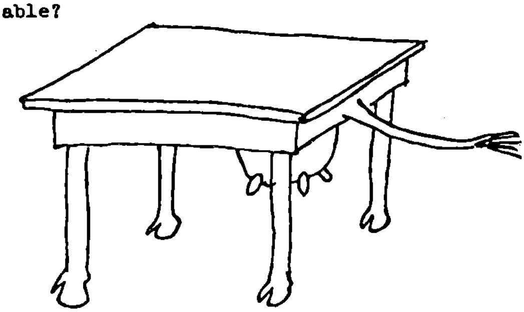
Futhermore there was an important paper on a topic called Record Handling by C.A.R. Hoare. This paper brought in many ideas on the way how to bring in the what we now call "structured values". From this report on Record Handling from Hoare I cite:

> For example the question "who is the mother of" is answered by asking the value of the reference field "mother" which is allocated for this purpose in the declaration of the record class for cows.
> In real life, most relationships are confined to holding between members of given classes; for example a house cannot be the mother of a cow, nor can a cow contain a table......

As a reaction to this Van Wijngaarden circulated the following rebuke around the table of which I happen to have a copy. This illustrated how a cow can contain a table and how an object can be both a cow and a table. He furthermore asks: "Can't a house be the mother of a cow if even a mountain can be the mother of a mouse?

COMMENTS TO "RECORD HANDLING" BY C.A.R. HOARE

Can't a cow contain a table?



Can't an object be both a
a cow and a table?

Can't a house be the mother of
a cow if even a mountain can be
the mother of a mouse?

A. van Wijngaarden, 25.10.1965

This St. Pierre meeting can be considered as the true beginning of the new language. The first two formal resolutions taken at that meeting ran as follows:

1. That a subcommittee be set up, consisting of Hoare, Seegmüller, Van Wijngaarden and Wirth: the subcommittee to be charged to prepare a draft report from the existing material, mainly that which they have themselves presented, taking into consideration to the best of their knowledge and ability what the committee here has expressed as its wishes and views. The subcommittee should exist and hopefully work between this meeting and the next.
2. Whatever language is finally decided upon by WG 2.1, it will be described by Van Wijngaarden's metalinguistic techniques as specified in MR 76. [The orthogonal design etc].

The method of description introduced in MR 76 consisted of a second level of production rules, the so-called meta rules, to produce in their turn the production rules of the language. So we recognise for example:

```
F sequence: F; F sequence, F.
G list    : G; G list, comma symbol, G.
```

The meta syntactic notions are indicated here by single capital "syntactic marks". This made some of the rules terribly hard to read. As a result a request was made to make these meta syntactic notions more intelligible by using words for them. It is strange to note that in later meetings the opposite view was heard that the whole syntax description was too verbose, should be made shorter and could not be translated in foreign languages (natural languages).

Sentences such as:

> The text of the program is considered to be presented as an ordered sequence of symbols. This order will be called the lexicographic order. Typographical display features such as blank space and change to a new line do not influence this order.

can be found almost unchanged in the final Report on ALGOL 68.
At that time the Orthogonal Design made a distinction between three different kinds of minus, i.e. the "minus symbol" for the sign of signed numbers, the "minus symbol" for the monadic negation operator, and the "minus symbol" for the dyadic subtraction operator. APL kept this distinction between the sign of a number and an operator, ALGOL 68 dropped it later out of practical reasons.

Discussion went on on many topics such as exemplified in:

Hoare:	The purpose of the for statement is to single out the common cases of loops, to provide convenient notation for such cases, and to help the reader realize this. Therefore I propose that the controlled variable be invisible outside the for statement and constant inside the controlled statement, and defined as by Wirth rather that by Seegmüller.
Bauer:	I prefer Seegmüller's description.
	....
Van Wijng.:	We should allow programmers to omit parts of the step until element where the standard use was required.

Naur and Randell objected to this as being an instance of empty options.

Bauer:	We should either allow all 8 possible omissions or no omissions at all.

Alan Perlis, one of the original ALGOL 60 report authors joined us as an observer in that meeting for the last time. I include here a few of his quotations.

Perlis: There are three main categories of programming, namely scientific computation, business data processing, and symbol manipulation. These are separate at least in as much as their practitioners are separate. We should propose an ALGOL X which is satisfactory for all three fields.

Another was during discussion of parallel processing:

Perlis: Your language allows parallel execution, but does not permit accurate description of the effects of different rates of execution.

As you will see, not all wishes ventilated in the WG were taken in the final report. The same is true for the next statement:

Perlis: An implicit declaration of the controlled variable removes flexibility - for instance it cannot be other than single precision.

In general the St. Pierre meeting was a most constructive meeting.
Naur introduced his notion of Environment Enquiries and also contributed a proposal for the introduction of the report, explaining its aims and purpose. Although we were always short of time and often worked during the evening time as well as on subcommittees, there was a lot of fun and jokes. In my own notes I find a lot of funny jokes and quips of which I cannot always trace its author or inventor.

Would you please call a syntaxi for me?
We have forgotten to put Gargoyle on the fire!

(Garoyle was a system writing language devised by Jan Garwick [21]).
Another double bottomed saying (I think coming from Ingerman, who always was a maker of pun and fun) was:

This language fills a much needed gap.

As a sideline I find here a nice definition of artificial intelligence.

Artificial Intelligence is the misusing of machines to act like human beings.

The four people designated by the committee to write a single report for the next meeting, i.e. Hoare, Seegmüller, Wirth and Van Wijngaarden actually came together between meetings in April '66 in Kootwijk Radio, Holland. At that time Barry Mailloux had joined the mathematical Centre as a research student. Mailloux attended the Kootwijk meeting as an observer. I also could attend as an observer in my quality as chairman of WG 2.1.
Very soon it became clear that the Kootwijk meeting would become a breakpoint of opinion between Hoare and Wirth on one side and Seegmüller and Van Wijngaarden on the other side. Hoare and Wirth had progressed between themselves so far in the direction of particular proposal which took the direction of the "diagonal approach" that it was very difficult to reconcile this with the "orthogonal approach". The orthogonal approach is the approach in which all possible combinations of two or more independent concepts were allowed, while the diagonal approach only would insert those possibilities in the language as were seen fit for some purpose. Such situation arose e.g. in the declaration of simple quantities as constants or as variables and in the same way declaring procedures as constants or variables. The same diagonality appears in the conformity relation, which under the diagonal approach would be made applicable only to records (as has been laid down in SIMULA 67, another offshoot of the

record ideas of Hoare), but would also be applicable to other "modes" such as united modes in the orthogonal approach. Also the speed by which the different parties thought they could produce a final report was not agreed upon. Let me quote some passages from the subcommittee report.

> The other two members of the subcommittee (Hoare and Wirth) felt that their primary duty was to produce a report which WG 2.1 would have a good chance of accepting as ALGOL 66 [!], even if such a report should be inferior to one which might be accepted in the following year.
> ....
> In view of this fundamental disagreement on approach, it was agreed that Wirth and Hoare should proceed on the original plan to edit the most important of the unanimously agreed improvements into the "Contribution" and a summary of the changes is being sent to members of WG 2.1. for their consideration.
> ....
> All abbreviations in the metalanguage and metametalanguage should be replaced by full words of the English language.

The "Contribution to the development of ALGOL" by Wirth and Hoare [10] ultimately resulted in ALGOL W, developed at Stanford University [11]. This was taken out of the realm of activity of WG 2.1.
Barely before the meeting in Warsaw (which had already been postponed because of the enormous difficulties in turning out a document) a new proposal was sent around. This proposal did not yet contain any I/O procedures and had to be considered as incomplete. Nevertheless it was accepted at the meeting as the working document, commissioned from the subcommittee working in Kootwijk. Hoare supported the document if it would not be simply rubberstamped by WG 2.1, but he withdrew from the subcommittee. Wirth on the other hand was not able to come to Warsaw. He wrote a letter in which he stated that he was not prepared to discuss the report before Van Wijngaarden had fulfilled the task taken upon him in Kootwijk. He further thought that the document should be released if and when an implementation of the language had been proved to be practically possible.
The document as it was now on the table contained the parameter mechanism with the identity declaration as it is now in the Report on A68. But many things had not been invented yet. There were no coercions, there were no definable operators yet. Let me again quote from what was said. (These quotations are partially derived from the informal minutes of the meetings, partly from my own note book. The informal minutes were were not formally accepted at the meetings, but they are pretty reliable, thanks to our different secretaries, R. Utman for Princeton and before, B. Randell for St. Pierre and W. Turski from Warsaw onward).
In the introductory discussion on the just submitted new document:

> Van Wijng.: I think that the delay in producing the final version may mot be very long.

We still were optimistic at that time! The parameter mechanism was explained.

> McCarthy: I could propose a new notation but I think I should do it in writing. Two questions more: 1. Can we have other constructions like quaternions in the language. 2. Could we do the list processing in the language.
> Van Wijng.: Yes, to both questions.
> ...
> McCarthy: Why cannot we have overloading as defined by Hoare in the NATO Summer School Notes. I advocate it!
> Van Wijng.: I do not need this concept. I can do everything without it, via an appropriate procedure. .... The procedure is a much more fundamental thing. I am against having too may specia-

	lized tings.
McCarthy:	So it is a matter of taste. If I put a resolution for having overloading would we vote on it, or would it upset all other things. ... Could you, or any other expert, help me to work it out.
Van Wijng.:	O.K.

We now know that it actually got in between Warsaw and Zandvoort. (Overloading was a term, which was used for operators, which had to be redefined for other data types such as matrices or quaternions);

Woodger:	Stop talking about notation. Overloading should belong to ALGOL Y.

But a few minutes later the same Woodger said:

Woodger:	If overloading should be in ALGOL Y, why not in X. Why do we not put a good thing into ALGOL X when we find one, other than because of the fear that all good things would be put into ALGOL X and nothing will be left for ALGOL Y.

References always were a hot topic. Wirth had struggled with them before and had declared himself against several times.

Bauer:	That was the problem of conceptual economy to merge references and references to records. Was it difficult to bring them together?
Van Wijng.:	I recognize them as being the same thing. It did not cause any difficulty, on the contrary, it simplified the matters.
....	
Landin:	What if I want to remember whether the name of the variable to which I assigned the value a "q" in it. ... I should have a mechanism of manipulating an identifier.
Van Wijng.:	Not at all - the identifier is used for identification only, it has no inherent features. If you want your language to be conscious of the identifier structure please do so, but that is not ALGOL.
....	
Van Wijng.:	I will tell you the history of my thoughts. In Princeton, there was no talk on records and, of course, not on references and their restriction. In Grenoble, I did not include any records into the othogonal language because I did not feel safe on these grounds. It has been decided, however, that we should include records into the language. We were thinking how to glue these things together, and the best way we could do it was adopted. I did not change my mind, my thoughts have envolved.

In this way these meetings went on. It is really very hard to swallow new thoughts from somebody else in another frame of reference. You must first map it back to your own frame of reference before you can really disgest it.
S. Moriguti was our designated representative from Japan. But Japan is far away and the Japanese wanted rather to give a different person the opportunity to go to the meeting. So we had had in the previous meetings three times another representative, Mr. Moriguti. In Warsaw we had for the first time in fourth representative, Nobuo Yoneda. But he was quite different from all others. He mastered the English language fluently and he was one of the sharpest analytical minds in our group. At the table speeches on the closing banquet it was remarked that "Yoneda was the best Moriguti we ever had". He was going to stay as a

member his own right since then.

A few more quotations from the end of the meeting:

Van Wijng.: I want to add that the document published will include I/O. ... I do not expect that future differences in documents will be very big.

Again what an unwarranted optimism!

V.d. Poel: I think the document should be published in the ALGOL Bulletin and should submitted to as many journals as will accept it free of charge.
Randell: By the time it comes out in, say, CACM, it will be obsolete.
McCarthy: As a piece of scientific information it will not be obsolete.

When discussing some points on structured values for which of course the example <u>person</u> was always chosen, I remember the following sentence enunciated by McCarthy:

McCarthy: Persons may be said to be cartesian products of some members and their father.

Historical!

At last the following formal resolution was taken:

a) The document identified as Warsaw 2 [this was the submitted document] be amended in the manner indicated in the discussion of this document. These amendmends will include at least the incorporation of the I/O Proposal and the addition of missing sections of explanation, motivation and pragmatics.
b) The amended document is to be published as a working paper of WG 2.1 in the ALGOL Bulletin and offered for publication to other informal bulletins. This working paper is <u>not</u> to be offered to any formal or refereed journal for publication.
C) The editing committee working on this document will take into particular account those weaknesses and deficiencies, if any, discovered in the course of implementation of the language.

Van Wijngaarden was then asked to act as editor, which he accepted. The period between Warsaw and Zandvoort was rather long, too long in the opinion of some members. I have gone into the previous meetings rather in a detailed fashion, because the basic principles were laid down in these early meetings. As the day of final acceptance drew nearer, more and more time was devoted to formal and procedural discussions. But let us first look at some quotations again.

Van Wijng.: If you recall the Warsaw meeting you should remember that I agreed to write the report but under the specific conditions that no time pressure will be brought to bear on us.
We have incorporated two new features: the Samelson's feature and the overloading. "We" in this context means myself and Messrs. Mailloux and Peck who worked as devils.

Indeed, the complete report was now reworked. The Samelson device was the handing in of parametrizable forms, or lambda forms as they are called in other languages, as actual parameters. The coercions also were invented by that time but they were by no means leak proof yet.

The old-fashioned notation <u>real</u> x now was an extension, a kind of abbreviation for <u>ref</u> <u>real</u> x = <u>loc</u> <u>real</u>, although the syntactic sugar tasted a little bit less sweet in these days. So a <u>ref</u> could be dropped sometimes. But <u>real</u> pi = 3.14 could not be extended. This prompted Seegmüller to ask the following question:

Seegmüller:	When we go from strict into extended language ... we drop something in one case but not in the other. Is this not slightly misleading?
Mailloux:	It is very simple. You just explain to people that = is a negative reference.

....

Bauer:	Why to use the term "generator" and describe its action as creation?.
Van Wijng.:	It is difficult to find better terms. If you could give them to us we should be happy.
Bauer:	The words you use are so ambitious.

Parallelism was discussed to great extent. There were "elementary" actions defined in the report (what now are called "inseparable actions") but pressure was exerted on the editing committee to insert the P and V operations of Dijkstra as the means of synchronization. The discussion was rather inconclusive and the dangers of only giving some quotations from the full discussions are great. Nevertheless I want to quote the following:

Randell:	Dijkstra says that taking a value and assigning a value are the only two elementary actions.
Mailloux:	We have already agreed to give you P and V.
....	
Van Wijng.:	... We shall say we are not ignorant of the problem but the state of art is such that it does not yet permit for inclusion of parallelism in ALGOL (67). But, whatever will be the outcome of the research on parallelism, the concept of elementary action and elementary symbol will be in, so let us let them in.

He was wrong in that statement. For a while the elem symbol stayed in together with the P and V operation, later called up and down operation. It was Niklaus Wirth who transmitted the message that not both concepts could stay in together, although he had left the committee as a member later. As a consequence the elem operation disappered, but the elem symbol reapeared in a later version, now as the 'n-th element of' symbol.

Wirth:	It would be funny to take a parallelism out, but only part of it.
Randell:	It is like taking half a tooth out.

All this talk on parallel phrases made some of us invent a nickname for Fraser Duncan. He was called a parallel fraser.
At this moment I recall another anecdote. When planning the Warsaw meeting Bauer asked, why in Warsaw. What can you buy in Warsaw on Saturday. Answer: the same as on Friday. From the Zandvoort meeting I also have the quip:

> If the bible had been written like this there would have been many less christians.

In the very beginning of the WG 2.1 on ALGOL there were attempts from the side of IBM to get a unified effort of developing FORTRAN and ALGOL.
Later there has been an effort from SHARE, which developed the NPL (later being known as PL/I) to bring this New Programming Language and ALGOL X together. Actually both committees have exchanged observers at some time.
McIlroy once attended our meeting as an observer in Baden and I have attended a SHARE meeting on NPL in Hursley. But the principles of designing a language were so far apart that these efforts soon bled to death. Not only the scientific

starting points were different, but in particular the commercial viewpoint was different. How could a firm as IBM who felt responsible for the language PL/I put things in the hands of such an irresponsible bunch of scientists. On the other hand it must be said that the selling power of the IFIP is not always that it could or should be. We sometimes made the joke of saying: PL/I for the IBM CCCLX.
At the request of Yoneda there was an added syntactical chart to the document. Yoneda himself produced several fine specimina in his very precise handwriting. One produced by Peck had the motto:

> People who like this sort of thing will find this the sort of thing they like. (Abraham Lincoln).

Speaking about motto's I always regret that one motto has disappeared from the final report, but figured in one of the numerous intermediate versions.

> Yes, from the table of my memory I'll wipe away all trivial fond records. (Hamlet, Shakespeare).

This motto headed the chapter on structured values, formerly called records after the idea of Hoare. The editors apparently thought it unkind to wipe away all fond memory of records.
Another very long year went by before we had the next meeting in Tirrenia, Italy. The editing committee had now grown to 4 people:
Van Wijngaarden, Mailloux, Peck and C.H.A. Koster. Koster mainly worked on transput (i.e. Input and Output). Peck became the specialist in syntax and coercion, Mailloux worked out implementation [4], Van Wijngaarden was the party ideologist. In the mean time a "Draft report on the algorithmic language ALGOL 68" (Report MR93 of the Mathematical Centre, Amsterdam) [13] had been mailed in February 1968 as supplement to ALGOL Bulletin 26 to the subscribers of the AB. The Tirrenia meeting would be informal except for the last day, because of the 3½ month rule of Zandvoort. Only so long after the mailing could the meeting be convened to give the proper opportunity to the members to read the revised document. But alas, nobody ever read the papers of anybody else in this committee. (Or is this true in other committees too?) Naur did not believe in committees any more as the stated in BIT [20]:

> A committee is a group of people unwilling to work, organised by other people incapable of doing so to do work which is probably useless.

Well, the editing committee certainly has not been unwilling to do work. If I only measure the height of the stack of iterations of documents I come to some 75 cm. And it may be true that a committee wastes hours, it keeps minutes.
The meeting in Tirrenia was about the last one where really technical matters were discussed. There were some strong objections to the publication of the Draft Report because some copies indeed had penetrated to refereed journals and even some copies were found for sale in a London bookshop. But all this was smoothed out. It was after only distributed as an ALGOL Bulleting Supplement.
A point of discussion was the description method. Several times other methods of description for the same language were invited but no reports were submitted except for one form Duncan, which reverted to the use of angle brackets. It did not convince the majority that it really was another kind of description, instead of just another notation for the same thing.
We often asked ourselves in how far the language to be defined was independent of the method of definition. Would not it be another language if the defining method is completely changed.
The MR93 certainly was difficult for the uninitiated reader. I quote here from a personal letter from Duncan of 25th March, 1968.

> ... In London we have been trying to get to grips with MR93. Landin has a

> fortnightly seminar, which the other 3 of us [Hill, Russell, Lasky?] usually attend. ... I think it is no exaggeration to say that a widespread opinion is that the document itself is extremely difficult to begin to understand (and unnecessarily so), but that inside it there may well be a good language trying to get out. Maar niemand wil een kat in de zak kopen [Duncan knew Dutch].

There was growing a good deal of opposition to the document and the language. Here is a quotation from a letter of Dijkstra (undated! but my date is 2nd April, 1968):

> Motto [one of them]: "there are writings which are lovable although ungrammatical, and there are other writings which are extremely grammatical, but are disgusting. This is something that I cannot explain to superficial persons." [from Chang Ch'ao] ...
> Thank you for sending me MR93, which has absorbed a considerable fraction of my available mental energy since it is in my possession.
> [Dijkstra was seriously ill at that time]. It must have been very hard work to compose it; alas, it also makes rather grim reading. The document turned out like I expected to be, only much more so.
> The more I see ot it, the more unhappy I become. I know it is a hard thing to say to an author who has struggled for years, but the proper fate of this document may indeed range from being submitted to minor corrections to being completely rejected. ...

Here is another reaction of H. Bĕkic of 23rd April, 1968:

> ... My first impression was that it is much richer ... much more complete ... and also more condensed than previous versions. ...
> I cannot help deploring many of the reactions to the Report, even though, in a sense, I share them. It is an amazing question how it can be that a Committee which has charged you to do that work and has had the chance of watching the direction into which it moves and of voting on intermediate results, now produces such reactions; and I think it would be worthwhile to analyse this question from the Minutes or from some more complete private recordings. The main concern seems to be about matters of style, and of understandability. Now style is a very important thing, but very difficult to argue about. ...
> ... I for one find it difficult to get a really thorough and connected view of such a big thing like the ever-growing informal definition of PL/I, or our formal definition of it, or now your Report, and others may find themselves in a similar necessity to divide their energies.
> ...

Much of the critique came in directly to the Editor. These letters form an enormous stack together. In the same style as introduced in MR93 using two letter abbreviations as PP for Preliminary Prologue er EE for Ephermeral Epilogue, series of remarks from certain places got abbreviations too. E.g. AA for the Amsterdam Ameliorations, BB for the Brussels Brainstorms, CC for Calgary Cogitations (Peck was in Calgary again), MM for the Munich Meditations, LL for Landin's Laments and even greek letters such as $\phi\phi$ for the Philips Philisophies. The BB's have been issued later as Report R96 from the Manufacture Belge de lampes et de Matériel Electronique, where four very active members were working: M. Sintzoff, P. Branquart, J. Lewi and P. Wodon. This report alone contains 197 BB's and is 2 cm thick [16].

A few quotations from the Tirrenia meeting:

[1:2] <u>real</u> b = (3.14, 2.78)
Goos: [The above clause] is undefined by the language.

Van Wijng.:	It is not.
Goos:	Then I can treat it, I can see it easily.
V.d. Poel:	So you want to forbid only cases which you cannot see?
Goos:	Yes.

Yoneda raised a new point and insisted that unions should be defined in such a way that they are commutative so that union (int, real) would be the same as union (real, int). They also should be accumulative. This has become one of the showcases of what could be done with the syntactic formalism but when you ask me personally, I still find it ugly and too complicated. But as usual, it the editors saw a way to satisfy the wishes of the members expressed in their voting, they tried to do it and they often succeeded.
The struggle for acceptance had begun, we neared completion and the technical content of the meeting went down, the formal matters going up.

Van Wijng.: I have been a long long time in the Algol Committee. I have had bad experience with producing working papers for WG 2.1. People have published what I couldn't publish (Orthogonal design). Therefore it is a fair request of the authors: If you like it, take it; otherwise, we publish. I have not fulfilled my task if you consider (what is not in the Minutes) the talks before closing the Warsaw meeting.
This WG has worn out its first editor, Peter Naur. Then it has worn out two authors, Wirth and Hoare. If I understand right, it has worn out now four authors.

...

Bauer: Aad, [Van Wijng.] don't throw away the baby because the shoes don't fit. You want the committee to accept not only the language you have defined but also the peculiar form of description you have chosen for your definition.

...

V.d. Poel: Perhaps this is the last chance for a Committee to design a language.

At the beginning of the North Berwick meeting, I seriously considered to invite a psychologist as an observer to study the behaviour of this very peculiar group of scientists. If ever somebody thought that a language design could be made on reasonable grounds alone, he is mistaken. I have never seen so many emotional arguments being brought in as in this WG.
Gradually a dissident party could be discerned in the group. Ranging from "drop the whole thing" to "it should be more formally defined" the discussions were sometimes very chaotic. When discussing on in and out procedures, we found the appropriate terms: insane and outrageous. I find it very difficult indeed to give a clear account of the very subtle shades of opinions, which were sometimes ventilated in rather fierce attacks in words. The best I can do is still give some literal quotations, but I am aware of the fact that even the selection I had to make could give a partial impression. I can assure you that I found these last two meetings before the final acceptance the most difficult ones.

The last formal resolution of Tirrenia read:

The authors are invited to undertake to edit a document based on MR93, taking into account the questions and remarks received before, on, and possibly after, this meeting to the best of their power in the time they can afford for this job. This document will be submitted to the members of WG 2.1 before 1st October, 1968. This document will be considered by WG 2.1. Either WG 2.1 accepts this document, i.e. submits it to TC 2 as Report on ALGOL 68, or it rejects it.

The first days of North Berwick were used up in a rather fruitless polling of opinion on the most important topics for the future. Among them were Maintenance of ALGOL 68, self-extending languages, primitives, abandonment of ALGOL 68, operating systems, conversational programming, shared data bases and so on. Many of these terms were only O.K. words and were not defined.

Dijkstra: Condensing of the interest is very interesting and promising but I would recommend to the members of bit of soul-searching to discover the extent to which they were lured by a number of the O.K. words. I am extremely verbally thinking and my thinking can be led astray for days by vague associations caused by O.K. words.

The possibilty was discussed to have a minority report going with the document.

Van Wijng.: Is it really necessary to have the minority report? The ALGOL Working Committee prepared documents published in 1958, 1960, 1962 and 1964. On all these occasions there was no one who agreed in every respect with the documents.
In many cases the precise formulation of the documents was not even known, but the names were attached. The voting on the Subset was on the verge, the minority was very substantial yet there was no minority report.

Randell: It would be very nice to believe that the intersection of our opinions is to be published, it is obviously premature to believe that the minority report will be necessary. But the ruling that there is not going to be a minority report is as deplorable as I can imagine. ... There must be a vote in December. Until then the discussion about the minority report is premature.

...

Zemanek: We should take into account the effort undertaken.

Dijkstra: The amount of effort has no bearing on the successfulness.
I cannot honestly see why we should take into consideration the amount of efforts put into work. Amount of efforts should bot influence the judgement, should not put pressure on us. I am still using mild expressions.

Zemanek: Sir, I know you think of blackmail. I am not putting any pressure on you.

Van Wijng.: I want to make my personal interpretation of Zemanek's statement. The amount of efforts was put into activity by the request of the members who were kind enough to attend last meetings. This puts some responsibility on the members who requested this effort. This does not put any responsibility on members who showed no interest. I would only like them to continue not showing any interest in the future.

Sometimes the atmosphere was nasty as you see. There was a kind of loss of trust as Randell expressed it.

Bauer: Can we go back to the idea of working parties? ...
To me it seems that "primitive" and "self-extending" people could sit together, I do not know about the others.
I hope that the Chairman has enough wisdom to help such parties to be created.

V.d. Poel: Do you suggest that these parties submit their results to the whole group or that they should have their own rules?

Bauer: I refuse to give you the answer.

Dijkstra: I am trying to picture such a liberal grouping. The group to which I would be most attracted would be less decided by the subject of the work and more by the attitutes of other member bers in such party.

Turski: Is it that you do not care what you do as long as you do it with whom you like doing it?

Dijkstra: Certainly not, but what you can achieve depends on the attitude as much as on the subject. I can be better cooperative in the group which is better suited to my slow-wittedness.

As we know now a new Working Group was formed later, called WG 2.3 on Programming tools. In contrast to WG 2.1 this group had not the task of developing ALGOL, that is, a definite language to be used.
Here I come across a Guiding Principle, invented during the coffee breaks, i.e. the Bauer Principle.

Ross: Do I understand that you have simple modules of the language, and the experimental ones?

van Wijng.: We apply the Bauer Principle: who does not want to use complex facilities, does not pay for them. If the user wants to use them he has to pay a little.

Lindsey, who had written "ALGOL 68 with fewer tears" [22] was one of our new observers at that time and soon afterwards became a member.

Lindsey: ... The built-in operators, like + and -, shoud be implemented in an efficient manner, not by procedures. ... The operator definitions certainly should not be permitted to be recursive.

...

Van Wijng.: Is it meant that this WG 2.1 is recursive in its decisions in the sense that we may undo decisions on which two years of work were based? If we accept this point of Lindsey we will procedure a FORTRAN-like language, by this I mean its intellectual level.

Somewhat later the difficulties of storage administration for the heap were discussed.

Hoare: ... We are still exploring the areas of storage administration and the solutions are yet unknown. ...

V.d. Poel: There is no real problem in it. In the single level store the garbage collection problem is solved now.

Ross: I would dispute this.

At this moment we know for sure that it has been solved!
Another example how different attitudes and frames of thinking were popping up repeatedly was the "assignment operator" as some people called it. This is perhaps true for a typeless language such as LISP with only a built-in dereferencing of one stepp working uniformly on operands but it is not true in ALGOL 68 where "soft := strong" and "firm + firm".

Hoare: ... Inability of extend the definition of the assignment operator, as you can extend other operators, is responsible for many coercions built into the language.

Van Wijng.: I disagree because := is not an operator at all.

Hoare: I agree that you made things very asymmetric.

That's how life is! The relevant formal resolutions stated that minority reports could be part of any final document produced, but then they must be or have been submitted in writing to all members present at the meeting at which the final document was to be accepted.

That brought us to the last meeting in which ALGOL 68 had to be accepted or dropped. I had indicated my wish to resign as chairman after seven years of office at the end of the Munich meeting. As I stated in my opening word:

V.d. Poel: I am very happy that we returned to Munich. I do not know whether it is symbolic, whether it is the end of our meetings, or the work is endless, cyclic.

As several refinements had been put in between North-Berwick and Munich (two more complete reprintings, labelled MR99 and MR100) there was again quite a lot of technical explaining going on. The case-conformity clause was invented.

Landin: I thought that the case clauses were some sort of nested <u>if</u> clauses!

Van Wijng.: Yes, but you first have to find the value of i [in <u>case</u> i in ...].

Landin: O yes, I see!

...

Van Wijng.: I would like to ask that at least point 2 [on additional clarification asked for and motivations] is continuously on the menu.

Dijkstra: I think I disagreee with that.

Van Wijng.: But I want to have the substance matter continuously on the menu.

...

Seegmüller: The idea of hardware language is introduced very vaguely. What is the distinction between the representation language and the hardware language?

Van Wijng.: It depends on your reading equipment.

...

Seegmüller: I would not go as far as this. But I would try to be a bit more precise.

Van Wijng.: Why do not you go, sit in the corner, and make proper wording.

Seegmüller: O.K., I shall try.

At this time the idea of the II, the Informal Introduction to ALGOL 68 [18] was brought up. Lindsey and Van der Meulen had volunteered to undertake such a work. Lindsey made a presentation of the lay-out of this work.

Seegmüller: A part of my suggestion was that the II should be published together with the defining document. I would like to repeat this point.

Lindsey: You will have to wait.

Seegmüller: Then I would rather delay the publication of the Report.

V.d. Meulen: You cannot write the introduction before the Report is closed.

V.d. Poel: There was not commissioning of this work, we are entirely in the hands of the authors of II; when they finish it, it will be published.

Now the negotiations began on the wording of a cover letter for the Report. This took a long time and all controversies were raised again.

Duncan: I am not of the opinion that the document describes a language. Another point is that I do not know why anybody should be interested in my opinion.

He was feeling very low apparently and I know why. I am not going to disclose that piece of information. I also have my professional secrets. Later on description methods, Duncan's against Van Wijngaarden's.

Duncan:	The description method [of vW.] failed by tests. Another thing is that if my objections as a member of this Group are not taken, then what a chance do I stand as a member of the public.
V.d. Poel:	Many of your objections were taken into consideration.
Van Wijng.:	I made improvements according to your suggestions even before I received your letter.
Turski:	A clear example of Extra Sensory Perception!

As an intermission to these little fights let me just tell you about another nice procedure which would in one stroke promote ALGOL X into an ALGOL Y. At one time the following procedure was proposed:

<u>proc</u> execute = (<u>string</u> progr): ¢ the string progr is considered as a possible closed clause and elaborated at the textual position of the call ¢;

This procedure could transform a sequence of characters into a closed clause, i.e. a syntactic notion. In other terms, it could invoke the compiler at run time. A simple operation system could now be written as:

<u>do</u> execute (read)

Execute as a program what you have read as a string and read the next program when you are ready. The proposal was not accepted. What a pity!
For the authors, who tried to create a milestone, found that it had become very much a millstone. They had to be careful that it would not become their tombstone.
The Munich meeting had sailed clear of a minority report but in the last half day it still happened. Signed by Dijkstra, Duncan, Garwick, Hoare, Randell, Seegmüller, Turski and Woodger such a minority report was handed in. For the text I have to confer to the ALGOL Bulletin, in which it was published. I rather quote here from the less accessible documents.
The meeting concluded with a number of formal resolutions:

1. Resolved that WG 2.1 recommends to TC 2 to create a working group on Programming Tool Requirements and to reconsider the membership of WG 2.1. This was proposed by Van Wijngaarden [!] and seconded by Dijkstra and taken by 35 in favour, 2 against. The creation of WG 2.3 informally was a fact. In a second resolution Lindsey and Van der Meulen were thanked for their initiative in producing II.
2. Resolved that the Chairman, with the assistence of the Secretary, shall transmit to all members of TC 2 a copy of MR100, together with the text of the agreed Covering Letter. Subject to the approval of TC2, the authors shall submit copeis of MR100, together with the agreed Covering Letter, at least to the following journals: Comm. ACM, The Computer Journal, Numerische Math. [17], Kybernetika, Calcolo, Revue d'AFCET. The authors may introduce all necessary corrections to MR100 before submission and at the proof-reading stage. This last vote was taken with 27 in favour and 2 against (8 abstained).

After this 4 more meetings have been held, now under a new chairman but an old member: Manfred Paul. The membership has changed and the topic has reverted back to very deepgoing technical discussions. Of course some errors have been found, but they were lying very deep and are of no concern to the ordinary programmer. Several long felt desires have been proposed and are readied for inclusion in a Revised Report as stipulated in the Covering Letter. Also a rather full

implementation proved many expectations to be true. It is not a big compiler, it is efficient [23].
I shall not go into these years. This is good for another jubilee and for another author. For the next chairman it could be "the only most important case" as he once said in another context. For me it were the "longest 7 years I ever had" to paraphrase another anonymous remark on the longest 5 minutes somebody ever had.

REFERENCES

[1] P. Naur, (Ed.) Report on the Algorithmic Language ALGOL 60. Regnecentralen, Copenhagen, 1960.

[2] P. Naur, (Ed.) Revised Report on the Algorithmic Language ALGOL 60. Num. Math. 4 (1963) 420-453 and in many other journals.

[3] R.W. Bemer, A Politico-Social History of Algol. Annual Review in Automatic Programming, 5 (1969) 151-237.

[4] N. Wirth and H. Weber, EULER, A Generalization of ALGOL, and its Formal Definition. Techn. Report CS20, Comp. Sci. Dept., Stanford University, 1965.

[5] A. van Wijngaarden, Generalized ALGOL. In: Symbolic Languages in Data Processing, Proc. of the Symposium by ICC, March, 1962. Gordon and Breach, 1962.

[6] A. van Wijngaarden, Recursive Definition of Syntax and Semantics. In: T.B. Steel (Ed.), Formal Language Description Languages for Computer Programming, Proc. of the IFIP Working Conference on Formal Language Description Languages. North-Holland Publ. Co., 1966.

[7] A. van Wijngaarden, Orthogonal Design and Description of a Fromal Language. Report MR 76, Mathematisch Centrum, Amsterdam, 1965.

[8] N. Wirth, A Proposal for a Report on a Successor of ALG . Report MR75, Mathematisch Centrum. Amsterdam, 1965.

[9] G. Seegmüller, A Proposal for a Basis for a Report on a Successor to ALGOL 60, Bavarian Acad. Sci., Munich, 1965.

[10] N. Wirth and C.A.R. Hoare, A Contribution to the Development of ALGOL. Comm. ACM, 9 (1966) 413-432.

[11] H.R. Bauer, S. Becker and S.L. Graham, ALGOL W Language Description, Report CS89, Comp. Sci. Dept., Stanford University, 1968.

[12] O.J. Dahl, B. Myhrhaung and K. Nygaard, SIMULA 67 Common Base Language. Publication No. S-2, Norwegian Computing Center, Oslo, 1968.

[13] A. van Wijngaarden (Ed.), B.J. Mailloux, J.E.L. Peck and C.H.A. Koster, Draft Report on the Algorithmic Language ALGOL 68. Report MR93, Mathematisch Centrum, Amsterdam, 1968.

[14] B.J. Mailloux, On the Implementation of ALGOL 68. Doctoral Thesis, Amsterdam, 1968.

[15] P. Naur, Environment Enquiries. ALGOL Bulletin 18.3.9.1. Oct. 1964.

[16] M. Sintzoff (Ed.), P. Branquart, J. Lewi and P. Wodon, Remarks on the Draft Reports on ALGOL 68. Report R96, MBLE, Brussels, 1969.

[17] A. van Wijngaarden (Ed.), B.J. Mailloux, J.E.L. Peck and C.H.A. Koster, Report on the Algorithmic Language ALGOL 68. Num. Math. 14 (1969) 79-218.

[18] C.H. Lindsey and S.G. van der Meulen, Informal Introduction to ALGOL 68. North-Holland Publ. Co. 1971.

[19] J.E.L. Peck, ALGOL 68 Implementation. Proc. of the IFIP Working Conf. on ALGOL 68 Implementation, Munich 1970, North-Holland Publ. Co. 1971.

In this last work a very extensive list of further references is given to ALGOL 68 papers.

[20] P. Naur, Quotation from BIT 9 (1969) 250.

[21] J. Garwick, Gargoyle User's Manual. Report S-24, Norwegian Defence Research Establishment, Nov. 1965.

[22] C.H. Lindsey, AGLOL 68 with fewer tears. ALGOL Bulletin 28.3.1. July 1968.

[23] P.M. Woodware and S.G. Bond, User's Guide to ALGOL 68-R. Royal Radar Establishment, Malvern, England, 1971.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

Historical Critique of IFIP/TC 9: Computer Relationships with Society

Harold Sackman

Department of Business Information Systems
California State University, Los Angeles
Los Angeles, California
U.S.A.

Introduction and Overview

Professor Heinz Zemanek, past President of IFIP and editor of the 25th IFIP Anniversary volume, invited the author, who is current chairman of the IFIP/TC 9 Committee, to contribute a chapter for the anniversary proceedings, on the history of TC 9. I was delighted to accept the invitation and prepare this chapter, not only for the anniversary volume, but also for the forthcoming Third Conference on Human Choice and Computers sponsored by TC 9, to be held in Stockholm in September 1985.

The author has had the benefit of being one of the founders of TC 9, has been the USA representative to TC 9 since its inception, and has been the only national representative who has attended every TC 9 meeting to date. He has been involved in most major conferences of TC 9 either on the program committee, as editor of proceedings, or as a contributor to the proceedings. The author has developed his own point of view of the origins, status and potential of TC 9 which are reflected in this historical critique. The author especially wishes to acknowledge the documentation originally provided by H. Zemanek, C.C. Gotlieb and F. Margulies that made this account possible. Only the author should be held responsible for any misinterpretations, controversies, or errors in this paper.

This critique is essentially organized chronologically. It starts with the pre-TC 9 environment in IFIP, proceeds to the controversial and protracted effort to get a new Technical Committee on computers and society accepted by IFIP, moves on to key events that formally established TC 9 in 1976, through its early formative years in the late 1970's, its troubled years in the early 1980's, its resurgence in the mid-1980's, and finally, its potential and prospects through the end of this century.

Origins: Formulation of the Elusive Concept of Computers and Society in IFIP

The International Federation of Information Processing (IFIP) was founded in 1960 under the auspices of UNESCO. In 1984, IFIP had 44 national organizations representing 49 countries worldwide. IFIP represents the world community in computer-based information science and technology. The four general goals of IFIP at its founding are particularly relevant for TC 9. For matters concerned with information processing, the goals include 1) promoting international cooperation, 2) stimulating research and development, 3) facilitating human communication, and 4) encouraging education. These are the genes and chromosomes of IFIP, and they can be epitomized as extending the knowledge and benefits of computer-based information processing for international society in the broadest sense of the term, for all people on this planet.

Shortly after its founding, IFIP developed Technical Committees (TC's) to facilitate its basic goals. The term "technical" was deliberately chosen to emphasize information system science and technology. The chronological order is instructive for our history. TC 1 was concerned with computer terminology and nomenclature. It was later dropped, but may perhaps be reactivated. Since 1962, TC 2 has been dedicated to programming languages, programming systems and methodology and is fully active today. TC 2 overlaps with TC 9 in the areas of programming psychology and computer-aided problem solving. TC 3, established in 1963, is dedicated to education and training in informatics. An arguable case can be made that TC 3 was not and is not really a "technical committee", but is in fact a socially oriented committee. As such, TC 3 is a major IFIP precedent setting the stage for the subsequent emergence of TC 9.

TC 4 was concerned with computers in medicine, but later split off as a partially independent "Special Interest Group" known as the International Medical Informatics Association (IMIA). Medicine thus represented a major computer applications area in IFIP as distinct from methodology. TC 4 was another precursor for TC 9, in the health care domain which, of course, is a major social concern.

TC 5, formalized in 1970, was aimed at "Computer Applications in Technology," broadly conceived to include methodology as well as applications in industry. Although TC 5 seems to have a highly technical aura, its Working Groups in computer-aided design, production planning and product documentation overlap substantially with human problem-solving and management activities.

TC 6 emerged in 1971, concerned with "Data Communications." While computer communications is a highly technical interdisciplinary area, there is substantial overlap with voice, video, teleconferencing and social communications, particularly with the emergence of home information system networks. TC 6 is also concerned with computer-aided communications for disabled persons.

TC 7 arose in 1972, aimed at "System Modeling and Optimization." Although this area also may appear highly theoretical and esoteric, the more challenging problems, in many respects, are those that involve modeling and simulation using people and real organizational facilities as distinguished from computer-only simulation. TC 7 is also concerned with economic and social modeling. All these areas of overlap to some extent with TC 9.

TC 8 was established in 1974 and is called "Information Systems." It is aimed at understanding and facilitating the "analysis, design, specification and evaluation of computer-assisted information systems." A reasonable case can be made that TC 8 is concerned with computer systems management in the broad sense of the term, which overlaps with a key objective of TC 9--social management of computer systems to achieve social objectives.

TC 9 was formally accepted by IFIP in 1976, after substantial controversy and resistance. More on this shortly. It was entitled "Relationships Between Computers and Society."

TC 10 was established in 1976 as "Digital Systems Design," concerned with "concepts, methodologies, evaluation methods and tools in digital system design." TC 10 may be claimed to overlap with most of the other TC's since applied system design is highly interdisciplinary, including designer behavioral characteristics.

Finally, TC 11 was established in 1984, and designated as "Security and Protection in Information Processing Systems." This area includes information system security and computer crime broadly conceived, overlapping in many ways with management and criminology which are key concerns to TC 9 and other TC's, such as TC 8.

The above chronological account of IFIP TC's is intended to serve several purposes. First, note that TC 9 is the least "technical" of the TC's when "technical" is conceived as traditional computer and information science and technology. Second, note that TC 9 is the broadest and least focused of all the TC's, opening up a potential Pandora's Box of multiple and often conflicting interpretations as to its proper scope and aims. This is the inescapable basis for the "elusive" nature of TC 9. Third, note that there is ample and consistent precedent for a TC concerned with social impacts of computers starting from IFIP's original aims and goals, which are strongly social, through the establishment of virtually all TC's that demonstrate significant social and human links TC 9 in varying contexts. It should be fully appreciated, that within the IFIP family, TC's have scrupulously avoided defensive territoriality, and have stressed their interdependency and overlapping interdisciplines. This is particularly evident in numerous joint conferences and projects in areas of mutual concern.

At this point, the account turns to the specific origins of TC 9 within the broader IFIP context. Here I borrow heavily fro Heinz Zemanek's account of early TC 9 history (1983), and from my personal experiences as observer and participant during this period.

Within the founding TC 9 circle, Heinz Zemanek has always been acknowledged as the "father" of TC 9. When he assumed the presidency of IFIP in August, 1971, he promised to achieve three goals during his administration: 1) maintain scientific and technical standards, 2) improve administration, and 3) "foster the human aspect." The latter is the initial gleam in Zemanek's eye in 1971 that eventually led to TC 9 in 1976.

The uncharted road to TC 9 had its own pitfalls and blind alleys. Zemanek tried, unsuccessfully, to kick off an IFIP conference on "Man and Machine" in 1972, focused on four areas: "Operator Before the Computer", " Work Humanization", "Privacy Protection", and "Social Responsibility". The International Labor Office in Geneva turned down co-sponsorship of this proposed conference, and it could not be held.

While still President of IFIP in Fall 1973, Zemanek submitted a formal proposal to the IFIP General Assembly for a new Technical Committee for "Non-Technical Affairs," for the field of human, philosophical, social and historical matters, with Working Groups on "Information Processing and Society," on "Computer Applications in the Humanities," and on the "History of Computers and Automation." The proposal was turned down, (Zemanek, 1983).

A new TC with a negative name ("Non-Technical Affairs") carried the unfortunate disadvantage of negative semantics. First, it was proposed as a "non-technical" committee when all the others were "technical." Second, it attempted to cover the vast domain computers in the social sciences and the humanities under one huge umbrella. Third, it could alienate social scientists and applied interdisciplinary scientists by labeling their work as non-technical, and by indirection, as non-scientific. As a Ph. D. psychologist, for example, as a result of my formal training, I have never had any doubts that people are fit subjects for rigorous scientific experimentation under controlled conditions with elaborate statistical designs that match the most "technical" work in the "hard" sciences.

These obstacles did not deter Zemanek, who kept the concept of the defunct 1972 IFIP conference alive and, with his persistence, put together a winning team for the First Conference on "Human Choice and Computers" (HCC 1) in Vienna in 1974. HCC 1 was the event that convinced the majority of non-believers in the IFIP General Assembly (GA) to become a majority of believers in the spirit and desirability of TC 9.

Breakthrough: The First Conference on Human Choice and Computers

A time-honored technique in IFIP to get the majority of member nations to sprinkle holy water on a new TC is to demonstrate the value and the viability of the proposed scope and aims of the TC with a successful prototype conference. The author had the pleasure of being on the International Program Committee for HCC 1 and being co-editor of the conference proceedings with Enid Mumford (England). The meetings of the Program Committee were spirited and creative, guided by the watchful eye of Zemanek. Fred Margulies, Chairman of the Local Organizing Committee, assisted by Gerhard Chroust, provided continually responsive support in Vienna. The Austrian government and Austrian Trade Unions offered substantial financial as well as scholarly and psychological support for the conference, which made it possible to attract top experts worldwide to present papers and contribute to the proceedings.

HCC 1 had 125 participants from 20 countries. The key professionals at the conference included social scientists, computer and information scientists, labor union representatives, managers, and representatives of international organizations. These professional constituencies have remained key supporters of TC 9 throughout its entire history. The conference featured plenary sessions (including a scholarly keynote address by Zemanek) and lively, intimate work groups where more questions were raised than answered in this virgin territory.

Sparks flew in many directions. Computers and information scientists were surprised that everyone else did not consider them objectively neutral in social impacts of their wares. Social scientists were accused of being too academic, and unwitting tools of management. Labor unions felt they were being left out and ignored in long-range technological planning, in information system design, and in shaping the quality of future working life. Everyone felt the brunt of free-wheeling criticism. These issues are still with us, except that the problems have grown much larger and more complex with massive advances in worldwide computerization since this conference.

In the final chapter of the HCC 1 proceedings, the editors summarized key themes that emerged from the conference stressing the role of human choice (Mumford and Sackman, 1975). It was clear that social consequences of information processing technology should represent social choice, preferably democratic social choice from the international community, the nation-state, the local region, various social groups, labor as well as management, and ultimately the human choice of the individual in nurturing and sustaining his or her quality of life.

The four keynote addresses were indicative of the wide-ranging issues that were addressed. Zemanek stressed the epistemological differences between human and machine communication. Hedberg and Mumford pleaded for machine design based on human goals with participative information system design including users. Dallinger argued for humanistic organization of the automated work place. He insisted that only union members can be relied upon to represent their own interests in new automation. The author stressed social equity and the long-range moral implications of universal computer information services for uplifting effective human intelligence and enhancing the quality of life for the entire human species. I have never wavered from this commitment.

The HCC 1 conference concluded with several key recommendations for IFIP that were subsequently pursued, to varying extents, by TC 9. First, computer-related professionals should become more socially responsible by more effective formal training in "human and organizational disciplines." Second, computer technology should be viewed as a tool to serve "social, organizational, individual and economic goals." Third, non-professionals need to be adequately educated and aware of computer developments as they relate to social choice, so that such options "can be identified in good time, discussed, clarified and adequately publicized with recommendations." And finally, IFIP should develop international codes of practice as moral and ethical guidelines in the human use of computers, including the possibility of an international "Computer Bill of Rights."

Formative Years: Early TC 9 Development

TC 9 chronology subsequent to HCC 1 reveals the fits and starts and prolonged labor pains that gave birth to TC 9. Shortly after HCC 1, at the 1974 IFIP General Assembly, as Zemanek's presidency of IFIP drew to a close, he again attempted to recommend approval of TC 9. Fred Margulies extensive report to the General Assembly on the resounding success of HCC 1 was used as the basis for the viability and promise of TC 9 (Margulies, 1974). The General Assembly temporized by accepting TC 9 "in principle," and setting up a task group to flesh out the detailed proposal. In the Spring of 1975, C.C. Gotlieb (Canada) agreed to chair TC 9 for one year at Zemanek's request.

The first working meeting of embryonic TC 9 was held in Boston, August 28, 1975, with 15 people showing up. Gotlieb was chairman and Margulies was Vice-Chairman. I had agreed to be the initial USA representative to TC 9 at the invitation of A. Ralston, then President of the American Federation of Information Processing Societies. Five other national representatives were present, and nine countries in all had national representatives appointed. The meeting was primarily concerned with proposing initial Working Groups. Three were selected: 1) computers and work; 2) information systems and public policy; and 3) the working environment of computer personnel. We were fortunate to have Kelly Gotlieb as chairman, who ran a well-organized, professional meeting.

At the subsequent IFIP/GA meeting in 1975 at Rio de Janeiro, Zemanek again proposed acceptance of TC 9, only to have it postponed once more. In his letter to Gotlieb, with copies to TC 9 designates, Zemanek indicated "I got so sad that I gave it up ... My patience is finite." But at a later point in this letter, he cut right into the heart of the central issue by stating that "The human aspects of information processing today have become more important than any technical aspect." And he ended on an upbeat note, "I therefore trust that you and all TC 9 members will not be discouraged" (Zemanek, 1975).

The wheels were already in motion. Embryonic TC 9 had an IFIP budget and the next TC 9 meeting was held February 18 and 19, 1976, in Admsterdam. Eighteen people attended. The Scope and Aims of TC 9 were hammered out at this meeting, as shown in Table 1, which are still in force today. It was my pleasure to draft the initial scope and aims with R. Sizer (UK) at this meeting for full committee review and revision.

Note that the scope focuses on social impacts as distinguished from strictly technical computer developments. Also note that the aims are similar to the general aims of IFIP (e.g. communication, facilitation of research and education), but also include humanizing information systems, enhancing the quality of life for individuals and society as a whole, and putting some teeth into these good intentions by stressing responsible long-range planning to ensure human benefits. Three Working Groups were recommended for IFIP approval at the Amsterdam meeting: 1) Computers and Work; 2) Information Systems and the Citizen; and 3) Social Accountability.

At the 1976 General Assembly meeting, TC 9 was finally formally adopted by IFIP. Only two Working Groups were authorized, WG 9.1, Computers and Work, and WG 9.2, Social Accountability. Sven Jonasson (Sweden) was appointed first chairman of WG 9.1, and Rob Kling (USA) accepted chairmanship of WG 9.2. The European core of WG 9.2 was chaired by Klaus Brunnstein (FRG). The scope and aims of both WG's are shown in Table 2. It should be especially noted that WG 9.1 had a relatively

Table 1

TC 9 RELATIONSHIP BETWEEN COMPUTERS AND SOCIETY
est. 1976

SCOPE

The Committee is concerned with the influence of the applications of computers to individuals, groups, institutions, and society. It is not concerned with computer developments which are strictly technical, or developments in which there is no scientific or technical component.

AIMS

- Communicating Social Consequences:
  promote communication between computer-related professionals and others on relationships between computer technology and society.

- Promoting Social Accountability:
  help computer professionals to develop increasing awareness of the social consequences of their work, within IFIP and in the profession at large.

- Facilitating Research:
  encourage studies on the effects of the uses of computers on individuals and society.

- Humanizing Information Systems:
  examine how the needs of individuals and society affect the design of technical systems involving computers.

- Enhancing the Quality of Life:
  identify and promote those uses of information processing which improve the quality of life of individuals and of society as a whole.

- Encouraging Responsible Long-Range Planning:
  promote forecasting studies to disseminate early warnings on human consequences of the use of computers, and encourage the development of long-range social plans to ensure that social use results in human benefits.

Table 2

WG 9.1 COMPUTERS AND WORK (est. 1977)

AIMS

1) to study and report on how computers have affected employment levels, job content and structure, working conditions, career patterns, and participation problems;

2) to collect, exchange, and disseminate information relating to the above;

3) to give an account of problems relating to computers and work, and of proposed measures for dealing with these problems;

4) to encourage and support the design and development of systems which promote not only efficiency but provide job satisfaction, for example through interesting work and reduction of stress.

SCOPE

WG 9.1 is concerned with the effects of computerization on the life of three distinct groups of persons:

- computer professionals,
- users of computers,
- non-users affected by computers.

WG 9.2 SOCIAL ACCOUNTABILITY (est. 1977)

AIMS

1) helping make computer professionals and system designers and others aware of the social consequences of their work;

2) developing criteria to determine how well the public is served when it comes into contact with computerized systems;

3) enabling and encouraging designers and users of computer systems to make a human choice, i.e., a choice which takes into account human needs and wishes.

SCOPE

The Scope embraces those aspects of computers which affect the public interest. Among these are:

- ethical issues arising out of the use of computers,
- the freedom of access to information, as well as the right to privacy and to the protection of sensitive data,
- shifts in the balance of power arising out of the use of computers,
- the effects of computers in public and private organizations,
- education of the public about computers, and of computer professionals about the effects of their work.

well-defined focus in the work place whereas WG 9.2, had a relatively amorphous charter covering wide areas of accountability, responsibility, human needs in general, and ethics. This vagueness, among other factors, led to continuing problems for WG 9.2.

The 1977 meetings of TC 9 were held in Dorking, England and later in conjunction with the IFIP World Congress at Toronto. TC 9 attracted substantial attention at this Congress through the panel sessions it sponsored, particularly the session on "Social Accountability" which drew an audience of about 400. The third issue of the TC 9 Newsletter, under the editorship of R. Sizer, was distributed at that time. Sizer was the host of the meeting at Dorking. The successive issues of the TC 9 Newsletter were generally favorably received by a growing list of interested readers.

The major TC 9 development in 1977 through 1980 was the preparation and planning for the Second Conference on Human Choice and Computers (HCC 2). Kelly Gotlieb and Fred Margulies served as co-chairmen of HCC 2, with Margulies again chairman of the local organizing committee in Vienna, as in HCC 1. The Program Committee for HCC 2 was also set up in 1977, consisting primarily of TC 9 members, and chaired by A. Mowshowitz (Canada).

The 1978 meeting of TC 9 was held in Hamburg (FRG). Professor Klaus Brunnstein served as the local host. Two representatives from eastern socialist countries joined TC 9 for the first time (Yugoslavia and Bulgaria), expanding the scope and significance of TC 9 activities. It was noted that membership for WG 9.1 and WG 9.2 was increasing, and that WG meetings were usually well attended. Problems were arising in sharing the responsibilities and costs of the TC 9 Newsletter. Steady progress was made with HCC 2 planning including consolidation of the program and speakers, and verification of substantial funding support from the government of Austria.

The first meeting of TC 9 in 1979 was held in London. Budgetary and load-sharing problems of the Newsletter arose again, with TC 9 working out a temporary editorial arrangement. The author accepted the chairmanship of a long-range planning subcommittee for TC 9. A formal resolution was passed by TC 9 urging "free expression of opinion about the problems and possible misuses of computer systems" in connection with charges brought against Prof. W. Steinmuller, a member of WG 9.2. Final preparations for HCC 2 were reviewed and approved, with excellent final budget support from Austria.

HCC 2 was held June 4-8, 1979 in Baden, Austria, generally following the HCC 1 design and format. The available budget permitted TC 9 to invite a significant number of distinguished speakers, and the overall quality of the papers maintained the high level set at HCC 1. HCC 2 had an attendance of approximately 100 people, and as described by Gotlieb, the "coalition of computer scientists, union officials, managers, sociologists, and political economists which characterized HCC 1, and which was such an interesting feature of it, has proved stable." (Gotlieb, 1980)

The papers and conference working groups fell under six broad areas: 1) prospects for human choice with computers, 2) research on social issues in computing, 3) computers and trade union perspectives, 4) computers, management and work, 5) computers in politics and government, and 6) computers, human attitudes, and ethics. Note that the coverage was very broad, and like HCC 1, did not permit intensive focus on any single area, except perhaps, for computers and work.

A. Mowshowitz, the editor of the HCC 2 proceedings (and Program Chairman), provided a useful classification scheme of 10 broad areas for social issues in computing. These include "computers and" 1) record processing, 2) mass communications, 3) the economy, 4) the service professions, 5) organizations, 6) decision making, 7) developing nations, 8) culture (emphasizing the humanities), 9) everyday life, and 10) computers and society as a discipline. The broad scope of this listing stresses the elusive nature of computers and society.

In working toward a framework for analysis, Mowshowitz stressed two broad themes to provide more definitive focus. One was social equity and the other was social control, both linked to the central theme of human choice rather than "human chance" (as noted by Margulies). Mowshowitz reflected his own concern and that of many of the HCC 2 contributors. A more rigorous disciplinary approach to computers and society was needed, utilizing the applied scientific techniques of the social sciences, so that TC 9 efforts would not "suffer the ignimonious fate of the automation discussion of the 1950's and the 1960's." In his keynote address, Zemanek noted with satisfaction that the modest beginnings of HCC 1 were expanding into a steadily growing tide of general interest and concern around the world as reflected not only in HCC 2, but also in numerous other professional societies. He further noted, with satisfaction, that TC 9 had already converted most of its critics into friends and supporters.

Troubled Adolescence: TC 9 in the Early 1980's

The decade of the 1980's started out auspiciously for TC 9. The April, 1980 meeting was held in Bernardin, Yugoslavia, the first socialist country to host TC 9. Professor Silvin Leskovar was our solicitous host. The second draft of the TC 9 long-range plan was reviewed, and competing TC 9 objectives were prioritized by committee vote. The resulting order of TC 9 objectives are of special interest and are shown below (3 and 4 were tie ranks):

Rank	Objective
1	Protection of Individual Rights
2	Employment and the Quality of Life
3	International Problem Solving
4	International Studies on Social Impacts
5	Professional Social Accountability
6	Universal Social Benefits
7	Protection of Group and Collective Rights
8	International Planning and Cooperation
9	International Education

Note that the primary orientation is toward human rights, with the main focus on individual rights, work, and the quality of life. Education was ranked last, perhaps because TC 9 members felt that TC 3 is concerned exclusively with education. Social equity was ranked sixth, just below social accountability of computer-related professionals. The general pattern indicated greater concern over the individual and work issues as compared to group, national and international affairs.

The second TC 9 meeting in 1980, was held in conjunction with the IFIP World Congress at Melbourne, Australia. TC 9 helped organize an international seminar on "Computers in Developing Nations" at this World Congress, together with the Australian Computer Society and the IFIP Committee on Informatics for Development. UNESCO and the Intergovernmental Bureau for Informatics were co-sponsors of this conference. The author, Kelly Gotlieb, and T.V. Natarajan (India), presented papers from TC 9.

The editors of the proceedings, Kalman and Bennett, particularly stressed the growing gap between the information rich and the information poor countries. While special stress was placed on the need for coherent national policies and national long-range planning to facilitate the social use of computers, relatively modest or virtually no national planning was in evidence for most countries. Regional mutual aid was highlighted and encouraged as in the ASEAN (Association of South East Asian Nations) experience in facilitating cross-national computerization. Other joint efforts included shared use of communication satellites and international educational centers to foster communication, cooperation and more effective transfer of computer technology.

The rich diversity of the varying cultural approaches to national computerization make these proceedings a most valuable baseline for insight into the problems and pitfalls of computerization in developing nations. There were national reports from India, Singapore, Malaysia, Indonesia, the Philippines, Papua New Guinea, Nigeria and the ASEAN group as a whole. The implications for national planning in this conference served as one of the springboards for the central concept of HCC 3—comparative national policies in the social use of computers.

The 1980 TC 9 meeting at Melbourne is notable for reviewing the third draft of the TC 9 long-range plan, and unanimously adopting it after some minor changes in language and terminology. This plan is currently the guiding policy for TC 9 and is summarized here.

The plan is an 11 page document, consisting of four parts: 1) baseline, 2) forecast, 3) objectives, and 4) implementation. Each is briefly described and critiqued. The baseline was an evaluation of TC 9 performance up to and including 1980. The evaluation was generally positive and upbeat. TC 9 was "formally and firmly established in IFIP" with growing membership. As in the case of most IFIP TC's, national representation was strongest from Europe and North America, modest in Eastern European socialist countries, and weakest in developing nations. HCC 2 was regarded as eminently successful. The cumulative output of the two Working Groups was regarded as "limited." TC 9 member participation was regarded as "fairly good, although uneven," but marked by good morale. The TC 9 Newsletter received a mixed, but generally favorable review. TC 9 management--primarily referring to Kelly Gotlieb's tenure as Chairman and to Fred Margulies as Vice-Chairman--was described as "able, conscientious, productive ... generally effective and well regarded." The overall evaluation was that TC 9 had "made a very modest, but significant initial impact on the international scene."

The second section, concerned with a 10-year forecast, projected "an order of magnitude increase in ... social impacts of computers." The overall computer-communications industrial complex was projected to double its worldwide market every five years, working toward at least a trillion dollar global industry by 1990. (This estimate seems to be reasonably on target from the later vantage point of 1985). The forecast also indicated growing computer literacy, multiple careers and lifelong learning, increasing confrontation between management and labor with advancing automation, growing individual threats from organizational and bureaucratic computerization, the emergence of computer-communications as major political issue, increasing citizen participation in public network information services, and growing gaps between information rich and information poor nations. By and large, these forecasting trends have been generally confirmed by subsequent events through 1985.

The third section of this planning document was concerned with prioritized TC 9 objectives which were previously described. The objectives virtually cover the social universe, and the plan indicated that "Only a very tentative and modest beginning has been made by TC 9 toward these goals." The point of prioritization was to selectively focus on top goals, and in fact, greatest TC 9 effort had been placed on the top three goals—individual rights, employment, and international scholarly studies.

The final section of the plan was concerned with administrative follow-on to accomplish the ambitious objectives of TC 9. It featured a larger executive staff for TC 9 for more effective administrative load balancing, project management procedures for quick startup of new thrusts, and easier phaseout for ineffective activities. Special stress was placed on improving TC 9 publications both qualitatively and quantitatively. It is planned to review and update the TC 9 long-range plan after the HCC3 conference in September, 1985.

The 1981 meeting of TC 9 was held in Paris, hosted by F. Gallouedec-Genuys (France) and chaired by Fred Margulies. The first order of business was the announcement that IFIP President, P. A. Bobillier, had appointed R. Brotherton as the new chairman of TC 9. Gotlieb originally agreed to serve as TC 9 chairman for one year, extended it to four years, and was urged on all sides to remain chairman a full six years, the maximum allowable in IFIP. At the 1980 TC 9 meeting in Melbourne, R. Brotherton was favorably considered as a potential replacement in general discussion. There was no formal motion at that time for a TC 9 vote for a new chairperson. According to Gotlieb's minutes of this meeting, "It was agreed that the chairman should inform the President of IFIP of the TC support for Mr. Brotherton".

The announcement came as a "fait accompli" from top IFIP management. There was no vote, no discussion of possible alternative chairpersons, no objections, just quiet acceptance of administrative fiat. Subsequently, at the 1984 General Assembly at Varna, Bulgaria, when presenting the annual TC 9 report, I expressed my disagreement with this approach. Normally, practically all TC's vote for new chairpersons. Only under unusual circumstances does IFIP top management intervene and appoint new TC chairpersons without a TC vote. Apparently, IFIP management was convinced that such intervention was appropriate.

From the vantage point of hindsight, I lay the blame on everyone, including myself. TC 9 members should have objected and asserted their right to express their preference by democratic vote. IFIP management should have insisted on TC 9 member preference at least as a partial basis for the final appointment. I also fault the TC 9 chairman and vice-chairman for not defending the right and the obligation of TC 9 members to express their preference by discussion and vote. Leadership in an IFIP TC where all members contribute their expertise and valuable time on a voluntary basis, is a fragile and delicate affair based on mutual trust and respect, and above all on self-government.

It is virtually impossible for a relative newcomer to be assigned TC chairmanship and succeed, regardless of the chair's talents, without the prior voluntary consent of TC members. At the Varna IFIP/GA meeting, I recommended to IFIP that top priority be given to ensure democratic TC voting procedures to promote more effective future leadership, higher morale, and greater collegiality among TC professionals.

At this 1981 Paris meeting, the TC 9 Newsletter was severely criticized by Kreuwels, the Dutch representative. The key problem was a lack of articles from international contributors. The tenth Newsletter was canceled for this reason. A new Newsletter committee was set up to keep this communication link alive, chaired by R. Brotherton, the new TC 9 Chairman.

It was at this meeting that HCC 3 was initially discussed. WG 9.1 also announced its plans for a conference on "Systems Design, for, with and by the Users." Each national representative of TC 9 presented a brief summary of social impacts of computers in their own country, which drew spirited discussion from the participants.

The next meeting of TC 9 took place in Amsterdam in February, 1982, chaired by R. Brotherton. After extensive discussion, the basic concept of HCC 3 was established at this meeting--comparative national policy and national reports on social impacts of computers, presented in a proposal formulated by the author. I accepted the chairmanship of the HCC 3 Program and Editorial Committee, with Sven Jonasson as Chairman of the Local Organizing Committee at Stockholm, the selected site for HCC 3. Other HCC 3 committee members were appointed to initiate follow on planning and preparations for HCC 3.

It was at this meeting that the TC 9 Newsletter was quietly retired at the recommendation of the Newsletter Committee. Key reasons cited were inadequate article contributions and the heavy administrative workload in integrating and distributing each issue.

At this meeting, a changing of the guard for WG chairs took effect. U. Briefs (FRG) was the new Chairman of WG 9.1, and R. Sizer (UK) was the new Chairman of the European Core for WG 9.2. The differences between the two WG's were striking. WG 9.1 had a well-planned conference and proceedings for "Systems Design, for, with and by the Users," to be held in September, 1982 at Riva Del Sole, Italy. WG 9.1 also fleshed out a project to prepare a state of the art report in the form of a "Reader on Social Aspects of Computerization" (ROSAC). Both projects have since been successfully consummated.

In contrast, WG 9.2 held no meetings in the North American core, and made limited progress in working toward their first conference in the European core. This conference was aimed at social consequences of computerization in bureaucracies.

It should be pointed out, that after six years of formal operations (1982), WG 9.1 held one conference and published a proceedings, whereas WG 9.2 held no conference and did not publish any proceedings or books. This slow start and relatively low WG productivity was based on the confluence of several factors. First, HCC 2, an activity of TC 9 as a whole, consumed much of the time and energies of TC and WG members, diverting these resources from the WG's. Second, the TC 9 Newsletter was a continual manpower drain on all TC and WG members, diverting them to some extent from productive conferences with substantive proceedings. Third, management pressure from TC 9 was unfortunately not placed on early WG activities to "produce or perish." This lax attitude encouraged the "debating society" syndrome, which reinforced passiveness and low levels of participation. Fourth, TC 9 (and all other TC's in IFIP) has no control over the selection of national representatives. Unfortunately, this more often results in political rather than professional choices, and in passive observers instead of active participants at the TC and WG levels.

Fifth, most representatives miss more meetings than they attend. This is understandably due in part to the uncertainty and often prohibitive expense for travel funding which typically results in only about one third of the membership showing up at TC and WG meetings. A sixth reason is that international committees tend to have a long and slow period of gestation and acclimation before a critical mass is achieved for successful communication, cooperation, and a sustained level of productivity.

Later in 1982, R. Brotherton regretfully announced his resignation as Chairman of TC 9 due to health problems. At the request and urging of TC 9 and WG members at the Riva del Sole conference, and with the concurrence of A. Melbye, the IFIP Trustee for TC 9, Fred Margulies graciously accepted the interim Chairmanship of TC 9 until a new chairperson could be elected and appointed.

The Riva del Sole conference was the first major successful conference for a TC 9/WG. Some 80 participants from many disciplines attended, with a focus on labor union professionals. The proceedings were a remarkably diverse collection of articles representing the broad European experience in participative information system design. Conference publicity and the local arrangements were smoothly orchestrated and efficiently handled in a pleasant conference setting. The entire process was organized by WG 9.1 members in their own way within general TC 9 and IFIP guidelines. A significant and loyal constituency for WG 9.1 was clearly identified in the work place/labor union area.

Two TC 9 meetings were held in 1983. The first was in May, in Stockholm, chaired by Margulies, and hosted by Sven Jonasson. Attendees were able to visit the site and facilities for HCC 3. WG 9.1 co-sponsored a conference a month earlier with TC 3 in Salzburg on "Education for System Designer/User Cooperation, with 28 participants from 12 countries. WG 9.2 spelled out its plans for their conference on "The Benevolent Bureaucracy" planned to be held in 1984, including the call for papers. The Cognizant IFIP Trustee, A. Melbye, discussed formal IFIP procedures relating to TC's. Margulies outlined nomination and election procedures for the new TC 9 Chairperson, which were unanimously adopted after some discussion.

The second TC 9 meeting in 1983 was held in conjunction with the IFIP World Congress at Paris. Margulies chaired the first session and conducted the election for the TC 9 Chairperson following the approved procedures. A secret ballot was conducted and the author was elected Chairman with a majority of 11 votes out of 15 that were cast. After thanking Fred Margulies for assuming the interim chairmanship, and for his unstinting support of TC 9 since its inception, the author chaired the last session of this meeting. Bernard Levrat (Switzerland) accepted the offer of Vice-Chairman of TC 9 at my invitation.

New developments included the establishment of an IFIP review committee to evaluate TC 9. In my opening comments, I mentioned my strong concern over relatively poor attendance at TC and WG meetings, and the need for improved productivity of TC 9.

WG 9.1, under the leadership of U. Briefs, indicated its plans for a forthcoming conference on "Women, Work and Computerization" to be held at Riva Del Sole in September, 1984. This topic elicited great interest. WG 9.2 was not represented and did not present any report at this meeting.

The retirement of Kelly Gotlieb as Chairperson for TC 9 in 1981, the one-year tenure of R. Brotherton, and the one-year interim chairmanship of Fred Margulies left its mark on TC 9. For almost a three year period of shifting and temporary leadership, discipline was lax and productivity was very low in WG 9.2. There was virtually no activity in the North American core of WG 9.2. The proposed conference on "The Benevolent Bureaucracy" was the only sign of life in the European core of WG 9.2. In contrast, WG 9.1 picked up and took off on its own in a productive series of conferences and publications. Fortunately, TC 9 was on track for HCC 3. The early 1980's were indeed a troubled and uneven, yet a promising adolescence for TC 9.

Maturation: TC 9 at the Crossroads

This final section covers developments in TC 9 through early 1985, the time of this writing. The next TC 9 meeting was held in Velm, Austria, on May 31 and June 1, 1984.

One of the striking contrasts in this meeting was the energy and vitality of WG 9.1 as compared against the relative inactivity of WG 9.2. At this meeting, WG 9.1 revealed the enthusiastic and comprehensive planning for their conference on "Women, Work and Computerization", led by Bo Carlsson and Ingela Larsson. This conference was "sold out" in June with high registration exceeding available rooms, and was very successful later that year in September at Riva Del Sole. There no question that a major new constituency has been tapped for TC 9--the role of women as professionals and as users, as beneficiaries or as victims of the social use of computers.

WG 9.1 also proposed plans for a conference on "Participative Information Systems Development" in the eastern sector of Berlin, sponsored by the German Democratic Republic, for March, 1986. Klaus Fuchs-Kittowski, the TC 9 representative for the GDR, is Chairman of the Local Organizing Committee. This conference will be the first sponsored by TC 9 in an East European Socialist country. We hope it will pave the way for much greater participation and leadership from these countries in TC 9 affairs. To date, TC 9 membership includes the GDR, Yugoslavia, Hungary and Bulgaria.

In contrast, WG 9.2 unfortunately was in a state of disarray. Rob Kling had resigned as Chairman of WG 9.2 earlier in 1984 after a largely unsuccessful attempt to get a working, productive North American core of interested and committed professionals. The principal organizers for the one and only conference ever proposed by WG 9.2 (The Benevolent Bureaucracy) were initially at odds with each other over the organization, budgeting and scheduling of this conference. It was necessary to work out a special interim arrangement for holding this conference in January, 1985 at Namur, Belgium, under the leadership of Jacques Berleur. Although the turnout was somewhat low, this conference was original, provocative and successful for the participants.

A wide-ranging discussion was held at the Velm meeting as to whether WG 9.2 should be disbanded or continued in view of its low productivity and low morale. It was decided to set up a Review Committee, chaired by Bernard Levrat, to prepare an evaluative report with recommendations for the next TC 9 meeting. Dick Sizer was asked to chair WG 9.2 during this interim.

The significance of this issue is a universal one for IFIP/TC's. How can relatively obsolete and unproductive WG's be formally dropped and replaced by more viable and more relevant WG's with minimal disruption of the social and working relationships in the parent TC? Perhaps a maximum 6-year legal life span for a WG, with a mandatory requirement to either disband or reorganize with a new charter might be workable. This could be a formal IFIP requirement, and could be linked to the maximum 6-year tenure for WG chairpersons. This kind of an approach would provide new WG's with new leaders on a periodic basis. It would also help to shake up and replace the "old boy" and "old girl" networks in the WG's and help give newer members more active roles.

Three new social problem areas emerged as possible candidates for new TC 9 WG's. These included: 1) computers, detente and international peace; 2) home information systems and social networking; and 3) robotics and artificial intelligence. Following the helpful suggestion of A. Melbye, the TC 9 Trustee, it was agreed to set up TC 9 task groups for each of these areas to report back to the TC 9 meeting in September, 1985 with their final recommendations. The Chairmen for these three task groups are, respectively, Paul Kolm (Austria), John Kjaer (Denmark), and Dan Millin (Israel) with Klaus Brunnstein (FRG).

These three areas illustrate both the promise and the pitfalls of new thrusts for TC 9. The suggestion for computers, detente and international peace was initially triggered by Colin Beardon's (New Zealand) memo to TC 9 on computers and nuclear war at time of the IFIP World Congress in 1983. The task group chaired by Kolm is evaluating the possibility of a new WG aimed at international peace.

The task group on home information systems and social networking is aimed at the universal, interactive and networked home terminal expected in industrialized nations by the end of the century. It is also in response to my memo to all TC 9 members urging exploration and long-range planning for an IFIP-sponsored "World Computer Users Society." Home information systems are likely to have major impacts on the individual and the family, on the quality of life, on "telecommuting" and on national and international economies. These network information services are expected to generate annual global markets in excess of one trillion dollars by about the year 2000.

The third task group, on robotics and artificial intelligence has not had the benefit of previous work or reports from TC 9. Here the emphasis lies in social impacts of fifth generation computers which still represents speculative virgin territory. Millin (Israel) has recommended that we set up a working conference on this issue in conjunction with the proposed annual meeting of TC 9 in Israel in 1987.

The forthcoming third conference on Human Choice and Computers (HCC3) is also likely to generate some new options for TC 9 in the general area of national policies and long-range planning for the social use of computers. There is a possibility that HCC 3 may be co-sponsored by UNESCO which is especially concerned with furthering the use of computers to help developing nations. Some 20 national and regional reports on the social use of computers are expected for HCC 3 which should generate new avenues for TC 9 to explore.

After HCC 3, at the forthcoming meeting of TC 9 in Stockholm in September, 1985, all the above task groups reports, HCC 3 evaluative feedback, and the formal IFIP TC 9 review will be examined to work toward a revised long-range plan for TC 9. Growing TC 9 membership, and the infusion of fresh, new talent and new ideas in TC 9 and in its WG's, augurs well for an expanded and more active role in IFIP affairs. In moving from a two WG structure to perhaps several new and more promising WG's, TC 9 is at a significant historical crossroads.

An encouraging trend in TC 9 is the shift away from the initial intellectualizing and the "debating syndrome" toward major practical problem areas. The focus is moving more toward the new problems with fifth generation automation, computers and international peace, the feminization of the work force, and home information services. The "elusive" concept is becoming more pragmatic. On the other hand, it is conceivable that TC 9 over the very long range might move toward a WG structure representing the academic and humanistic disciplines as originally proposed by Zemanek.

Membership is growing slowly, close to about half of the IFIP national membership at 25 countries. TC 9 is still only partially represented in the eastern socialist countries in Europe, particularly with the absence of the USSR. As in other TC's, representation from developing countries is virtually nonexistent. Stronger liaison and support from UNESCO might change this situation.

The overall output of TC 9 is still modest, and has yet to make a major impact on scholars, the computer-related professional community, and the exponentially growing computer user constituencies. It has long been TC 9 policy to reach out to wider audiences to "get our message across." TC 9 is attempting to tailor its written output to appeal to a broader readership, particularly computer users and the general educated public. We hope some of our publications might be successful as textbooks for college courses on various aspects of computers and society. It is my belief that IFIP policy toward its publications should change significantly to compete more realistically and more effectively for larger markets. For example, editors should receive more support, and possibly some royalties, the quality of English style and fluency should be systematically upgraded, and stronger quality control on technical excellence should be exercised by editors for contributions to proceedings. TC 9 is starting to move more strongly in these directions with its publications.

It has taken a full decade for TC 9 to incubate and grow from a wobbly fledgling to youthful adulthood. There are promising signs that TC 9 is maturing toward a coordinated international team competent to meet the fast-changing challenges of the Information Age.

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

INFORMATION SYSTEMS: THEMES AND TRENDS

From MIS to DSS and Office Systems

Alexander Verrijn-Stuart

Institute of Applied Mathematics and Computer Science
University of Leiden
The Netherlands

The current trends in the field of informations systems derive from foundations laid in the '60-s, when information structuring began being formalized and information as such was first recognized as an important organizational asset. The original emphasis on its use in a central control mechanism has given way, however, to an approach in which more specialized decision support is aimed at. The modern expert system as well as the emerging office information systems may be viewed as constituting forms of purposeful decentralization.

Two themes dominate the design methodology: formalization (in particular, functional specification) and generalized implementation (i.e. the development of automated tools, application generators, etc.). The latter are expected to have most practical impact.

INTRODUCTION

This paper attempts placing IFIP Technical Committee TC8 "Information Systems" and the contributions of its family of researchers and practitioners in the context of the general developments in the field. TC8 was founded in 1975. It was a natural offspring of the database movement, which had its start around 1970 and, within IFIP, manifested itself in the form of the Working Group WG2.6. There, the formal aspects and practical applications of modern data modelling were addressed. However, what the data collections stored and retrieved were to be used for was more or less accepted as given.

When the use of information in organizations became recognized as a field of research and application in its own right the time had come for a body specifically dedicated to what had already become known under the general name that TC8 also adopted. Whilst "organization" at that time primarily referred to purposeful groupings of people with recognizable assets and boundaries, such as an enterprise, a company department, a government agency, a university, a hospital, the designation evidently applies to every coherent set of objects with their interactions, if that interaction predominantly depends on the exchange of signals and messages.

It will be demonstrated how the original thrust of centralized usage of information, that gave rise to the so-called Management Information System (MIS), has now developed into a variety of approaches, each dealing with one or more specialised aspects, without necessarily loosing touch with the common objectives that characterize an "organization". The developments of TC8 and its Working Groups mirror these trends.

ORIGINS

The concept "information system" began to emerge around the year 1960. The use of magnetic tape as a storage medium brought with it the need for automated file handling systems. Such mechanisms enabled an integration of information streams to an extent far exceeding the then common punched card systems. These had themselves become complex - and often elegant and advanced - dynamic repositories of operational and management data, but did not constitute more than what we would call sub-systems today [9, 35]. The same can be said about the first systems to be transfered to computers.

However, the structured nature of the data collections involved soon invited formalization. Some early papers already demonstrate a truly fundamental approach. Of these the ones by Young and Kent [40], Lombardi [18] and the CODASYL Development Committee [6] deserve special mention. They anticipate the "relational" data modelling and manipulation [7], which is an important basis for present day formalisms, by a decade.

The importance of the "information system" (henceforth referred to as IS) was recognized some time before it was explicitely designated by that name. Langefors [16] certainly was one of the first to use the terminology in describing the coherent acquisition, handling and usage of data in order to provide purposeful information. Likewise, his major book is called a "theoretical analysis" of such systems [17]. The addition "theory" is found in subtitles to a number of publications in the field [e.g. 5]. Yet, for want of agreement of what constitutes an IS, there is no central, unified set of theorems, although many theoretical contributions have been made.

The reason for this lack of consensus lies in the nature of the IS's objectives. In Langefors' words [16]:

> "Information systems serve to provide the different functions within an organization with information necessary for rational decisions."

Another way of putting it is to recognize the existence of a set of objects in the real world, constituting the "real system" (RS), which one wishes to control on the basis of relevant information, which is provided by the IS. The problem then is to what extent the RS and the IS are merely sub-systems of one higher system, or individual, disjoint systems, only capable of treatment in isolation.

This is not just a question of semantics. The IS, insofar as it leads to computer-oriented procedures (algorithms and data structures, or generally, "information structures"), may be described in strictly logical terms (at the theoretical level) and completely unambiguous expressions, data collections and actions (at the operational level). The RS, on the other hand, consists of people, capital goods and transient materials. It is subject to a great variety of relationships. Uncertainty is the rule rather than the exception. The RS produces physical products or renders services, usually in non-uniform proportions. And it behaves more like an organism than like a machine [28].

As a result there are two general views of IS, which might be called the "open system" and "closed system", respectively. In the former, the IS is specified by its inputs and outputs only. A database which is kept up-to-date through a well-defined maintenance procedure and which can be accessed to provide required subsets of recorded data is a typical example of it. On the other hand, a "closed" system is one where the actual IS is integrated with the environment which it is designed to support [36]. We shall revert to the theoretical foundations for these views in a moment.

There are also two approaches to the design methodology for IS. One usually refers to the "data-oriented" approach and the "process-oriented" approach in distinguishing whether one first structures the data of use to an organization (subsequently allowing discretionary extraction of data required for producing information), or begins by sketching the information flow needed by the organizational users (emphasizing which processes might provide it and consequently, which elementary data would be needed for this) [see A.6, introduction]. As we shall see, the data and processes are interdependent to such an extent, that all modern design methods tend to integrate the two approaches. Yet, there are few where they are really treated on an equal footing [e.g. 2, 4].

The two views and the two design methodologies do not necessarily coincide in a one-for-one fashion. It is conceivable that a designer accepts the information requirements of the organization, yet looks for the transformation processes first. Similarly, a designer may aim at providing integrated organizational information, but model the data before attacking the procedures for achieving the ultimate objectives [see e.g. 9, 10, 30]. A more fundamental classification is based on the roles of the RS and IS, jointly and separately. Essentially one may recognize two paradigms:

- The "Organizational Mapping" paradigm
  The fundamental assumption is that the IS must be a true reflection of the RS in order to be effective. The customary approach (see e.g. Verheijen and van Bekkum [32]) is to define an "object system" (that part of the real world which is of interest[1], an "information system" (which provides the information necessary to perform actions with respect to the object system, or control it according to the goals pertaining to the latter) and an "environment" (consisting of the organizational information users):

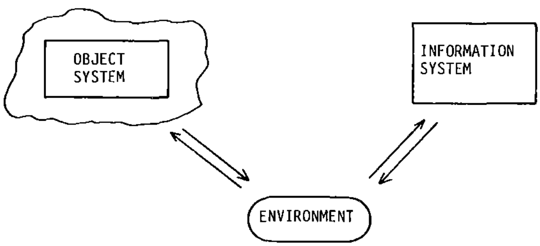
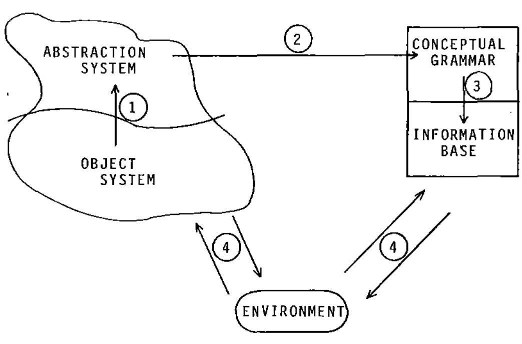


Figure 1.

Object- and Information System and the Environment [32, p. 538]

In order to arrive at a useful IS one describes the object system in a formal way ("abstraction system"), employing a language that produces unambiguous sentences ("conceptual grammar"). These, in turn enable the definition of the "information base", which reflects the state of the object system:



Process 1:
Classification, generalization, establishing rules, etc., i.e. modelling of object system.
Process 2:
Translation of abstract system into formal propositions.
Process 3:
Enforcement of rules of conceptual grammar upon contents of the information base.
Process 4:
Recording of facts and delivery of messages plus intervention in object system.

Figure 2. Result of the Information Analysis [32, pp. 539-540]

Once this has been achieved, dynamic usage of the correspondance between object system and information base constitutes the actual IS.

- The "Organizational Control" paradigm
  "Information" is generally accepted as consisting of data that has been selected, refined and grouped to serve some specific purpose [28]. This view has led to the idea that the IS is an integral part of the organizational control mechanism. Based on Forrester's Industrial Dynamics [13], Blumenthal developed a model for logistic management support [1], which has been generalized to embrace all information streams that can be conceived in the RS [35]:

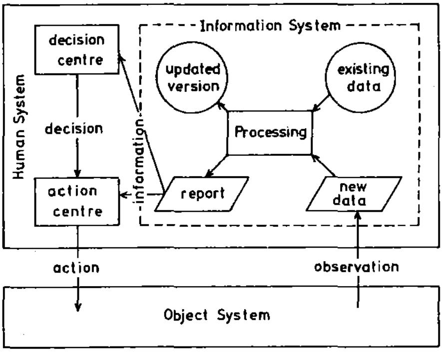


Figure 3.

The control model of the organization [35, p.155]

This "control model" in fact will even fit the case of "process control" if a direct link is laid between the output signal (the "report") and the RS. Similarly, it is capable of representing the reception of signals from the outside world, if one considers the RS as consisting of a finite (controllable) internal part and an infinite (uncontrollable) external part. Since the value of allowing data and/or information to flow along the various lines may be measured semi-quantitatively the variant that explicitely shows these flows has been called the "relevance model of information" [34]:

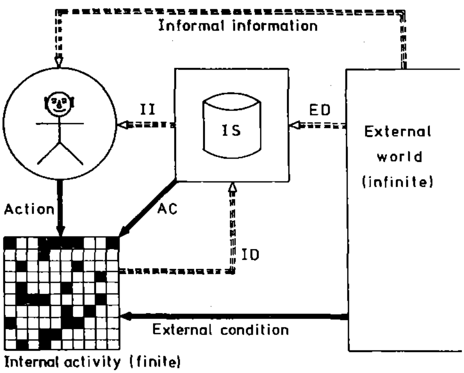


Figure 4.

The relevance model of information [34, p. 121]

The control model emphasizes the integration of the IS with the organization it serves. It does tend to overemphasize, however, the need for, or even the possibility of, centralized control. On the other hand, it enforces the questioning of what information requests are for.

Almost all IS design methodologies can be seen (subconsciously) to subscribe either to one or the other paradigm. Both have strong points and weaker points. The "mapping" paradigm, which, by its nature, is more data-oriented, provides great flexibility in dealing with unexpected requests, provided the database it has led to has anticipated a variety of segmentations [24]. But the need for a precise (pre-)specification of all data tends to preclude the full dynamism an organization may need, in spite of the flexibility of the database as such. Also the practical mapping will almost certainly remain restricted to parts of the organization only. Thus the coherence of the IS may ultimately suffer.

The "control" paradigm stresses the need to justify every bit of information. Although managements often express the wish to have existing or preconceived information flows automated, they can only be provided with a framework for deciding what is useful if this is stated in some context that involves the organization itself. This is what is done when reference is made to the various connections. It leads to process-orientation in a rather natural way. The integral view also makes one more aware of the time element (validity, action points, response time, etc.). On the other hand, it suggests possibilities for central control which may be difficult to achieve.

Generally speaking, a process-oriented approach is to be preferred in the early stages of a project, whereas data-orientation is more and more needed as one progresses. We shall revert to these points in later sections after an historical exposè of the evolution of thinking in TC8 and its Working Groups, and of simultaneous developments elsewhere.

EDUCATIONAL PROBLEMS

The outdoor banquet of the IFIP Ljubljana Congress (1971) - as many will remember with affection - was a lively affair. Untold acquaintances were renewed or newly made. Among other things, arrangements resulted for a follow up to two earlier workshops devoted to defining a curriculum for IS designers. After two more sessions the findings were published in the form of a 40-page report [14].

The initiative for this activity had been with TC3 "Education", in particular its WG3.2 "Advanced Curriculum Projects in Information Processing". At that time there seemed to be no other field which lacked education for prospective professionals as much as that of IS in general and of large IS in particular. Most enterprises had behind them a painful period of converting their mechanized (punched card) systems to computers. And they had found that the wrong, if any, talents were available. The old style "systems analysts" were not trained to deal with electronic equipment and the new breed of "computer programmers" did not understand what information meant or how it fitted the organization.

Actually, the problems encountered up till then applied at a fairly low level of abstraction. In later parlance, the systems in question where mostly straightforward administrative ones, of the payroll and materials nature. Only recently had one started thinking of so-called "Management Information Systems" or MIS. The guiding philosophy that all information streams within an organization are relevant to the management and, when combined, ought to give higher insight had just been discovered. This MIS movement led to much disappointment, although the early failures were due more to technical problems than to some innate difficulties. Often the wrong issues had been addressed, however, as one was to find out only much later. Meanwhile the interest in complex systems grew.

Now, the skills required for developing an advanced IS clearly are varied. Thus the educational problems involved are intricate also. To debate these, professor Dick Buckingham, WG3.2 chairman and instigator of the workshops mentioned, proposed that a full-fledged conference be devoted to the subject. Since one intuitively felt that most difficulties were associated with the systems' growing largeness this was to be reflected in the conference title. And as a natural partner the young TC8 was invited to join in its organization from the very start.

The TC3/TC8 WC "Education and large Information Systems" was held in The Hague, on 18-21 April 1977 [A.1]. Its introduction referred to the IFIP Curriculum,

"... which addressed the particularly difficult problem of education for people with varied backgrounds and a professional interest in an area of which only the name is generally accepted, but not its content. In fact, 'information systems', having something to do with computers, management science, organizations and the many ways in which these may be brought together, is a subject which probably must always be approached from different angles ... Most important would appear the three requirements for successful development of an information system:

a. a combination of both theoretical training and practical experience for those inolved in the actual design activity;
b. a suitable blend of techniques derived from different disciplines;
c. appreciation of potential opportunities and problems for those belonging to the organization within which the design takes place."

The format of the conference allowed a fair amount of discussion in conjunction with the papers presented, but also included two more extensive debates. One was to come early on and deal with our views of the current forms of education ('analysis'), the second would occur towards the end and concentrate on general and specific forms of action to be recommended ('synthesis').

Whilst the discussions were lively, some problems remained unresolved. In particular, how the elements of "largeness" and of "complexity" affected the problem difficulty could not be decided. On the other hand, the idea that there is a need for:

- a blend of talents in an IS design team
- a mixture of formal and practical education for each of its members

was generally accepted. The IFIP curriculum proposals were well received. It was stressed that their implementation in the form of "post-experience" education might be a very effective approach (e.g. along the lines of the "sandwich" courses, which are common in the U.K.).

Recently, the curriculum has been reviewed and an updated version is to be published before long. Once again, WG3.2 has been responsible for its development.

FORMAL MODELS

TC8's first Working Conference in its own right was held in Oxford, U.K., from 17 to 20 April 1979. The rather forbidding title - "Formal Models and Practical Tools for Information Systems Design" - reflects the mainstream of thinking in the Working Group which organized it. WG8.1 "Design and Evaluation of Information Systems", itself the first to be set up under TC8, was and is a microcosmos of almost all views encountered in the field of IS. The call for papers was so embracing that of its 20 preferred subjects each might suffice as the main theme of a single conference. Certainly the three main headings would [see A.2]:

"<u>Requirement Definition</u>
- Involving the end-user in the requirement definition.
- Formal models and formal languages for stating requirements.
- Transparency of the requirement specification. Documentation and representation problems.
- Tools for analysis and evaluation of requirement specifications.
- Methods for handling systems complexity in information systems analysis and design.
- The role of data semantics in requirement definition.
- Methods for integrating different users views of the information system.
- The use of system prototypes, based on simplifying assumptions about the system, for development of precise requirement specifications.

- (Any) special problems in modelling highly interactive systems?
- The role of requirement specifications in making decisions on the structure of the application environment.
- Involving the end-user in the development of priorities and planning horizons of the information system development project.

Requirements and Software Systems
- Comprehensive methodology for information system design, development and operation.
- Methods for controlling that a proposed software system design meets the stated requirement.
- (How) should changes in the software system be reflected in the requirement specification during debugging and maintenance?
- Methods for utilizing requirement specifications in software systems design, e.g. for software production, consistency testing.
- Methods for testing that software systems changes are consistent with the stated requirements.
- Methods for controlling evolution in the requirement specifications and the corresponding implementation of software extensions and software changes, i.e. methods for enhancing systems flexibility.
- Automatic software generation based on direct use of the requirement specifications.

Experimental Evaluation of Methods and Tools of the Systems Analyst and Designer
- Comparative studies of methods and tools. Studies concerning method proposals and studies concerning well established methods and tools are of equal importance.
- The relative importance of new methods and tools on the overall economy of the development, operation and maintenance of an information system."

One will be amazed at the wide range of subjects to be addressed. At the same time one must recognise with some surprise that this list (circulated in 1977) contains ideas that most of us would think originated much later. When one puts the 14 papers alongside the suggested issues an equally surprising number turn out to be covered. But also there begins to develop a trend of differentiation, of approaching the field from specific angles. Paraphrasing these one might distinguish:

- The formal specification approach
- The tool-oriented approach
- The user-oriented approach
- The pragmatic approach

The formal and the tool-oriented approaches are expected reflections of the conference title (or should one say that the conference derived its inspiration from these already existing trends?). The user-orientation, however, represented more than merely the "practical" aspect of the tools referred to. At the time one of the most significant contributions was found to be de Maio's paper on the "socio-technical system" or STS-approach [21]. But three more papers explicitely addressed the user in one form or another. This interest heralded an important development, soon to be picked up by WG8.2, that of participative design methods. We will hear more about it in the next section.

Formality, in connection with the design of IS, may mean the use of a precisely set of rules, such as lead to unambiguous specifications, absence of inconsistency and, ultimately, clarity of documentation. Important tools are a standardized check list and a systematic schema technique. Top-down design and the use of logic-oriented requirement statements were other early characteristics. Although the possibility of automatic code generation had been a well-known idea for a number of years [31], precision and consistency certainly weighed more heavily for WG8.1. In process-oriented methods the main problem emerging concerned the "functional specification". This was exemplified in the panel session, held under the title "What is a Formal Requirements Specification? What does it contain, how is it structured and for what is it useful?" It raised more questions than it answered [A.2, pp. 281-287].

The tools-oriented approach manifested itself at the Oxford Working Conference in the form of software-based [e.g. 37] and systematic descriptional methodologies [e.g. 19, 23]. The former were precursors to the present day "fourth generation software", to be picked up at later working conferences. The latter did not constitute one coherent group, but in fact offered more a variety of advanced data modelling techniques.

One other tendency began to emerge, viz. the interest taken by the professional practitioner. Led by common sense and with a basis in years of experience, such persons often spoke critically to the academic representatives. The pragmatic approach, as referred to above, more than anything else manifested itself in the claim that there existed such-and-such IS design methodologies, that were puported to be superior to the untried formal-theoretical offerings of academia. A year was to elapse before WG8.1 undertook a project for dealing with this situation. It resulted in the later "CRIS" exercise.

ORGANIZATIONAL ASPECTS

WG8.2 "The interaction of Information Systems and the Organization" was conceived at the same time as WG8.1, viz. at the founding meeting of TC8 in Amsterdam, in November 1975. It took until 1977 before it was officially established, primarily because its scope overlaps with that of other WG's, not least with that of its sister in TC8. The Oxford WC call for papers was an illustration of this: no IS can be successful unless it fits into its environment, but that means considering both "hard" technical aspects and "soft" human-oriented aspects. Whilst WG8.1 clearly addresses the former, it cannot leave out the latter and the reverse applies to WG8.2. The organizational nature of the problems of interest to WG8.2 makes for overlap with several other TC's, notably TC9. In consequence, one finds a striking diversity of personalities at WG8.2 meetings.

Having studied a number of angles through position papers in restricted workshops, a broad WC was organized in Bonn, from 11-13 June 1979, under the title "The Information Systems Environment". Its Conference Committee Report, which is included in the Proceedings, makes for interesting reading [A.3]:

> "In the early days of computing the prime constraints lay, in most cases, within the DP [data processing] department itself. This was a reflection of three things. Firstly, DP technology was new, limited in capacity and function and often unreliable. Thus there were technological constraints associated with even simple systems. Secondly, systems analysis and programming were practically 'black arts' without formalized methods or a disciplined approach. Thus there were constraints associated with the internal DP management process which often lead to dramatic cost and schedule overruns. Thirdly, the applications or systems attacked first were usually simple, formalised applications. These were well-understood and established and therefore computerisation had little impact on the organisation or on user attitudes.
>
> Perhaps inevitably, therefore, the management processes and systems evolved to deal with these DP constraints emphasized those characteristics of the total Information Systems process which were associated with the DP department ... The non-DP characteristics were either ignored or noted in terms of their impact on the DP characteristics. A common example of this was 'user resistance has impacted the project schedules' ...

It has been shown that the key constraints increasingly lie in three areas:
- Non-formalised, inappropriate and changing basic business systems.
- Lack of effective user/DP department communication, epitomised by failure to involve users effectively;
- External constraints impeding DP development ...

The ... conference was established so that researchers and practitioners could meet to discuss the non-DP constraints ...

Although the themes covered by the speakers covered a wide range of ideas it was possible to classify the papers under four major headings:
1. Organisation and behaviour
2. Participative design techniques
3. Methodologies and tools
4. Personal views and speculations ...

The papers read ... and the accompanying discussion indicate strongly that technology is no longer (if indeed it ever was) the prime constraint. Indeed the conference provided clear evidence that information systems interact closely with the organisational structure and the way people work within the organisation. Accordingly information systems cannot be realistically designed without knowledge and experience of the ways in which these systems impact people and organisation ...
The conference also indicated the gap which exist between the opposing design philosophies apparent today. At one end of the spectrum are the technologists who place the hardware and software design requirements first. At the other end ... are those who feel that human and organisational factors are the most important. Whilst this distinction has been apparent for many years the conference illustrated again how difficult it is for designers who follow one extreme to come to terms with the necessity of taking other design criteria into account ... "

Of the 26 papers included in the proceedings four may be singled out as characteristic examples of the approaches taken. Earl and Hopwood [12], demonstrated that many widespread beliefs about organizations held by professional systems analysts are untenable. In particular, the importance of unofficial and non-routine information is shown to warrant a much broader approach to information management. Courbon and Bourgeois [11] championed a special twist to the participative methodology in which the analyst acts more as an advisor and teacher than as the actual designer. Thus this paper is a prelude to the current idea of the "information centre", which helps user departments in the organization build their own systems. Land, Mumford and Hawgood [15] provided an insight to the talents that must be developed in design teams to be effective. They consider organizational features to a much larger extent than normally done, but their proposals fit in well with the aforementioned IFIP Curriculum. Lastly, special mention ought to be made of the LEGOL project of Stamper (Cook and Stamper [8]), because it represents a unique approach to dealing with the intricacies of natural language, as used in legal documents, but also typical of the general information streams that matter in any kind of organization.

The contents of this WC clearly demonstrate what distinguishes WG8.1 and WG8.2. Both are devoted to the same ideal and cover the same ground, but with totally opposing points of departure. It did not come as a surprise that at the TC8 National Representatives Meeting which immediately followed the Bonn WC it was decided that the time had come to hold a joint conference. This event was to take place in 1980 in Budapest. The title was to be "Evolutionary Information Systems".

At the same time a proposal was made to take a closer view at the multitude of IS design methodologies, offered commercially or reported in various forms of development by academic researchers. Also considered was the importance of IS-independent tools, which seemed worth working on. Both approaches suggested were to be pursued by task groups. More about all these proposals later.

DECISION SUPPORT SYSTEMS

Although the formal establishment of WG8.3 "Decision Support Systems" was put before TC8 only at its meeting held in conjunction with the Budapest WC, it is appropriate introducing it at this stage. For it represents a modern development which has not been mentioned sofar, viz. that of applying IS in a situation of uncertainty.

Up till about 1975, i.e. the time TC8 was set up, IS had aimed at increasing the effectiveness of organizations in their standard functions. The systems mostly served the administrative and operational management. Where the "future" was involved - and that had come as early as the mid '50-s - it had been in the form of well established operations research techniques, such as linear programming and critical path planning. In other words, one had always dealt with "well-structured" problems.

The introduction of remote terminals probably was a prime cause for bringing computation at the decision makers' finger tips (or at least the decision makers' assistants finger tips). Whilst the reams of paper produced by integrated systems, offered under the name of MIS, were soon put aside, the possibility of quick calculations on central-company or ad-hoc collected data exerted a strong appeal.

Thus the idea of "decision support" was born. In TC8 it had found its proponents among the tool-oriented researchers [e.g. 22], although the emphasis had usually been on the flexibility of ad-hoc IS design, a movement currently referred to as "prototyping". As a result of active contacts with the International Institute for Applied Systems Analysis (IIASA), which had hosted a meeting explicitely devoted to the subject in 1980, the new WG8.3 "Decision Support Systems" was established. Its scope sums it up neatly:

> "Development of approaches for applying information systems technology to increase the effectiveness of decision-makers in situations where the computer can support and enhance human judgement in the performance of tasks that have elements which cannot be specified in advance."

That this can never be a purely computer-oriented activity is clarified in the aims, which state that at least six "reference" disciplines are involved: information technology, artificial intelligence, cognitive psychology, decision theory, organizational theory, and operational research and modeling. As a result WG8.3 has become a meeting place for a truly multidisciplinary group of researchers and practitioners. Its wide problem domain is evident from the papers presented at WG8.3's first WC "Processes and Tools for Decision Support" [A.7], held jointly with IIASA, and once again hosted by the latter at Schloss Laxenburg near Vienna in Austria. These range from epistomological aspects of knowledge-based DSS and logical domain programming to text processing and the organizational variables influencing DSS implementation. The interest in representing knowledge and how to construct "expert systems" is already clear.

As WG8.3's scope states, DSS generally are needed in situations where problem solutions cannot be specified in advance. This is not a characteristic that applies to DSS exclusively. It is also encountered in what are called "ill-structured" problems in the field of IS in general, viz. those where the objectives can be specified, but the modeling variables and relationships are unknown or uncertainty prevails. The obvious approach is to find the proper structure, that is to say, discovering non-evident structure that is present in hidden form, or, alternatively, imposing a useful structure where there is none sofar.

It may be argued that the failure of the older MIS was precisely their inability of dealing with problems of this kind, by choosing inappropriate structures, viz. the abundent recordings of data from the past, instead of looking for what may be termed "knowledge about the future". Of course, this is easier in the natural sciences, where induction from controlled observations leads to theories that are capable of prediction with a degree of certainty. Yet it is through models of the object system (or RS) that useful decisions can be arrived at in situations other than immediate operational control. Sol addressed the problem via the technique of simulation [25] and in his editorial to the Schloss Laxenburg WC suggests that it is also one way of developing a DSS [26].

Simulation used in this fashion is a general tool. WG8.3's earliest approach is also tool-oriented in a broader sense. Sprague [27] views the problem as the ad-hoc development of a system by a "builder" on behalf of a "user"[2] by putting together elements that a "toolsmith" has made available. An important objective for the DSS researchers, therefore, is to arrive at generalized tools, that he calls "DSS-generators". These would contain a data base, a model base and an intermediate software system which interfaces the DSS with the user. These elements are precisely the same as those proposed for flexible IS development by Meyer and Schneider [22] at the earlier Oxford WC!

The tool-oriented approach (making available useful and varied modules, that may be coupled with ease and in a great variety of ways) is by no means a cure-all. In fact, most mechanical multi-purpose tools are inferior in any application to those designed specifically to deal with such a single application. This may well apply to the information processing world also. The very flexibility of the electronic computer constitutes both its strength and its weakness. Weaknesses there are, in fact, in more than one respect. Thus, one may easily be led to early usage of systems that are not fully tried out and be forced to consequent correction later. Such action, of course, all too often takes the form of major modification, with even less testing. Also one may try to load too many different tasks on a single system and then complain that its performance is disappointing. And the clear obsessions with centralized databases and all-embracing networks must have been due to the apparent, but actually non-existent flexibility of available technology.

This is not saying that all general-purpose tools are bad, but certainly that one must be careful in putting too much reliance on them or expecting them to be useful in all situations. This reservation is precisely what one does observe among the responsible persons in the DSS world. There is indeed a second line of attack, viz. the attempt at achieving a better understanding through the study of purpose-built systems. This approach has the advantage that such systems result as practical byproducts of the research (reality probably is that the specific DSS is built anyway and the researcher is allowed assisting in the process!).

EVOLUTION

From the foregoing it will be clear that the field of IS can only be dealt with successfully by a multidisciplinary and multidimensional approach. Now it is also evident that, in spite of the extensive expertise built up by the professionals, to date no one is fully satisfied. There is no coherent theory of IS yet, only a limited number of truly successful IS exist and an incredible amount of work must be done continually to maintain those that do exist. But the worst aspect is the inflexibility of the computer-based system just mentioned.

That the application of an extremely flexible tool is not flexible itself at first seems surprising. Understanding that it is not the (computer) <u>processing</u> but the (computer) <u>programming</u> that is difficult to change at will makes one aware of the real bottleneck. The abstraction system that the RS is mapped into is a very complex structure. It is hard enough to conceive, let alone, modify. Now, the real system that it represents (in fact only represents a very small portion of) is subject to continuous change. In the case of mechanical or electro-mechanical automation one expects good service and reliability, but does not demand the specification to be capable of arbitrary change at the drop of a hat. Yet this is what the IS-user always seems to expect.

Until recently the answer to a challenge of this nature in the mechanical world has been to design new products, which replace the existing ones. One buys a new car, one buys new clothes, one installs new machinery in a factory. Replacing all rolling stock of a railway system, however, is a major operation, redeveloping a city quarter an almost insuperable one (but these, in fact, involve changes in system!). An early breakthrough came in the DP field itself. The wiring panels of "mechanized" collators and calculators provided the flexibility of adapting such machines to a variety of tasks. In our days, of course, the program controlled robot enables "flexible manufacturing". But even this very advanced form of flexibility is minor as compared to what is required of an organizational IS.

From 1-3 September 1981 WG8.1 and WG8.2 jointly organized the WC "Evolutionary Information Systems". The undertaking reflected the growing awareness that the members of the TC8 family were engaged in one field and needed each other to achieve success. The specific objectives of this conference were ...

> " ... to explore the role of information systems in a changing world, including functional aspects such as environmental and human factors which impose requirements and constraints on development, as well as structural aspects, such as how formal design techniques can make information systems adaptable to changing requirements ... " [A.7, editorial introduction]

Aiming at theoreticions and practitioners with different outlooks was a deliberate move. So was the programme, which allowed a large amount of discussion. But ...

> " ... If approach and format can be considered successful, can the same be said about the subject as such? The characterisation 'evolutionary' had been chosen to indicate that ... there is sufficient knowledge and expertise available to adapt information systems ... in a smooth and gradual way, rather than by the tortuous and traumatic routes so often followed when equipment is replaced or a new 'information philosophy' is introduced. We all know that organizations and their environments are in a state of constant change, without this immediately constituting a revolution, in general. Why then do we design systems as rather static constructs, mostly incapable of anything other than superficial adaptation? Why do we give rise to a situation where the system users rightfully complain that they always have to conform to the system rather than the other way round? ... Is the only alternative to an existing system seen to be revolutionary change? ...
> In retrospect I am not so sure that the pretension implied in the conference title has been fully vindicated. We did hear extremely interesting views on change and flexibility, on being useful to the organization and on being fundamentally sound in our approach to the various problems ... Yet, a single formula for making information systems 'evolutionary' has not emerged. Nor is it likely to do so in the future, for the conference did demonstrate that 'change' applies to aspects of different dimensions. Thus, smooth adaptability is a desirable characteristic in a variety of ways, but it is not an indivisible quality ...
> In [various] points mentioned, as in the papers themselves, the lack of a firm theoretical basis is evident. This is not saying that theoretical contributions to date have no value, but it does mean that these have addressed isolated features only ... The main angles on theory, as they seemed to emerge, were the following:
> - Ill-structuredness and the reduction to a structured formulation;
> - Data-modelling as a powerful means of process independance;
> - The promising contribution of 'decision support system generators';
>
> Possibly these might merge, in the near future, into a unified 'theory of information resources' ... " [A.7, conference summing up]

These words were written four years ago. Whether the expectations will come true and promises fulfilled the late 1980-s will have to tell. Meanwhile let us follow the TC8 Working Groups as they turned to a number of urgent tasks.

INFORMATION SYSTEMS DESIGN METHODOLOGY

The Task Group "Comparative Review of Information Systems Design Methodologies" ("CRIS" for short) was set up within WG8.1 under the chairmanship of T.W. (Bill) Olle, who first proposed the idea and subsequently took a leading role in devoloping it. The rationale for conducting such a review was the existence of a large number of "methodologies", either commercially offered or championed from academic research centres. Practitioners often ask which of these is "the best". Apart from the fact that quality of a design methodology has a large number of dimensions, (and thus might be strong in some features and weak in others) even the question properly phrased could not possibly be answered for lack of enough (if any) comparative evidence.

The Task Group, therefore, set out on a multi-stage course. The first task seen was to find out what exists in the way of methodologies ("taking stock"). Assuming that this exercise would provide sufficient material, the second step was to agree on suitable points of comparison ("feature analysis"). Lastly, a form of synthesis would be attempted. It should be made very clear, from the outset, that this will never (and indeed cannot ever) result in a simplistic pronouncement of which is "the best" methodology. What one must aim at, on the other hand, is:

- an anatomy of the class of systems we call "information systems";
- an anatomy of all design methodologies suitable for arriving at these.

Whether one also must aim at a guide for fitting particular methodology elements to specific classes of IS elements is a point to be resolved through research. A suggestion in this direction would be purely speculative at this time. As will be demonstrated the problem has at least two dimensions, viz. the quality of the design process and that of the design product (a good methodology may lead to a poor design, an unsuitable methodology may yet provide a good IS). Therefore, the ultimate achievable will be an indication of which methodology is more appropriate than some other methodology, for some particular problem in some particular environment. No more.

In order to have a basis for comparison it was decided that the first exercise would be to invite the application of IS design methodologies to one standard case. A contribution of this kind would consist of a stepwise description of a design product, with an explanation of what was done in each step and why that particular action was undertaken. A critical review of his own methodology by a contributing designer would be much appreciated, of course.

The case to be adopted had to be non-trivial, without being exessively complex. It was chosen from our own (IFIP) environment: how to support a Working Conference, organized by an IFIP Working Group. The reactions in the TC8 family varied. Some thought it so well defined that the problem statement, in their view, amounted to a full systems requirement definition, i.e. there seemed to be nothing left to be "designed". On the other hand there were those who considered it so ill-structured that an extensive formalization would be required before even the first design step might be dreamt off!

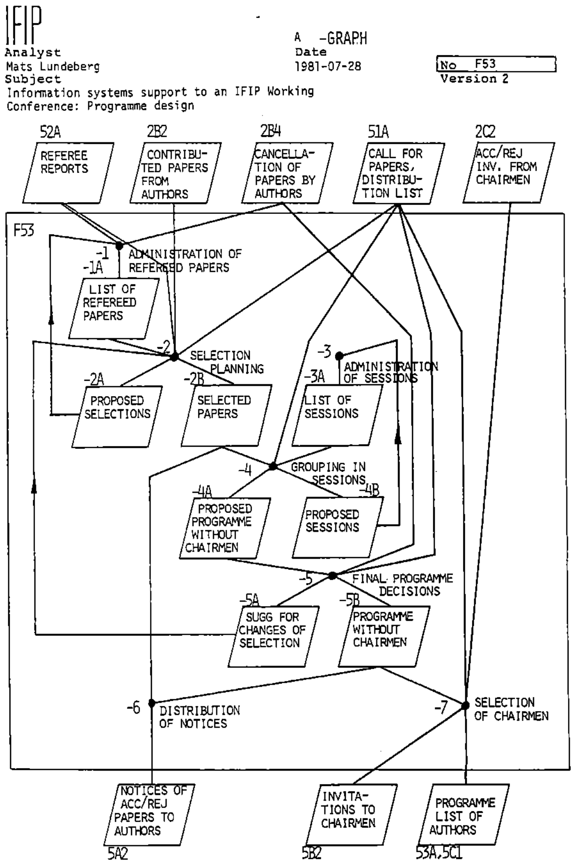
Two conferences have been held in the CRIS-cycle sofar. The first one ("Taking stock") took place in Noordwijkerhout, Netherlands, from 10-14 May 1982. Its proceedings [A.6] serve its purpose very well indeed. The 13 case studied included span the spectrum of academic research to a considerable extent and they include a fair representation of what is available commercially. Thus in the objective of demonstrating the current variety of approaches the exercise has not failed. It must be admitted, of course, that not all authors have commented on their own design process as much as one might have liked, but their approaches can be traced without difficulty.

What one does see, however, is that the range of approaches is smaller than expected. The contributions (of the 25 submitted, seven were discussed in the WC and another six merely incorporated in the proceedings) cannot be classed under extreme labels, such as "pure data analysis" or "pure process analysis", but either tend slightly more to one of these or indeed give them equal emphasis. Almost all employ graphical diagrams for communicating with the "user" and most also utilize a more or less formal language for the functional specification.

If four papers will be briefly discussed here, it is not because they were better than the others or led to a superior product, but because they are each representative of some typical feature that puts them in a special class.

Lundeberg [19] applies his own ISAC-method (described in detail in a book [20]). In many ways it is a descendant of the "Scandinavian school" - as one sometimes calls the earlier work of Langefors [3, 17], Sundgren [29] and others - in particular in its top-down approach with emphasis on a dialogue with the user (who, in this paper exercise, is imaginary, of course). It is a characteristic example of process-orientation in modern form, relying extensively on diagrammatic representations. Thus it supports especially the initial phases of a project ("AC" stands for the "Analysis of Change" in the organization it is applied in) and allows a designer much freedom in the later, detailed phases of his task.

Verheijen and van Bekkum [32] demonstrate the use of NIAM (Nijssens Information Analyse Method), which is a representative of the "organizational mapping" view of the IS mentioned before. It describes the elements of the abstract system in the form of binary relations (as in the Entity-Relationship model). These make it effective in that phase of the analysis where the problem definition has progressed to the point where one can begin being precise. In this sense it has a clearly data-oriented origin.



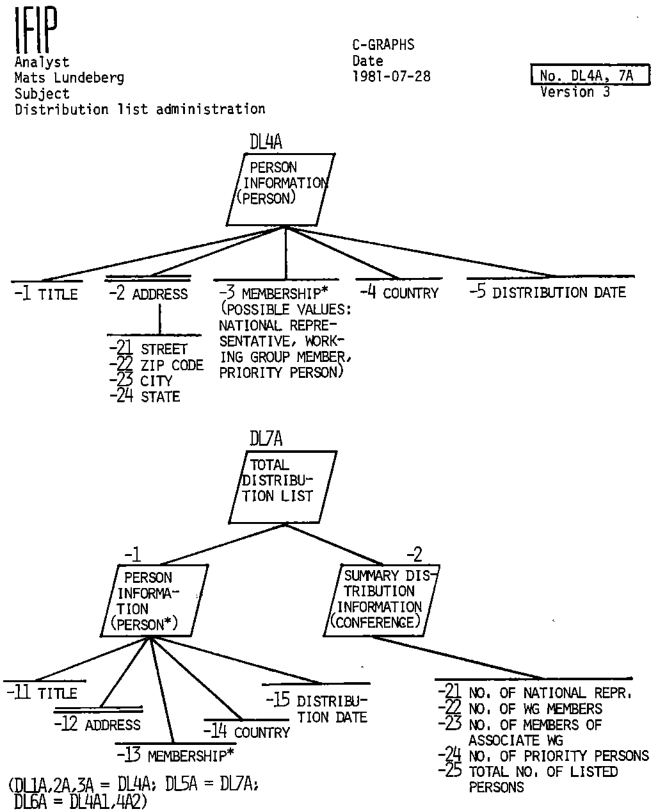


Figure 5. Two examples of ISAC-diagrams [19, p.199, p.213]

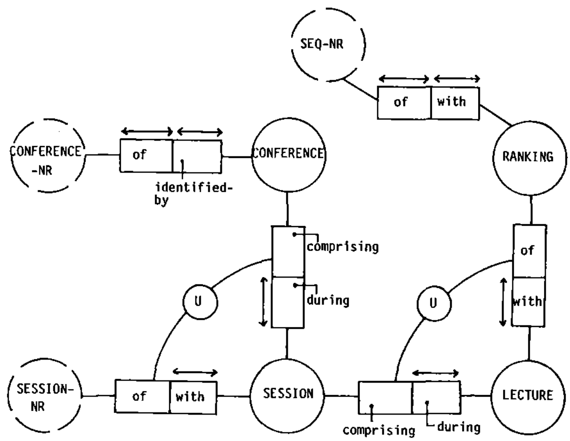


Figure 6. Example of a NIAM-diagram [32, p.553]

Brodie and Silva [2] made use of the ACM/PCM methodology (Active and Passive Component Modeling), which at the time of the CRIS exercise was in a stage of development in its academic environment. It pairs process-orientation with data-orientation and employs simple graphical representation symbols as well as a very formal data- and process-modeling technique. Lastly, it takes more explicit account of the dynamic (time) aspects of the RS than most other methodologies in that, at each level of abstraction, it distinguishes "structural" and "behavioral" modeling features (hence its name).

Wasserman [39] first presented his USE (User Software Engineering methodology) at the Oxford WC [37]. USE itself is not an IS design methodology in the customary sense, in that various models might be applied en route to the starting point of its application. As the name implies, it is in fact a prototyping tool, and the author shows how to move through all phases of the design process. In the CRIS contribution data flow diagrams and structure charts serve the user-oriented representation, while the documentation incorporates samples of user/system dialogue. The design details are expressed in a design language, the main specification is formal in style.

It should be stressed again that this highlighting does not imply any value judgement of the methodologies presented, nor of the papers themselves as compared with the other contributions. They do indicate, however, the different ways in which formality may be introduced. Also one observes at least two ranges: process-orientation to data-orientation, and schematic to prototyping, respectively.

That many dimensions must be considered became even more clear in the second CRIS conference. It was held in York, UK, from 5-7 July 1983. The short interval between the two made a deep study of the CRIS-1 material and a combination of the results with other observations virtually impossible. Yet new contributions to the basic theme were made and the discussion supplemented these significantly. The proceedings [A.8] are especially interesting by providing an insight in the crystallization process, for here "audi alteram partem" (or should one say "aliquas partes") is recorded in the form of four comments on comments by CRIS-1 authors.

The York WC, intended as the second of three, obviously is only one step on the way to the synthesis aimed at. Comparison of IS design methodologies will remain one of the TC8 themes for some time to come. One aspect, sofar not highlighted, is the progress made in practical application. It will be taken up in the third CRIS WC, to be held in 1986 [A.13]. A full "synthesis" will follow only later.

AUTOMATED TOOLS

The tools-orientation referred to at several points before, has a very pragmatic basis. Neither ad-hoc systems, nor academic theories will lead to real progress, unless a broad field of possibilities is explored. In the USA this was felt in the early '70-s, when both the language-specialists and database-specialists seemed to come to the end of a road. A considerable impulse was experienced from ACM-SIGSOFT, a special interest group dedicated to the development of software tools. A proposal to undertake similar work in TC8 resulted in setting up the Task Group "Information Systems Engineering", chaired by A.I. (Tony) Wasserman.

The direct "product" of this Task Group is the maintenance of contact on a global scale, with Working Conferences at appropriate times. The first of these was held in New Orleans, from 26-28 January 1982. Five main areas were addressed: Tools for analysis, Tools for system design, Tools for data design, Application development systems, and Integrated development environments.

The word environment has at least two meanings in our context. In the original one it is what a worker, a department or an organization live in the midst of. It is e.g. part of the Bonn WC title. For the software engineer, of course, it designates the collection of tools a professional in this field is surrounded with. One should hope that his or her perspective reaches farther than these, but the terms "automated tools" and "programming environment" are almost synonymous today. In the WC "Automated Tools for Information Systems Design" [A.5] these and their feasibily are studied from a variety of angles. In his general review Wasserman [38] sees the <u>software development methodology</u> as taking the central position of the "environment", which consists of <u>technical methods</u>, <u>management procedures</u> and <u>automated tools</u>. As to the latter " ... it is observed that present capabilities are quite primitive and that a new generation of software tools must be built to take advantage of advances in hardware and database technology ... ".

The material presented is so varied, that mentioning individual papers would distort the correcter impression of a large number of researchers gradually synchronising their approaches. One may say that there are two essentially different lines, viz. the analysis and design tool work leading to integrated "development environments", and that of building "application generators".

The manual craft-like approach currently practised in IS design and its subsequent program development, undoubtedly must be replaced by a more industrialized one. It may take the "generator" line mentioned (with possibly no IS being redesigned after a running prototype is achieved because the development costs might far outweigh any processing inefficiency), or a mix of computer-aided component-design followed by industrial-style building. Interactive development will certainly be involved, useful both from the user involvement and adaptability points of view.

What level was reached in New Orleans will become clear later this year, when the workshop "Environments to support IS design methodologies" is to be held in Bretton-Woods, USA. There is more to it than a mere linguistic title substitution.

TRENDS AND PERSPECTIVES

A number of trends can be seen in the current work inside the WG's. Two recent conferences should be mentioned in this connection, viz. the Minneapolis WC "Beyond Productivity" (WG8.2, 22-24 August 1983) and the Durham WC "Knowledge Representation for Decision Support" (WG8.3, 24-26 July 1984). In spite of their apparent divergence of subjects, they have in common one central IS theme, viz. that of the required multiplicity of significant approaches. From the the former:

" A recurrent problem in all stages of the development of information systems ... is the variety of backgrounds of the participants ... The process of moving from vague recognition that an information system might improve organizational effectiveness to clear and well defined specification is lengthy and trouble-some. Such a process contrasts sharply with the apparent clarity and rationality of available IS development methodologies, methods, techniques and tools ... " [A.9, editorial introduction]

The WC had been announced as a "multiperspective view" and this is precisely what one gets in reading its 5 invited and 23 contributed papers. It is clearly one intermediate step in a much longer series to come. As in the Bonn WC and the joint Budapest WC in between the conclusion can only be that there is no final theory in sight. Perhaps the absence of one single theoretical framework is the theory itself: the full richness of a true IS results from a diversely based team (where the details of the diversity and the tools required need filling in yet ...).

The Durham WC constituted a kaleidoscopic approach. Practioners of very different disciplines joined in discussions on how to represent "knowledge". The need for a multidisciplinary slant was stated in WG8.3's scope (the six "reference disciplines"). However, one of the "knowledge-field-integration" problems - that a person with one background knows too little of what has been achieved in some other domain and spends a lot of effort in rediscovering what is already commonly known there - was very apparent on this occasion also. All the same this WC was a very enjoyable stage en route. But, as in the case of the organizational multiplexity, the final theory may not be a unified one. The failure, to date, of generalised expert systems (as opposed to ad-hoc ones) should be a warning!

Summarising ten years of TC8 activity in the field of IS, one may say that the disjunct research and development of the '60-s and early '70-s happened to come together, not least via our Working Groups. This has made it a very interesting period. As to the (near) future two main themes are expected to dominate:

- the search for a practicable THEORY of INFORMATION RESOURCES
- the development of GENERALISED IMPLEMENTATION tools

The key words for these are <u>formalization</u> and <u>generators</u>, respectively. What form they will take is harder to predict. However, the "environment" in the classical sense will most certainly be a determining factor. That means "people" in the first place. It also comprises the development of the "office" and its communications. Decentralized systems - expert systems and modern office systems must both be regarded as such - will become increasingly important. Among other things TC8 will be involved in these when it prepares for a new WG8.4 "Office Systems", taking off from a conference later this year [A.12].

ACKNOWLEDGEMENT

The author is much indebted to the TC8 family and its friends. These, over many years, provided him (and each other) with inspiration and challenge. This paper is a contribution to the 25th Anniversary Celebrations of IFIP, within the confines of which all this was possible. It is dedicated to our future.

FOOTNOTES

[1] The term "object system" was first used in the Scandinavian literature [3]; in abbreviating it as "OS" an unfortunate confusion with the "operating system" arises, which leads us to prefer RS as the designation of the real world, controlled, system, that is the objective of our IS ...

[2] Sprague actually refers to an "end-user", a well-known but very inappropriate terminology, which this author would prefer to put to rest once and for all; for there never is a "first user" or "previous user" of information as there is with durable goods, e.g. in the used-car trade!

TC8 PUBLICATIONS:

[A.1] EDUCATION AND LARGE INFORMATION SYSTEMS, R.A. Buckingham, ed., Proceedings of the TC3/TC8 Working Conference (The Hague, 18-21 April 1977), North-Holland, 1977.

[A.2] FORMAL MODELS AND PRACTICAL TOOLS FOR INFORMATION SYSTEMS DESIGN, H.-J. Schneider, ed., Proceedings of the WG8.1 Working Conference (Oxford, 17-20 April 1979), North-Holland, 1979.

[A.3] THE INFORMATION SYSTEMS ENVIRONMENT, H.C. Lucas, F.F. Land, T.J. Lincoln and K. Supper, eds., Proceedings of the WG8.2 Working Conference (Bonn, 11-13 June 1979), North-Holland, 1980.

[A.4] EVOLUTIONARY INFORMATION SYSTEMS, J. Hawgood, ed., Proceedings of the TC8 Working Conference (Budapest, 1-3 September 1981), North-Holland, 1982.

[A.5] AUTOMATED TOOLS FOR INFORMATION SYSTEMS DESIGN, H.-J. Schneider and A.I. Wasserman, eds., Proceedings of the WG8.1 Working conference (New Orleans, 26-28 January 1982), North-Holland, 1982.

[A.6] INFORMATION SYSTEMS DESIGN METHODOLOGIES: A Comparative Review ("CRIS-1"), T.W. Olle, H.G. Sol and A.A. Verrijn-Stuart, eds., Proceedings of the WG8.1 Working Conference (Noordwijkerhout, 10-14 May 1982), North-Holland, 1982.

[A.7] PROCESSES AND TOOLS FOR DECISION SUPPORT, H.G. Sol, ed., Proceedings of the Joint WG8.3/IIASA Working Conference (Schloss Laxenburg, 19-21 July 1982), North-Holland, 1983.

[A.8] INFORMATIONS SYSTEMS DESIGN METHODOLOGIES: A Feature Analysis ("CRIS-2"), T.W.Olle, H.G. Sol and C.J. Tully, eds., Proceedings of the WG8.1 Working Conference (York, 5-7 July 1983), North-Holland, 1983.

[A.9] BEYOND PRODUCTIVITY: Information Systems Development for Organizational Effectiveness, T.M.A. Bemelmans, ed., Proceedings of the WG8.2 Working Conference (Minneapolis, 22-24 August 1983), North-Holland, 1984.

[A.10] KNOWLEDGE REPRESENTATION FOR DECISION SUPPORT, L.B. Methlie and R. Sprague, eds., Proceedings of the WG8.3 Working Conference (Durham, 24-26 July 1984), North-Holland, 1985 (in preparation).

[A.11] THEORETICAL AND FORMAL ASPECTS OF INFORMATION SYSTEMS, A. Sernadas and A. Olivé eds., Proceedings of the WG8.1 Working Conference (Sitges, 16-18 April 1985), North-Holland (in preparation).

[A.12] OFFICE SYSTEMS, A.A. Verrijn-Stuart and R.A. Hirschheim, eds., Proceedings of the TC8 Working Conference (Helsinki, 29 September-2 October 1984), North-Holland (in preparation).

[A.13] INFORMATION SYSTEMS DESIGN METHODOLOGIES: Improving the Practice ("CRIS-3") T.W. Olle, H.G. Sol and A.A. Verrijn-Stuart, eds., Proceedings of the WG 8.1 Working Conference (Noordwijkerhout, 1986), North-Holland (planned).

OTHER PUBLICATIONS:

[1] Blumenthal, S.C., Management Information Systems; a framework for planning and development, Prentice-Hall, Englewood Cliffs, N.J., 1969.

[2] Brodie, M.L., and Silva, E., Active and Passive Component Modeling:ACM/PCM, in [A.6, 1982] 41-92.

[3] Bubenko, J.A., Langefors, B., and Sølvberg, eds., Computer-Aided Information Systems Analysis and Design, Studentlitteratur, Lund, 1971.

[4] Bubenko, J.A., Information Modeling in the Context of System Development, in Information Processing 80, S.H. Lavington, ed., 395-411, North-Holland, 1980.

[5] Burch, J.G., and Strater, F.R., Information Systems: Theory and Practice, Hamilton Publishing Co., Santa Barbara, Calif., 1974.

[6] CODASYL Development Committee, Language Structure Group, An Information Algebra, Comm. ACM 22 (1962) 190-204.

[7] Codd, E.F., A relational Model of Data for Large Shared Data Banks, Comm. ACM 13 (1970) 377-387.

[8] Cook, S., and Stamper, R., LEGOL as a Tool for the Study of Bureaucracy, in [A.3, 1980] 311-324.

[9] Couger, J.D., Evolution of Business System Analysis Techniques, Computing Surveys 5 (1973), 167-198; also in [10].

[10] Couger, J.D., and Knapp, R.W., System Analysis Techniques, John Wiley and Sons, New York, 1974.

[11] Courbon, J.-C., and Bourgeois, M., The Information System Designer as a Nurturing Agent of a Socio-Technical Process, in [A.3, 1980] 139-148.

[12] Earl, M.J., and Hopwood, A.G., From Management Information to Information Management, in [A.3, 1980] 3-14.

[13] Forrester, J.W., Industrial Dynamics, The MIT Press, Cambridge, Mass., 1961.

[14] IFIP, An International Curriculum for Information Systems Designers, J.N.G. Brittan, ed., ICC-IBI, Rome, 1974.

[15] Land, F.F., Mumford, E., and Hawgood, J., Training the Systems Analyst of the 1980's, in [A.3, 1980], 239-256.

[16] Langefors, B., Some Approaches to the Theory of Information Systems, BIT 3 (1963) 229-254; also in [10].

[17] Langefors, B., Theoretical Analysis of Information Systems, Studentlitteratur Lund, 1966 (fourth edition, 1973).

[18] Lombardi, L.A., Theory of Files, Proc. Eastern Joint Computer Conf. (1960) 137-141.

[19] Lundeberg, M., An Approach for Involving the Users in the Specification of Information Systems, in [A.2, 1979] 195-218.

[20] Lundeberg, M., Goldkuhl, G., and Nilsson, A., A Systematic Approach to Information Systems Development, Inform. Systems 4 (1979) 1-12.

[21] de Maio, A., Bartezzaghi, E., and Zanarini, G., A New System Analysis Method based on the STS (Socio-Technical System) Approach, in [A.2, 1979] 167-194.

[22] Meyer, B.E., and Schneider, H.-J., Tools for Information System Design and Realization, in [A.2, 1979] 1-30.

[23] Nijssen, G.M., van Assche, F.J., and Snijders, J.J., End-User Tools for Information Systems Requirement Definition, in [A.2, 1979] 125-148.

[24] Olle, T.W., The CODASYL Approach to Data Base Management, John Wiley and Sons, Chichester, 1978.

[25] Sol, H.G., Simulation in Information Systems Development, PhD Thesis, University of Groningen, 1982.

[26] Sol, H.G., Processes and Tools for Decision Support - Inferences for Future Work, in [A.7, 1983] 1-6.

[27] Sprague, R.H., A Framework for Research on Decision Support Systems, in: Fick, G., Sprague, R.H., eds., Decision Support Systems: Issues and Challenges,Pergamon Press, Oxford, 1980.

[28] Stamper, R.K., Information in Business and Administrative Systems, B.T. Batsford, London, 1973.

[29] Sundgren, B., An Infological Approach to Data Bases, Thesis, Stockholm, 1973.

[30] Taggart, W.M., and Thorp, M.O., A Survey of Information Requirements Analysis Techniques, Computing Surveys 9 (1977) 273-290.

[31] Teichroew, D., and Sayani, H., Automation of System Building, Datamation (August 15, 1971) 25-30; also in [10].

[32] Verheijen, G.M.A, and van Bekkum, J., NIAM: An Information Analysis Method, in [A.6, 1982] 537-590.

[33] Verrijn-Stuart, A.A., Information Algebras and their Uses, Management Datamatics 4 (1975) 187-197.

[34] Verrijn-Stuart, A.A., Kwantitatieve Aspecten van Informatie-Systemen, Samsom Alphen aan den Rijn, 1976 (in Dutch).

[35] Verrijn-Stuart, A.A., The Past and Future of Information Systems, EURO IFIP 79, P.A. Samet, ed., 153-161, North-Holland, 1979.

[36] Verrijn-Stuart, A.A., Hierarchies of Information Systems, in Mathematical Structures - Computational Mathematics - Mathematical Modelling, 2, 320-325 Publishing House of the Bulgarian Academy of Sciences, 1984.

[37] Wasserman, A.I., USE, a Methodology for the Design and Development of Interactive Information Systems, in [A.2, 1979] 31-50.

[38] Wasserman, A.I., Automated Tools in the Information System Development Environment, in [A.5, 1982] 1-9.

[39] Wasserman, A.I., The User Software Engineering Methodology: An Overview, in [A.6, 1982] 591-628.

[40] Young, J.W., and Kent, H.K., Abstract Formulation of Data Processing Problems, J. Ind. Eng. (Nov-Dec 1958) 471-479; also in [10].

J. Vlietstra

A QUARTER CENTURY OF IFIP
H. Zemanek (Editor)
Elsevier Science Publishers B.V. (North-Holland)

AUTOMATION in TECHNOLOGY
- THE CASE OF COMPUTER AIDED DESIGN AND MANUFACTURE -
A contribution to the 25th anniversary of IFIP.

by

J.Vlietstra
past TC-5 chairman
AT&T and Philips Telecommunications B.V.
Hilversum
The Netherlands

Abstract

From the moment that computers were introduced in industrial environments, rapidly evolving computer technologies have been applied in design laboratories and factories. The use of computers and Information Technology (IT) in the technologically oriented parts of the industrial firms is expanding very rapidly. This despite the fact that the development of Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) is one in which the majority of the Information Processing Community took very little interest until recently.

Enormous progress has been made in both development of CAD and CAM software and in the application of these techniques in a very large variety of engineering disciplines.
An attempt will be made to present some aspects of the exciting world in which development laboratories, engineering departments, drawing offices and factories have been and are introducing CAD and CAM.
The evolution of CAD and CAM will be briefly summarized, followed by an overview of the many constituting areas and techniques which define CAD and CAM.
The article will further elaborate on the current technology in CAD and CAM and what is to be expected in the near future. A critical short note on the way in which certain sectors of the Information Processing Community tend to approach CAD and CAM with the fashionable CIM-techniques will be followed by an enumeration of known organizational, technical, social and cultural problems. Some observations will also be made on how these problems can be overcome or how one has to learn and live with them.

This article also implicitly reflects the important contributions of IFIP's Technical Commity 5 on Computer Applications in Technology in Computer Aided Design and Computer Aided Manufacture.

Introduction

On an occasion like this kind
it becomes more than a moral
duty to speak one's mind.
It becomes a pleasure!

Oscar Wilde.

Technical Automation consists of those activities in the commercial, development, engineering, production and service departments which deal with its *technical, i.e. engineering* aspects. These technical activities are to-day dominated by what is called CAD/CAM: Computer Aided Design and Computer Aided Manufacture.

In different parts of the world CAD and CAM mean different things. Sometimes CAD only covers the automated or computer controlled drawing process, and CAM is limited to the application of Numerically Controlled (NC) Machine Tools. As a consequence new notions: CAE for Computer Aided Engineering, CAL for Computer Aided Logistics, CAP for Computer Aided Production, CAPE for Computer Aided Production Engineering and CAT for Computer Aided Testing were introduced. Assuming that organizationally a Company contains a Laboratory for the functional design, an Engineering Group for the physical design and a Factory for the actual realization of the product(s) we will limit ourselves, for the sake of simplicity, to CAD as applied in the Laboratories and Engineering Groups, and CAM as applied in the Engineering Groups and Factories. CAD activities will thus include those of CAE and CAT, while CAM activities will include CAT, CAP, CAPE and CAL.

Note: Due to the specific expertise of the author the article will specifically address the CAD and CAM aspects of an electronic industry.

1. THE EVOLUTION OF CAD AND CAM

1.1. Computer Aided Design

Computer Aided Design (CAD) activities were introduced in design and engineering offices soon after the introduction of the first industrial computers in 1951. The engineering environments which most benefitted by the advent of computer technology were those in the avionic and the electronic industries.
It became possible for these two fields of application to replace the tedious and difficult hand-calculation methods with procedures and algorithms that could be solved using the first electronic computers, providing more accurate results than ever before.

The avionic industry was the very first to benefit from CAD techniques by utilizing programming methods to calculate the loads and stresses in the essential parts of an airplane. The finite element analysis techniques [4] used in such calculations thus became the backbone of many design methods which would never have been applied without the fast calculation abilities of electronic computers. In the very same industry the analysis of structures was soon to be followed by the usage of computer methods to model shapes and bodies of aircrafts [2]. The combination of this geometric modelling technique with the structural analysis methods provided the basis for the phantastic speed with which the aerospace industry leaped forward.

Not so much later, the first CAD techniques were modestly applied in the engineering discipline that had itself given birth to the means which were used by the avionic industry: electronic engineering. The first methods were developed to calculate the behaviour of analogue circuitry. The advent of digital techniques soon led to the first simulation programs which could analyze the correct design of this type of product. Similar to the development in the aircraft industry, other applications were rapidly introduced in the electronics industry. The publication of Lee's algorithm [3] opened the way to replace the tedious and time-consuming layout activities by computer-supported aids.

The two examples cited above were put into practice in the very first 10 years of computer existence in industrial environments. In the decade that followed, the methods were refined, the algorithms improved, other application areas were developed, and the constant improvements in the speed and memory capacity of computers made the processing faster and more efficient. The development of computer graphics [10] added capabilities to the CAD methods to such an extent that CAD activities were no longer confined to laboratory type of work, but was even being introduced in drafting offices as well.

And, with that introduction of CAD into the drafting world together with the subsequent success of the so-called "turnkey" suppliers of CAD-equipment the fast development of CAD came to a temporary halt.
The orientation fixed on the possibilities of replacing conventional drafting methods with more and sometimes very advanced techniques created a culture which dominated (and to the opinion of the author still dominates) CAD practices far too much. It is not to be disputed that the introduction of computer graphics in the drafting practice yielded very striking results. But, what happened was a degradation of the very essentials of the complete design process itself. Hence, all actions were directed towards drafting and detailing, and many too few CAD-experts focussed on the other phases in the design process.

Each phase is equally important and regrettably the very essential phases of product specification and product documentation have hardly been considered as CAD activities where at least as much can be earned in time and capacity, as is being earned in the detailing phase.[1] It may be argued whether advanced and computer interpretable specification techniques are defining the most important aspects of all what is called CAD.

The advent of the VLSI era will show that without considering CAD for the VLSI design process in its totality, the complexity of such circuits will never be mastered.

1.2. Computer Aided Manufacture

Like CAD, the first experiments in CAM, i.e. electronically supported manufacturing processes, were made shortly after computers found their way into Industry. In 1953 the Massachusetts Institute of Technology (MIT) achieved

---

[1]All drafting work, including the layout process in electronic engineering is classified as 'detailing'. This is done to maintain the same notation over a large number of engineering disciplines.

success in putting a first trial model of a numerically controlled (NC) machine into operation. By the end of the 1950s the use of NC equipment was clearly increasing, specifically in the aircraft industry, and as one became aware that it would not be feasible to go on programming this kind of equipment manually, i.e. manually putting all NC instructions into the controller's memory, the first NC-oriented computer languages were being used towards the end of the same decade.

Like other forms of automatic process control, NC expanded enormously during the sixties and seventies. In addition to milling, other machining operations were included in the NC package. Then non-cutting operations were added, such as welding and chemical forming techniques. Although NC was mainly used for machining and forming operations, the control methods used in it were found suitable also for automating other factory processes., e.g. the transportation of tools (drills, boring tools, milling cutters, etc.) from specially constructed stores to the tool holders. The techniques applied to the tools were also found to be applicable to the transportation of the parts to be machined. Special control units were replaced by dedicated computers to be followed by larger computers controlling and scheduling a number of NC-machines. Soon after that robots emerged. Hesitantly at first in the early seventies, then with more impetus. Initially the robots used were of a simple design. Programmed instructions were combined with a great many degrees of freedom of movement for picking-up materials and products and carrying them to a different location, complete with changes in spatial orientation. Later versions permitted "human operations" to be sensed and stored in the robots memory, enabling the robot to imitate these human operations exactly. And lastly the camera was introduced to relax or overcome some of the existing constraints with regard to the location and orientation of the product to be transported or processed. Today robot technology has matured to an extent that will slowly but drastically change the sceneries and working environments in our factories.

All the automated factory functions mentioned thus far are related to processes involving discrete manufacturing techniques. The production methods for metallurgic and chemical products are not discrete but continuous. These methods, too, began to be subjected in the 1960s to monitoring and control by what were called process computers. It is this form of automation that the mini-computer and micro-computer owe their successes.

Finished products or subassemblies are usually, before leaving the factory, subjected to a quality inspection or test sequence. Especially in the electronic industry use is made of advanced equipment backed by full-fledged computers to perform this function, especially for testing Integrated Circuits (IC's), printed circuit boards or complete systems. Often the test data gathered in this way is passed on to computerized quality registration and analysis processes. This approach to testing and quality management began to emerge in the 1970s and will soon be coupled to knowledge-based* systems with which the repair sequences can be predicted very accurately.

A very important aspect of CAM focusses on the logistic operations in the factory. From the very first moment the computer proved to be a realistic proposition in industrial applications, the information committed to this new equipment for processing included management information. Computers were found to be eminently suitable for handling jobs such as scheduling, job recording, record updating, report generating, etc. In the 1960s computer professionals learned that work of this kind is regularly done not only in the office environments but also in factory environments. That did, however, not lead to a major break-through until around 1970.

As production methods were increasingly computerised for the purpose of production control, the emergence of communication techniques for interlinking computers made it a realistic proposition to pass on data from individual control devices to a centrally located computer charged with the task of performing all sorts of logistics processing operations. At the same time the preparation of parts-lists (bills of materials) was computerised in many areas. If all the information that is to go into all the parts lists is brought together into a huge data file at an early stage of product development, a basis is established for the planned ordering of all the constituent parts, components, materials, and - to-day even - software.

Keeping up records of goods entries and goods issues was next entrusted to "plant computers". And these machines could also take on the task of logging events in inspection departments. The reject percentages determined there not only provide a valuable input for planning and scheduling but also ensured the vital feedback into the management function. With such a plant computer (or an interlinked series of computers on the factory floor) it is possible to keep track of machine loading, available human and other resources, thus obtaining data with which a master production plan could be updated at a real-time basis.

Finally, there are some other, hardly less important, automation aspects of the manufacturing environment - entering the scene in the 1970s - which deserve to be mentioned in this review.
Materials that are to be formed or assembled into products have to be stored. So have the incoming goods and the final products of the manufacturing process. There is an increasing use of automation today in the operations of issuing materials from the factory store and stockpiling products in commercial stores or warehouses [8]. Identification of materials or products is done by sensors which can read bar- or dotcodes. Since the late 1970s we have also reached the stage where computer-controlled conveyor systems can automatically pick and transport raw and half-finished materials and completed products.

Clearly all these ingredients make the control of a production unit a straightforward matter once all processing and transportation times have been fixed. And this condition is satisfied, indeed, if the process is controlled by machines. If CAD and CAM can be resorted to whenever required, all such manufacturing activities can be calculated accurately in advance. But in places where human operators still play crucial roles, allowance must, unfortunately, be made for uncertainty factors.

In this chapter the evolution of CAD and CAM was reviewed. Most of the important aspects of the Information Technology Discipline were mentioned. These - the aspects which constitute CAD and CAM - will be explicitly discussed in the next chapter.

2. THE CONSTITUENT PARTS OF CAD AND CAM

As has been stated in the Introduction CAD is exercised in the Laboratory and the Engineering Group and CAM is predominantly an activity of the Factory. However, a fair number of activities that will result in data which has to be used in CAM processes is being generated with the aid of CAD programs. An overview of the CAD and CAM activities is presented in the following overview.

+ COMPUTER AIDED DESIGN ACTIVITIES

- PRODUCT SPECIFICATION
  A formal method which lends itself to rigourously define a product. An example could be the description of a pure digital circuit through its boolean equations. A number of Product Specification Methods uses a combination of graphical and high-level language notations [6] [5].

- DESIGN SYNTHESIS
  The process that (in the electronic industries) leads from Product Specification to the complete set of functional diagrams and descriptions that are readily understood by the department that will construct a physical model based on the results of the Design Synthesis' activities.
  Sub-activities in this synthesizing work are:

  * Analysis: Technique with which the architecture of a complete system can be analyzed on the basis of the product specification.

  * Design Partitioning: Activity which partitions the functions of a circuit over software and hardware implementations and which partitions the hardware part over a number of (different) carriers. The carriers may consist of semi-conductor technologies, hybrid technologies or printed circuit technology.

  * Simulation: A method with which a computer model of a circuit or system can be constructed, after which the behaviour of the modelled circuit can be simulated in a computer. Simulators that do compute the behaviour of electronic circuitry on different levels of abstraction are today in use.

  * Testibility Audits: Programs which analyze a circuit on testibility. Also here a computer model (simulation model) has to be available.

  * Design Verification: Verifies the correctness of a design in certain design stages. Example: it is possible to detect whether the model used to simulate a circuit is consistent with the product specification.
    N.B. After a layout (detailed physical design) has been created it can be verified that this layout is in conformance with the simulation model. As such design verfication activities may appear throughout the design-production cycle.

- PART SELECTION
  Based on a set of given parameters the components which fulfill the conditions of the given parameters can be selected from a Data Base which contains the data of the allowable components and further related information.

- **DETAILING**
  The design process that will eventually lead to a physical model of the design intention and its accompanying technical product documentation.
  Detailing activities can be subdivided in:

  * Layout Realization: Drawing or layout activity in which the physical details and dimensions of a design are established.

  * Partslist Preparation: Composition of the information which represents the selected components, materials and parts and their required quantities.

- **PRODUCTION DATA PREPARATION**
  This activity represents the various processes in which information for a variety of production machines is being created in a form suitable for the electronic controllers of such production equipment, such as:

  * Data for Numerically Controlled Equipment: NC-programs capable of being handled by the electronic equipment of NC-machines.

  * Data for Insertion and Sequencing Machines: Data formats that will be accepted by the controllers of inserters and sequencers.

  * Test Data: Data formats for automatic test equipment.

  * Data for Robots: Programs suitable for controlling robotic devices.

  * Data for Automatic Chemical Processes: Data required for the control of chemical processes such as silicon foundries or automated soldering baths.

- **PREPARATION OF PRODUCT DOCUMENTATION**
  All the activities through which the Technical Product Documentation can be generated. Examples are:

  * Parts Lists: Structured information on all the used materials and components. The structure of the information is based on the product structure (composites, mono's, etc.)

  * Drawings: Schematic drawings, assembly drawings, mechanical drawings etc.

  * Test Specifications: The complete set of specifications indicating how the tests of a specific design have to be carried out. These documents contain both textual and graphical information.

  * Software Sources: In those situations in which part of a product is defined by computer programs the sources and possibly its compiled code has to be documented.

  * Document Overviews: List of the set of all generated documents and drawings with their status and date of birth. Also computer files that contain information for electronically controlled test- and production-machines belong to this survey.

- ARCHIVING AND DISTRIBUTION OF PRODUCT DATA
  The activities that will result in combining all relevant product documentation, storing this documentation, and distributing it to authorized persons or departments with the aid of computer equipment and data-communication techniques.

+ COMPUTER AIDED MANUFACTURING ACTIVITIES

  - PRODUCTION MANAGEMENT
    Composition of master plan and global shop floor plan of the factory. The plans are based on the required materials, the facilities and resources of the factory and the known priorities. The Production Management [9] activities contain as very important ingredients:

    * Engineering Data Control System:
      This activity coordinates the gathering and modifications of all information determining the product structure (engineering and production parts lists) and the production process (production groups, capacity groups, work centers and routings) as well as the information pertaining to all master records (parts list items).

    * Master Production Scheduling:
      Translates a Master Plan (4-year strategic plan) into an operational plan, on the basis of received customer orders and sales forecasts. It establishes the finished goods demand expressed in quantities of products to be made and/or bought and specified per period of time. It checks the stock to find out to what extent a demand is already covered by available stock and/or purchase and work orders not yet honoured. It further draws up a Master Production Schedule for the make and buy products.

    * Manufacturing Activity Planning:
      Together with the Inventory Management these two make use of Material Resource PLanning - MRP-II -, which permits a step-by-step gross-to-net requirement calculation for all parts list items (both make and buy products) with the aid of the Material Production Scheduling and purchase order allocations and on the basis of the product structure and the production routing data. Next, order quantities are determined and the release orders are established, taking the lead time of buy and make products into account.

    * Inventory Management:
      Administers the stock data and its modifications.

    * Work Order Release:
      When the planned date for releasing work orders has come, MRP-II generates work orders. Work order release carries out a material availability check, allocates the required materials per order, verifies whether the capacity of a production group is sufficient, and draws up material issuance documents and work order documents, if the material and capacity required are available.

- AUTOMATIC WAREHOUSING
  The automatic storing and retrieving of all physical components, parts and materials. An automatic warehouse is usually a combination of modern mechanical constructions with conveyors and elevator/crane constructions picking and moving standardized pallets or buckets under the control of - also usually - a medium-size computer.

- AUTOMATIC PLANT TRANSPORTATION SYSTEMS
  The computer controlled transportation of components, parts and materials to the factory processes and the transportation of (partly)-finished products to other factory processes or warehouses.

- PRODUCT IDENTIFICATION & REGISTRATION
  All products, passing the various activity sites in the factory and in the stock have to be identified automatically and this data has to be kept up-to-date in a product data base. Identification can be executed with the aid of bar- or dot-codes which can be automatically read by dedicated bar- or dot-code readers. The exact location of the individual items is thus permanently known.

- JOB SHOP SCHEDULING (MANUFACTURING PROCESSES)
  Detailed factory plan which directs all the factory activities on a real-time basis. Most of these activities are carried out under local control of a real-time device. The Job Shop Scheduling System interacts on a real-time basis with the Production Management System (Logistic System), constantly issuing reports on the workstatus of the processes in the factory.

- REAL TIME DEVICE CONTROL (MANUFACTURING PROCESSES)
  Electronic devices that will monitor and control a large number of factory processes in real time. The latter means that tasks and functions of the device are executed so rapidly that the feedback at various stages in the process can be used to guide the device in completing its task.
  Real-time devices are further subdivided in:

  * Numerically Controlled Machinery: Software embedded in the control equipment of a numerically controlled machine tool, which makes the NC-machine that it behaves as intended. Such software operates on a real-time basis. The same holds for:

  * Automatic Insertion and Sequencing Machines

  * Automatic Test Equipment

  * Robots

  * Real Time Controlled Chemical Processes

- QUALITY CONTROL
  Registration of all errors and defects in the manufacturing activities of the product. These data can be analyzed and rules can be deduced from such an analysis in order to improve the development/manufacturing processes or accelerate the repair cycles.

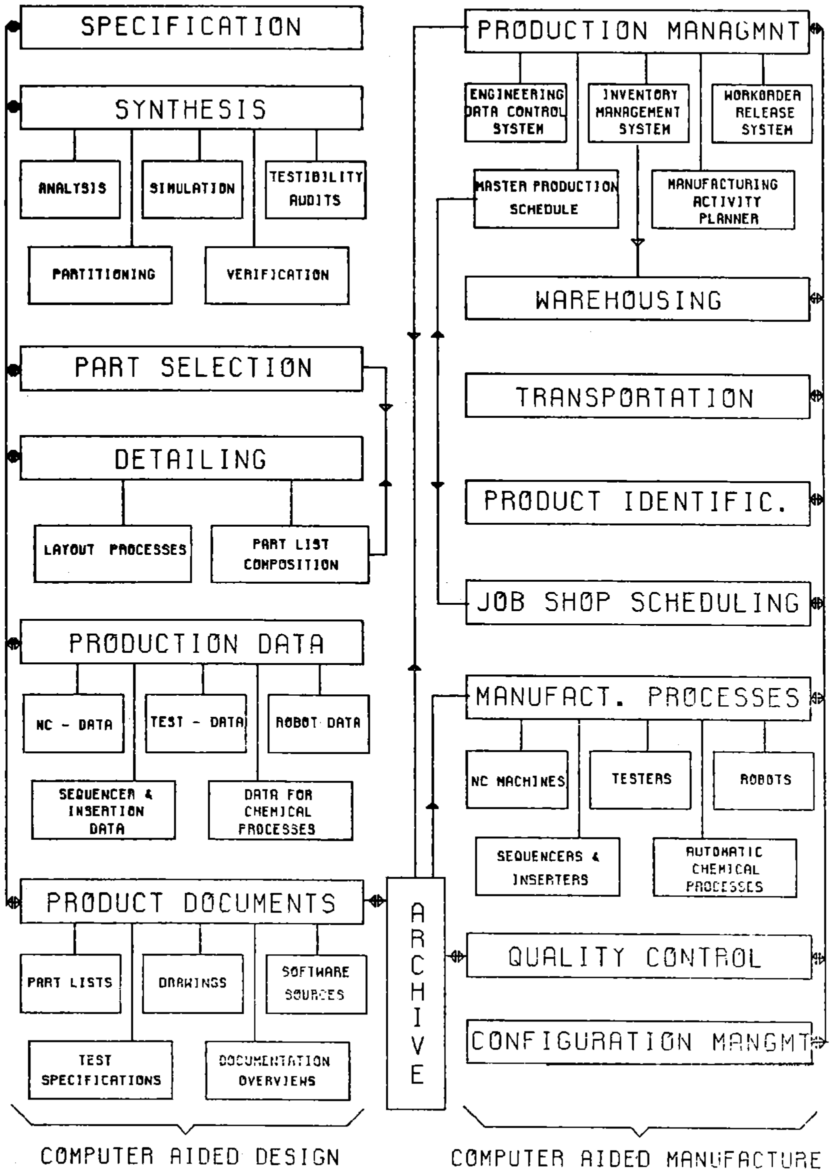


Figure 2-1. The Constituent Functions in CAD and CAM

- CONFIGURATION MANAGEMENT
  Registration of the complete hardware and software configuration of an assembled product. In case parts or components have to be replaced after installation at the customer's site those parts or components can be identified, retrieved and replaced almost immediately.

As can be seen from the above itemization Production Management, an activity which has almost always been governed by the EDP departments has also been added to the list of CAM activities. This has been done intentionally in order to emphasize the technical aspects of this activity and the importance of creating appropriate interfaces between the CAD/CAM worlds and the world which is predominantly concerned with "*Management Information Systems*". The functional location of these CAD and CAM constituents and the interrelated information transports are visualized in figure 2-1.

3. THE STATUS AND IMMEDIATE FUTURE OF CAD-CAM

In each of the constituents of CAD and CAM immense progress has been made over the last thirty years. In the design area specification languages are being developed. Such techniques will insure the unique definition of a product which will be used as the reference specification throughout the lifecycle of the product. Advanced analysis, simulation and testibility auditing techniques are available today, detailing and drafting activities are highly efficient due to the progress made in advanced design algorithms and the extensive utilization of interactive graphics. The latter is constantly being improved in both technical capabilities as well as in availability to an increasing number of users. Artificial intelligence and pattern recognition techniques are providing the design community with reading devices which will read and interpret manually prepared engineering drawings, and, at the other end, production drawings are being automatically generated.

Manufacturing activities follow a similar trend. Numerically controlled machines have been followed by machining centers, flexible manufacturing systems and manufacturing cells with automated supervision. Each of these will soon be equipped with advanced sensoring, automatic viewing and pattern recognition devices, while industrial robots for a variety of assembly and finishing tasks are being installed. Automatic transportation and packing devices, electronically driven and controlled assembly lines, automatic test equipment and extensive scheduling systems are available and already in use today. The data flow and control of our factories will be monitored by large computer systems and data will be managed in hardware oriented data base machines creating possibilities for the technical staff to store, retrieve and modify data instantaneously and to acces all relevant engineering data immediately.

Much, if not all of the information that will have to be used by the production departments will be created in the design phases. A smooth transfer of desing data from design and engineering to manufacturing areas will be carried out by modern communication means through local and wide area networks. Such transfers relate to data files where the importance of drawings and human-readable documents will gradually disappear. This aspect also shows the relative overemphasis that has been placed on computer graphics!

It is further to be expected that intelligent low-cost work-stations for designers, producers, managers, documentalists, librarians with interactive graphics, data dictionaries, advanced editing features and equipped with voice recognition, speech synthesizing devices will be installed in large quantities. This will especially be the case when the price per work-station has been decreased to the $ 5000.- range, a price setting that can easily be obtained with the current price level of the constituting hardware components of these emerging peripheral devices.

In the very near future knowledge based systems will aid the design/manufacturing departments in the decision making aspects of their work. It is to be expected that this and other future computer generation techniques and methods will have a great impact on the technology/part/material/resource selections, that it will accelerate the repair cycles, will start to solve the partitioning problems and improve the total quality of the industrial products.

Nearly all these facilities are of very great use in each separate step or phase of the design/manufacture process. In its totality, however, the process requires optimal communication between each of the earlier mentioned CAD and CAM phases, if one does not wish to run the risk of introducing inconsistencies in the various stages. *It is only too frequent that a realised product is inconsistent with the original functional design!* This causes errors, a considerable delay in throughput time and an excessive amount of extra work, not to mention the corresponding waste of material and computer time. To transfer all the results from one phase to the next and carry out all the necessary reporting back, use is made of "expensive" human-power, which in fact is used as if it is inappropriate "computer-power" to translate results, copy them, eliminate surplus information and apply CAD and CAM program-dependent instructions. It is quite obvious that this represents a second great source of faults.

There is a growing conviction that we could improve our throughput times and our quality considerably if we could shortcircuit the above mentioned design phases which in fact means that we have to create a well-defined communication highway between all the design activities [11]. This means that everything that can possibly be performed by an automated process should be done indeed. *To achieve this, many standards and agreements will be necessary, and certain limitations on the freedom of design will be unavoidable.*

These so-called integrated CAD-CAM systems are being conceived and implemented today and will be put to usage in the years to come. This will mean that the time of producing fancy geometric bodies of revolution and manipulate them on even fancier graphical displays will come to an end. It will feature the start of an economically viable implementation of Technical Automation which will again prove to be a challenge for the industrial engineering society.

4. COMPUTER INTEGRATED MANUFACTURE

The author wishes to keep this chapter short. The engineering worlds have worked their way up from early-constructed design algorithms to interworking and interlinked automated design and manufacturing modules. The human-conceived computer-controlled factory has become a reality.
Is it jealousy or is it ignorance which makes so many "Information Experts" to leave their "Information Caves" and worship their new "Computer Integrated Manufacture" religion?

"Computer Integrated Manufacture": a notion which differs from what most of the design and manufacturing engineers still refer to as CAD and CAM, but a notion which probably serves the purpose of this new generation of "CIM-Consultants". The engineering world has succeeded in making Information and Computer Technology a success, contrary to the situation in the business world where the service industry performs poorer and in a more expensive way with each new computer and device that it installs.

It is to be hoped that such a phenomenon is not to be inflicted upon the typical engineering areas which have proven to be able to produce better, faster and more economic than their "business" colleagues.

5. OTHER AREAS OF CONCERN

Despite the impressive results obtained over the last three decades one should be realistic enough to seriously follow the advent of CAD and CAM. Areas of concern should stimulate the engineering profession never to accept technological achievements on that basis alone. In the authors personal experience one still has a long way to go in order to overcome a number of major problems:

5.1. Technical Problems

Almost all programs and systems which are in use today have been developed in isolation. Specification languages, simulation programs, drawing systems, numerically controlled machine tool languages, production control systems, etc. have been created without proper communications and without the appropriate use of adequate standards. Substantial interface programs had and have to be written in the attempts to create so-called integrated systems, where all relevant data can be passed from one phase in the design/manufacture process to another. In this situation it is to be expected that the addition of another design/manufacture solution that will be embedded in a program necessitates the need for another set of interfaces to those parts of the automated design/manufacture process with which it should communicate. In addition the data entry methods for the various parts of the design/manufacture complex exhibit different notation techniques and language incompatibilities which are rather growing than decreasing.

Added to this is the concern of ever growing libraries of symbols, parts, components, functions, etc. without the guarantee that these libraries will ever be able to mutually exchange their consistuent data, but at the price of enormous conversion and/or adaption costs.

The basic solution to this immense problem is the definition of the data elements that consistute the product and its related design and manufacturing processes. In this way a "hole" as it is defined in the product specification will mean the same as a "hole" as it is manufactured in the actual production process. The lack of data elements will only lead to laboriously constructed interface systems where the main purpose of the interface will be the translation of the data elements from one program to the other. Integrated systems making use of engineering data bases require standardized data elements. This problem generates a unique opportunity for the various International Standardization Bodies to tackle as it is truly an urgent problem.

Similarly, to take advantage of a possible standardization in the area of data elements, a similar attempt could be made in the area of data entry language notations. It is an unwanted and unnecessary situation that the IEC has worked for decades in order to provide the Electro-technical Community with a fine set of standards for drawing electrical and logic symbols while at the same time the language description of the same symbols appears in hundreds of different notations in the various CAD programs.

In places where more and more functions are automated, extreme care has to be given to matters of back-up, recovery, security and safety. In situations where "conventional" human actions and interventions are entirely replaced by automated methods without having created the possibility to fall back on "manual" methods, gigantic losses and complete catastrophes may occur in case of machine malfunctioning, memory degradation, communication errors or even computerized fraud.

5.2. Organizational Problems

The use of information technology in the design, manufacture and production management has introduced new professions. Design laboratories are supported by CAD experts, production units are facing the problem of trying to communicate with CAM- and CIM-engineers, and the production management has to accept the increasingly dominating influence of computer-oriented logistic personnel. In addition design and production departments do make use of computers which are very often located centrally and live their own life, with local budgets and hence computer-center directed priorities.

The need for appropriate managing computer files and data bases has created additional professions: those of the data base manager and data librarian.

The new professions all stem from a new era of information oriented thinking and education, while in many instances the technicians are still educated by their "own" technical oriented schools. This situation creates frustrations and communication problems that are due to the separation of responsibilities: the designer reports to the design manager, the factory worker reports to the plant manager, the computer operator reports to the computer-center manager, the data librarian, the CAD expert, the CAM engineer and the data base manager report to "God knows Who", - a situation which appears to be unresolvable. In many cases a "neutral" coordinator or coordinating body is installed. The net result is more than often that "peace negotiations" are started. The real problem is never ever resolved!

There is a simple solution to this problem: All information processing dealing with design should become part of the design laboratory, and similarly with production/manufacture. After thirty years of industrial computing it is about time to include computers as a common tool in normal working environments and stop creating functions which are not normally incorporated in the daily working discipline. NC equipment and Automatic Test Equipment for that sake have never been decentralized and their programming staff has in almost all cases been included in the normal factory staffings.

5.3. Social Problems

For a long time the design and layout process in an electronic design environment was done in an almost laboratory-style atmosphere. Test set-ups were made, based on the diagrams prepared by the designer and the designer her- or himself would wield the soldering iron. Then the test set-up was thoroughly tested and after evaluation of the results one started to improve the set-up. In most cases this led via an iterative process to a convergence towards a prototype product. When preparing a layout it was quite common to use scissors and adhesive tape so that a four times magnified version of the layout of i.e. a printed circuit board could be made. The product documentation was produced by draftsmen (layouters) and the alphanumeric information by typists.

This picture has almost everywhere drastically changed. The diagrams are now converted back into programming languages, i.e. the designer or draftsperson sits in front of a display screen to enter the network information. The test results are read out from computer prints or appear on the screen. Graphical pictures are made by plotters and, after the data has been evaluated, the parameters are converted into the input language. The layout work also takes place in front of a display screen and the product documentation is mostly, if not always produced automatically.

Working with display-units, particularly if the screen contains graphical information, takes place in half-light, the designers or draftspersons operate a large amount of pushbuttons, keyboards, light-pens, mouses, etc. In brief, the situation has changed enormously [7]. And all this in a period of less than twenty years.

A piece of computing equipment operates at high speed and provides the user with a continuous stream of information. The user has to act on the information and, particularly in human-machine dialogue situations it is not uncommon for the human to be unable to make optimum use of the computer equipment in such a dialogue. The machine is operating at its optimum, but it is quite often forgotten, when CAD/CAM systems are being conceived that for optimum functioning of the human-machine dialogue one must take into account the characteristics of both the human and the machine. It is not unlikely that in a system in which things have not been correctly adapted to suit the potentials of the human being, that he or she will rapidly "burn out" [1].

An even more serious situation may well be created in the way human beings are communicating, or better, are learning how to use their communicative potentials. The foundation of the ability of the human to communicate with his or her fellow beings is formed in their childhood. Formal education adds value to this communication capacity which is further enhanced in his or her industrial career. The constant need to talk and listen to collegaues, peers and subordinates creates a very fertile ground for this "communicative" ability. At many schools the time of individual attention for the pupil is past. Video instructions and audio learning have replaced the teacher and the pupil only learns how to communicate with a "pre-programmed" system in which she or he is taught to make choices from a limited set of alternatives. Modern design and communication devices in the industrial life of the human forces him or her to communicate more and more with computer equipment, and less and less with other human beings. When coming home he or she is faced with preprogrammed entertainment through "dumb" and "unintelligent" computer games or alternatively, he/she inhales the decadent and brainwashing atmosphere of the "Dallasses" and "Dynasties". The result of this could well be a significant degradation of our human communication capabilities and our inter-human relations.

5.4. Cultural Problems

The fact that the natural and technical "language", language definitions and abbreviations in computer dominated environments are all based on the English language creates a cultural problem in most non-English speaking countries. Reports and documents exhibit a mixture of the local and "English-like" words, phrases and definitions. The continued advance of computer jargon in technology, education, entertainment, and even homes will certainly lead to a degradation of language cultures in many non-English speaking parts of the world. Only in a few countries are measures being taken to call a halt to this "cultural" development requiring, for example, even computer products to be described in local languages. Many more measures are needed to prevent a possible massive erosion in this respect, and - to the authors opinion - many more Governments should be alarmed with such a "cultural erosion".

5.5. Employment Problems

The reason for using automation and information processing is to make our product better, faster and cheaper. This is directly coupled with the objective of increasing the human productivity. With the decline of the increasing demand for industrial products and the almost phantastic increases in productivity which will be enforced once the technical problems are resolved, employment opportunities will drastically decrease. The industries which produce computers, robots, peripheral equipment, CAD/CAM systems and software will certainly continue to grow and provide for further employment opportunities. This will, however, constitute only a fraction of those employment positions which will become redundant. As an example, the robot industry creates not more than 20% of the jobs that are lost because of the introduction of robots. At the same time it has become clear that the service industry has ceased to expand at the rate expected and the long awaited post-industrial society has not yet materialized. It is very important to state the situation as it is when it comes to job opportunities and to never paint a rosier picture than really is the case.

6. CONCLUDING REMARK

The application of computers in technology has barely begun. Acknowledging the fact that this created many opportunities and problems, identifying and meeting these, converting the problems into challenges, and seeking appropriate solutions for these challenges may eventually lead the way towards a healthier society in which computer applications play a very important role in support of the "quality of life".

References

[1] M.J.Cooley.
Some Social Aspects of CAD.
Computers in Industry 2(3):209-216, October, 1981.

[2] Double Issue of Computers in Industry - In Memory to Steven Anson Coons
North-Holland Publishing Company. 1982.

[3] C.Y. Lee.
An Algorithm for Path Connections and its Applications.
IRE :346-365, 1961.

[4] S.K.Lee, W.S.Reed.
Finite Element Mesh Generation Employing Satellite Graphics.
In *Proceedings of the 13th Design Automation Conference*, pages 1-6. IEEE, June, 1976.

[5] Douglas Lewin.
Product Specification and Synthesis.
In J.Musgrave (editor), *Computer Aided Design of Digital Electronic Circuits and Systems*, pages 25-40. North-Holland Publishing Company, 1979.

[6] W.Y.P. Lim.
HISDL - A Structure Description Language.
Communications of the ACM 25(11):823-830, November, 1982.

[7] F.Margulies.
Trade Union Aspects and Experiences with Work on VDU's.
Computers in Industry 2(1):73-75, March, 1981.

[8] L.Marks.
Computer Aided Manufacturing (CAM) Technology.
Electronic Packaging and Production :100-112, September, 1982.

[9] D.J. Keulemans.
PTI Overall Logistic Information System (POLIS).
Communicator (62):9-16, 1983.

[10] I.E.Sutherland.
Sketchpad: A Man-Machine Graphical Communication System.
Technical Report 296, Massachusetts Institute of Technology, January, 1963.
Lincoln Lab.

[11] Jakob Vlietstra.
ARCADE - An Architecture for CAD in Electronics -.
Computers in Industry 5(1):3-20, March, 1984.

OBITUARIES

During its 25 years of existence, IFIP has lost not very many, but some members of its family.
They are not forgotten, but in our lasting memory.
A Tribute to them is a natural chapter of this volume.

ALWIN WALTHER, Germany (1899 - 1967)
HEINZ RUTISHAUSER, Switzerland (1918 - 1970)
LARS HYLDGAARD-JENSEN, Denmark (1919 - 1973)
NIELS BECH, Denmark (1920 - 1975)
STANLEY GILL, United Kingdom (1926 - 1975)
CHRISTOPHER STRACHEY, United Kingdom (1917 - 1975)
JAN VAN EGMOND, Belgium (1941 - 1978)
KLAUS SAMELSON, Germany (1918 - 1980)
JOHN PASTA, USA (1918 - 1981)
VICTOR GLUSHKOV, USSR (1923 - 1982)
DOV CHEVION, Israel (1917 - 1983)
DIMITER DOBREV, Bulgaria (1932 - 1983)
KRISTIAN BECKMANN, Sweden (1933 - 1984)
B. FRAEIJS DE VEUBEKE, Belgium (1917 - 1976)
AB JOHNSON, Canada (1924 - 1977)
HANS BEKIC, Austria (1936 - 1982)
JULIAN DAVIES, Canada
HOWARD AIKEN, USA (1900 - 1973)
BENJAMIN BARG, USA-UN (1932 - 1974)
VICTOR BROIDA, France (1907 - 1976)
SVERRE SEM-SANDBERG, Sweden (1930 - 1985)
FRED MARGULIES, Austria (1917 - 1986)

ALWIN WALTHER
(1899 - 1967)
IFIP Representative of Germany

The basic principles of Walther's thinking and working were formed during his time as student and assistent professor at the Technische Hochschule in Dresden and at the University of Göttingen and during his scholarships in Copenhagen and Stockholm. His "guiding stars" were Richard Courant, Felix Klein and, in particular, Carl Runge, whom he adored as the founder of "practical mathematics", the subject he introduced as the name of his institute (IPM) when he, already at the age of 30, was appointed Professor at the Technische Hochschule in Darmstadt in 1928. The idea was a "mathematical laboratory". Walther's motto was that at a Technische Hochschule, mathematics is not to be treated for its own sake, but as a fundamental tool for scientific and technical thinking and working, as an auxiliary science which facilitates the work of engineers, physicists and chemists by its unambiguousness, compactness and clarity. "Applied mathematics," he said, "depends entirely on the available tools and is determined by them. The dominant role is played by numerical procedures and, today, by the execution organs: the digital computing devices."

In order to have these tools available in his institute, and to develop them, Alwin Walther had constructed in his institute workshop - aside from many educational models - small and large mathematical instruments and machines. Outstanding examples are the analog integrator IPM-OTT for linear and nonlinear differential equations, and then the pioneer computer DERA, designed after Howard Aiken's (whom he admired much) MARK IV.

The impact of Walther's didactic mastership covered professional gremia as well as the general public. He organized the first international conference on computers (first at least in the German speaking Central Europe), the GAMM-NTG Fachtagung "Electronic Computers and Information Processing" in October 1955 in Darmstadt and he was the Chairman of the IFIP Congress 62 in Munich, which he had brought to Germany as the German representative (1960 - 196) and for which he laid out the organizational foundation - already overshadowed by his health condition.

Alwin Walther did not yet receive the historic recognition he deserves, not in Germany and even less internationally; his biography is still to be written. But IFIP conserves his memory as its first Vicepresident and as one of the shapers of the IFIP Congresses.

HEINZ RUTISHAUSER
(1918 - 1970)
IFIP WG 2.1 Member

Information Processing, the ETH (Swiss Federal University of Technology) and IFIP have suffered an irreplaceable loss: on November 10, 1970, Professor Dr. Heinz Rutishauser died in the midst of his work at his desk in the institute, of a heart disease which had tortured him for a long time - but yet very unexpectedly for the community of computing. Not only his family remained in deep sorrow: very rarely a man leaves a similar breach behind him and so much cordial feelings with collaborators, and colleagues. Heinz Rutishauser was an unusual mix of genius and human quality; his modesty and kindness kept him so much in unobtrusiveness that the professional world will notice only step by step what is lost with him.

Heinz Rutishauser was born on January 30, 1918, in Weinfelden and lived most of his youth in Frauenfeld (both places in the Swiss Kanton of Thurgau, between the lakes of Constance and Zurich). He studied mathematics at the ETH Zurich, and after three years of lecturer-assistant under Professor Saxer, Rutishauser became teacher of mathematics at district schools, a time he used essentially for writing his doctoral thesis on function theory, published in the distinguished Scandinavian "Acta Mathematica".

Rutishauser returned to the ETH and became assistant professor under Professor E. Stiefel, 1951 lecturer, 1955 extraordinary professor, and 1962 ordinary professor. From 1966 to 1967 he was head of the department for mathematics and physics and since 1968 of the new section on computer sciences. The computer heavily influenced Rutishauser's scientific development. In 1947 the ETH sent a delegation, consisting of Rutishauser, Speiser and Stiefel, through Europe and America to study the computer development. The report, published first in the Journal ZAMM and later as Volume 2 of the Mitteilungen of the Institute of Applied Mathematics, was an excellent introduction into computer technology which coined the German terminology of the field and certainly was not only for the author of the eulogy an important key to electronic computing. In 1950, the ETH took over Zuse's Z4 on which Rutishauser implemented small, but effective improvements. Between 1952 and 1955 a team of the ETH developed ERMETH, the Swiss pioneer computer, the special programming properties of which are due to Rutishauser. "The main scientific theme of his life was the algorithm", wrote his teacher Walter Saxer, "he was a master in the invention of algorithms, and the ones he established form the elementary stock of any related text book". In this respect he is a pioneer of numerical analysis. His theory of numerical stability of differential equations is a landmark in the history of mathematics.

Rutishauser's habilitation thesis from 1952 "Automatic Production of Calculating Schemes for Program-Controlled Computers" marks the beginning of programming languages and the origin of ALGOL. His proposition to use the computer for the production of programs appears today so trivial that one can not imagine what progress it was against the program boxes of earlier machines. In 1955, Rutishauser went into a close cooperation with Bauer and Samelson in Munich, Bottenbruch and Darmstadt on the design of a programming language, an activity that lead to the (triggering of) European input to ALGOL 58. With ALGOL, with the other authors of the ALGOL-report, and with the IFIP Working Group 2.1, Rutishauser remained in close contact during the later part of his life when his health did not allow him further direct cooperation. In 1967 his comprehensive ALGOL-book "Description of ALGOL 60" appeared with Springer; during the following year, Rutishauser took the lead in the organization of the Zurich "Tenth Anniversary Colloquium on ALGOL".

Professor Rutishauser had accepted to contribute a paper for a conference in Oberwolfach, Germany; a few hours before his death - six days before the conference - he wrote a declining letter and mailed it personally - did he feel that he could not keep his promise?

Anyone who has delved into his work and has experienced his cautious, but firm and reliable, laconic but thoughtful manners, his fine humour and his skillfulness in removing personal differences, knows that we have lost a genius and a man with strong character.

LARS ANTON HYLDGAARD-JENSEN
(1919 - 1973)

The Technical Committee on Computer Applications in Technology, TC-5, of the International Federation for Information Processing (IFIP) acknowledges with gratitude the invaluable contributions of Professor Lars Hyldgaard-Jensen to its program and deeply mourns his premature passing on February 14, 1973.

Professor Hyldgaard-Jensen was a world-recognized expert in the fields of land and ship based power system engineering and in the applications of automation techniques to land based power plants and to ships. As such he was instrumental in developing and arranging the programs for the Ship Automation Symposium at the Fifth World Congress of the International Federation of Automatic Control in Paris on June 12, 1972 and the IFAC/IFIP Symposium on Ship Operation Automation schedule for July 2-5, 1973 in Oslo, Norway. Both presentations would have been very difficult if not impossible without his counsel and contributions.

In addition to his expertise in the fields just mentioned, Professor Hyldgaard-Jensen was also quite knowledgeable in all areas of computer applications and automatic control. As such his advice was invaluable to the Committee in all of its many fields of activity related to the myriad of applications of computer systems in present world technology.

The members of Technical Committee TC-5 wish to convey their heartfelt sympathy to his family and his associates and assure them that he will be greatly missed.

Theodore J. Williams, Chairman,
speaking for Technical Committee, TC-5

NIELS IVAR BECH
(1920 - 1975)
IFIP Representative of Denmark

Tribute to Niels Ivar Bech:

Perhaps the most important measure of what has been accomplished during a lifetime is how one is remembered. And Niels Bech is remembered - with respect and affection. The following eloquent tribute by Mr. Auerbach helps to confirm and to bring into focus the many contributions that Mr. Bech made to IFIP.

Richard I. Tanaka, IFIP President

With Niels Ivar Bech's death, Europe has lost one of its most creative leaders in the field of electronic digital computers. He was a giant among his peers as the originator of computer development under the auspices of the Danish Academy of Sciences, the founder and first director of Regnecentralen, Denmark's and one of Europe's first independent designers and builders of electronic computers. He was an inspired builder of people, particularly his own countrymen, of both national and international organizations, and a tower of strength and source of sound advice to all who were fortunate enough to know him.

I met Niels Ivar Bech during one of the organizational meetings for the First International Conference on Information Processing held at UNESCO House in Paris in June of 1959. He was one of the original members of the General Assembly of the International Federation for Information Processing (IFIP) and he became one of my most trusted friends, advisor and counselor.

During the time Niels Bech served as the programme chairman for IFIP Congress 62 held in Munich, Germany, I became aware of the depth of Bech's humanity, sensitivity and knowledge, his indisputable integrity and total trustworthiness as a friend and advisor. He was of invaluable assistance during the most formative period of IFIP's gestation and continued to serve IFIP with boundless energy for over a decade.

He was an advisor to UNESCO and deeply involved in the evolution of the International Computation Center in Rome. He was one of the founders and inspirations for the formation of IFIP's Special Interest Group on Administrative Data Processing (IAG). He was one of the first men in Europe to identify the need for computer education and training within the entire European business users community. As a result he spearheaded the many seminars given on the use of computers and their application to business.

Bech was a warm, understanding human being with whom I shared intellectual exchanges as well as good food, drink, and camaraderie, in cities all over the world, wherever our paths crossed. Our last dinner together was in Toronto, Canada in 1970, during an IFIP Council Meeting. We sought out a Scandinavian restaurant where Bech was well known and enjoyed a dinner together which will be one of my treasured memories.

I have lost a valued friend, our profession has lost a dynamic contributor, and the computer industry has lost a highly creative entrepreneur, but the record of his accomplishments and the memories of his friends and colleagues are a legacy of great significance.

Isaac L. Auerbach
Founder and First President, IFIP
Honorary Life Member

STANLEY GILL
(1926 - 1975)
IFIP Representative of the United Kingdom

Stan Gill entered the computing field already in 1947 when he joined the team led by A.M. Turing, which developed the Pilot ACE computer at the National Physical Laboratory in Teddington. He subsequently returned to Cambridge to work at the Mathematical Laboratory under Professor Wilkes, where the EDSAC computer had just become operational. He obtained a PhD, developed in practice, for the first time, principles of computer programming and, together with Professor Wilkes and D.J. Wheeler, he wrote the book "The Preparation of Programs for an Electronic Digital Computer" (1951). After 18 months in the US (lecturing in Illinois and at MIT) he joined Ferranti (1955 to 1964) where he worked on the design of the ORION and ATLAS computers. Already in 1958 he published a paper on parallel programming and influenced the development of multiprocessing, multiprogramming and time sharing. From 1964 to 1970 he taught as a professor at the Imperial College, London, and subsequently worked in industry as a software specialist and consultant; in 1967/68 Stan Gill was President of the British Computer Society; he was a member of many institutions and committees and he acted as adviser to the British Government for computer questions.

IFIP loses a long-time General Assembly Member (1963-1970) and a contributor to many Technical Committees and Working Groups. As Chairman of the Organizing Committee of IFIP Congress 68 in Edinburgh, Stan Gill took a leading part in the scientific, organizational and financial success of this Congress.

In 1974, during the General Assembly Meeting in Stockholm, he received the newly-created distinction of the IFIP Silver Core Award for his contributions within IFIP.

We all who knew Stan Gill will never forget his unfailing good humour, his forthright manner and his deeply felt conviction that computers play an essential part in the life of man.

Prof. Heinz Zemanek, IFIP Past-President

The last time I saw Stan was in Tokyo in early October 1974. He and I had been invited to be the foreign speakers at a symposium. Our talks followed one another, and on yet another day, we shared the podium in a panel discussion.
In the intervening days and evenings, we spent much time together. And I came to know better this gentleman, this gentle man.
We talked of the future of TC-6, and he promised to help in making true my hopes for that committee. He remembered that promise, for he wrote, less than a month before he died, expressing his regret that he could not help us because of his illness - an illness whose criticality he never mentioned.
His attitude - his open, positive and receptive response to what we saw together in Tokyo - told me much about him, his sensitivity and sense of inner security.
As so few visitors manage, Stan was able to understand and take delight in the marvelous points of differences between his culture (and mine) and that which we saw in Tokyo.
One evening - our final evening - remains vivid in my mind. We were in a little restaurant at closing time. Three of us - the proprietor, Stan and I - were sipping sherry. In our exhuberance, we found a guitar, and tried to teach each other songs - from Japan, from England, and from the USA.

I remember the one that I tried, with these words:

"Today, while the blossoms still cling to the vine,
I'll taste your strawberries, I'll drink your sweet wine.
A million tomorrows shall all pass away,
E'er I forget, all the joy that is mine, today".

Thank you, Stan, for the joys of yesterday and today. We shall miss you.

Dr. Richard I. Tanaka, IFIP President

CHRISTOPHER STRACHEY
(1917 - 1975)

Shortly after Stanley Gill's death the British information processing community suffered another great loss: at the age of 58 Christopher Strachey, one of the most ingenious computer pioneers, passed away on May 18, 1975.

During his work at the famous School of Harrow, Strachey came into contact with the computer for the first time. Somebody had told him about the ACE Pilot System which Mike Woodger was then developing at the NPL (National Physical Laboratory) in Teddington. Strachey asked for a demonstration of the machine, shortly thought about an application and decided to write a program for draughts - a very daring idea at that time. Mike Woodger was extremely sceptical, but Strachey started his work with his characteristic profundity; he was at his creative best after midnight, in the small hours. Already on his next visit Woodger admitted that the result was quite useful. It is true that the program was run only some years later after somebody found the pack of cards, eliminated errors and ran the program on a larger machine, but it was the first working game program and, what is more, Strachey had thus become a programmer.

The ACE Pilot System had only been used for experimental purposes and had been disassembled after a short time (this was the main reason for the discontinuation of the program). Strachey moved to the Ferranti Machine Mark I at the University of Manchester where he met Turing. Many found Turing's papers difficult to read, but for Strachey they only represented a degree of accuracy indispensable for the programmer. Strachey wrote a simulator for program checking, which was a much longer program than had ever been written for Mark I. With this program he not only became a programmer, but a programmer of distinction. He developed the system for the computer Pegasus.

Strachey then switched to programming languages. Together with Maurice Wilkes he published cricial remarks on ALGOL and its efficiency, and soon he began to develop an ALGOL-like language with a group at the Mathematical Laboratory of the University of Manchester and a group at the Computer Unit of the London University: namely, CPL (Combined Programming Language). He also wrote a compiler for the Atlas computer. Although CPL had not been applied widely, it influenced many languages to follow.

I met Strachey at the ICIP 1959 in Paris, met him again at the ICC meeting on Programming Languages in Rome in 1962, and in 1964 he was a speaker at the IFIP Working Conference in Baden (near Vienna) where he gave a paper on Formal Semantics. In the same year Strachey moved to MIT for a period of one year, where he influenced the curriculum of computer science and, in 1965, he published a paper on his "General Purpose Macro Generator", a system similar to TRAC with a notation of its own. In the same year Strachey moved to Oxford where he was appointed Professor of Computation in 1971. Together with Dana Scott, Strachey wrote a book on the compiler correctness which has been submitted for a prize at the University of Manchester.

In 1972 the British Computer Society made him Distinguished Fellow.

For many people Strachey had the reputation of being eccentric and sometimes he helped to strengthen this reputation. However, those who had closer contact with him appreciated the clarity of his thoughts and his witty discussion, but especially his language which showed that he was descended from Shakespeare and a nephew of a man of letters (already his father had been a scientist, a cryptographer). The Shakespeare line died with him, but his programming spirit lives on, not only in England.

With Christopher Strachey, the IFIP community has lost a very active member of WG 2.2 from its foundation in 1965 until his death.

Heinz Zemanek, IFIP Past-President

JAN VAN EGMOND
(1941 - 1978)
IFIP TC 4 Secretary

Death comes suddenly. We know for sure that it will come, but we who are left behind are never prepared for it. When death has struck, we cannot accommodate to the bewildering fact that a person is gone forever.

Jan was a born clinician. But initiative, reasoning and the opportunities in Gent made him choose an alternative career in medical informatics. He worked hard on a multitude of projects parallel in time. As a co-worker he was reliable, as a comrade trustworthy.

Jan had just started a new phase of his life as general director of the new University Hospital of Antwerp. That is only one of the places he left open.

His image will be with his many friends for a very long time.

KLAUS SAMELSON
(1918 - 1980)
IFIP Representative of Germany / TC Member

Very unexpectedly IFIP and the world of information processing lost one of its pioneers: Professor Klaus Samelson, who died in Munich on May 25, 1980. He had been the IFIP representative of the Federal Republic of Germany from 1972 to 1975, a member of WG 2.1 from its foundation onwards, and a member of several IFIP committees during his period of service (Publications, Site Selection and Nominations); he was a member of the Programme Committee for Congress 71.

Professor Samelson was born in Strasbourg on December 21, 1918. He graduated in mathematics at the Munich University, and he was professor at the University of Mainz from 1958 and back in Munich from 1963 onwards. In the Fifties he belonged to the software group of the PERM development at the University of Technology Munich, and he cooperated very closely with Professor Bauer (who lost in him his most important friend), from their ALGOL and push-down storage (cellar principle) times until the system developments of the last years. He was one of the 13 ALGOL fathers (authors of the first ALGOL report), and, together with Fritz Bauer, he wrote the basic paper on Sequential Formula Translation and several other ALGOL-related papers (see ICIP 59 and IFIP 62). It is a nice symbol for their cordial cooperation that once somebody asked me in deep wonder: "Bauer-Samelson are two people?".

We all have liked the friendly and inconspicuous way in which Professor Samelson carried out his duties and his sharp mind which, however, never activated a sharp tongue. We will never forget him. And we cannot, because the traces and consequences of his contributions will remain with us for decades to come.

Heinz Zemanek, IFIP Honorary Member

JOHN R. PASTA
(1918 - 1981)
IFIP Representative of the USA

(This obituary is condensed from the paper "An Unusual Path Toward Computer Science" by K.K. Curtis et al., Annals of the History of Computing 5, 1983, p.224 - 238.)

John R. Pasta was born in New York City in 1918. He grew up in Queens and studied at the City College of New York from 1935 to 1938. In 1941 he joined the New York Police Department, but a year later was drafted into the U.S. Army Signal Corps. His time with the police left a strong impression; he mentioned this period of his life several times.

After graduating in Physics from Brookhaven, he became a staff member of the Los Alamos Scientific Laboratory. There he learned computing, on the MANIAC project, and met and cooperated with people like S.M. Ulam and Henrico Fermi (there is a "Fermi-Pasta-Ulam Problem", well known today). Invited by John von Neumann in 1956, Pasta went to work for the Atomic Energy Commission in Washington, but he maintained a lifelong connection to Los Alamos. In 1961, Pasta joined the University of Illinois staff; three years later he was appointed head of the Digital Computing Laboratory. He wrote the first ALGOL compiler on the ILLIAC II, and continued with work on ILLIAC III and IV.

This also was a period of increased international activity for John. From 1965 to 1966 he was the U.S. representative to IFIP and Chairman of the AFIPS International Relations Committee. He then spent a year at CERN in Geneva. From 1970, he was with the National Science Foundation. He died of cancer on June 5, 1981.

I met John several times during the seventies, for example at the International Research Conference on the History of Computing in Los Alamos in 1976 (the proceedings of this event are dedicated to John). We knew him in IFIP as a modest and slightly reserved person. Longer contact with him revealed what a special human being he was, what an eminent scientist we had in our meetings during that short period. His sense of humor never left him even during his painful illness. His courage - he continued to work with the Science Foundation even when he was no longer able to walk - is unforgettable to all of us who knew him.

VICTOR MIKHAYLOVICH GLUSHKOV
(1923 - 1982)
Chairman of the PC for IFIP Congress 74

Academician Victor M. Glushkov, Vice-President of the Ukrainian Academy of Sciences, Director of the Institute for Cybernetics in Kiev and holder of IFIP Silver Core, died on 30 January, 1982 after a long and severe illness.

Academician Glushkov was born on 24 August 1923 in Rostov on the river Don. After graduating from Rostov University he began his career as an assistant at the Ural Timber Institute. His first scientific contributions were in the field of modern algebra, where he obtained some fundamental results in the theory of graphs; they previded the basis for his doctoral dissertation (1955).

In 1956 he came to Kiev. From that moment onwards all his activities were closely connected with the Ukrainian Academy of Sciences. In the same year, a Computing Centre was established within the Academy, in whose organization V.M. Glushkov played an essential role and of which he was appointed Director. Under his leadership, the scientific developments of the Computing Centre progressed at an amazing pace and its excellent international reputation was established.

In 1962 the Computing Centre was transformed into the Institute of Cybernetics of the Ukrainian Academy of Sciences. V.M. Glushkov became its Director, a position he held until his death. The Institute was of primary importance for the development of the theory and application of computers and informatics in the Soviet Union. Many well-known scientists have worked and are still working there, among them N.M. Amosov (medicine and biology) and V.A. Kovalevsky (pattern recognition).

V.M. Glushkov was a scientist of a very broad range of interests. Beginning with abstract algebra, he went on to the theory of automata and still further to the theory of computers and programming languages. In addition to the theoretical aspects, he also dealt with the practical design of computers and, during the last years of his life, of computing networks. It is difficult to find any branch of computer science to which V.M. Glushkov did not make new and original contributions. His books on the "Synthesis of Computing Automata" (1962) and "Introduction to Cybernetics" (really: Automata Theory) (1964) are classics, not only in the Socialist countries. He desiged several special programming languages such as ANALYTIC, similar to but much more comprehensive than FORMAC, for the analytical transformation of algebraic expressions on the computer. The methods he developed for automatic and electronic data processing found wide practical application in the planning and organization of Soviet economy. The application of computers for process control were the first practical achievements of the Institute of Cybernetics making use of new technology, and many participants at the IFAC Congress of 1960 in Moscow will remember Glushkov and probably visited the Kiev Institute.

The first step towards international cooperation in the field of computer science was followed by many more; V.M. Glushkov contributed, in particular, significantly to the activities of IFIP. He was a member of the Programme Committee for Congress 68, chairman of the Programme Committee for Congress 71 and also a member of the Programme Committee for Congress 74. He participated as IFIP representative in the preparation of the UN Report "Computers for Development". The IFIP Silver Core was only a modest token of gratitude for his work in IFIP.

It is not only the computer community of the Soviet Union and of the Socialist countries that have lost one of their most prominent and active members, it is the computer community of the whole world. V.M. Glushkov's scientific work and the results he achieved in science and practice will for a long time to come influence the development of computer science throughout the world.

Heinz Zemanek, IFIP Honorary Member

DOV CHEVION
(1917 - 1983)
IFIP Representative of Israel / IFIP Vice-President 1967-1970

Dov Chevion was an example to his fellow men and women. He was respected for his strength of leadership, commitment toward worthy goals, as the spokesman in the computer field for Israel, for over two decades. He was particularly concerned with education, an area in which he made major contributions.

Dov was born on 16 April 1917 in Lodz, Poland. Educated in the gymnasium in Lodz, he emigrated to Palestine in 1935. He attended the Hebrew University in Jerusalem, where he studied philosophy, mathematics and physics and won a prize for the best student in philosophy. He became active in the computer field in the late 1950's and, with Aaron Gertz, was responsible for founding and developing the Centre for Office Mechanization (MALAM) for the Israeli Government which he directed from 1964 until he retired in 1982. As Director, he was responsible for teaching and training hundreds of computer and communication systems designers, computer analysts and programmers who now hold senior positions throughout Israel. He left his mark of accomplishment on the computer user community of his country and those other countries that were privileged to benefit from this teaching.

In the early 1960's, Chevion, together with some professors of the Weizmann Institute and Gertz, planned and founded the Information Processing Association of Israel (IPA). He served as Chairman of the Board from 1966 to 1976 and President from 1976 to 1982, and early in 1983 he was given the life-long title of Honorable President of IPA. He was responsible for the creation of the 1st International Jerusalem Conference on Information Technology (JCIT), was deeply involved in those that followed in 1974 and 1978 and was an active adviser for JCIT IV, May 1984. Just before his death, he was awarded the IPA Certificate for his life-long efforts for the development of computing in Israel. The Israeli Government awarded Dov the Kaplan Prize in 1972 and 1973 for teaching the blind to work with computers. He always employed blind people in his computing centre.

IPA becamber a Member of IFIP in January 1964, and Dov was its first representative. He served until 1978, when he was elected an Individual Member for a three-year term, having previously been a Trustee and a Vice-Président. He was a member of many IFIP Committees and was Chairman of Working Group 3.1 for three years. Dov received the IFIP Silver Core Award in Stockholm, 1974.

His special concern was with education and he worked hard in that field both for IFIP and in his own country. A particular example is that in November 1965, Dov suggested a joint Fellowship Programme between IPA and one of the Auerbach Corporations. This proved very successful and, as a result, IPA was able to expand the programme to include five other U.S. companies in the data processing field. A total of 30 Fellows have had the opportunity to participate in the programme to-date.

In 1977, Dov stimulated the IFIP General Assembly's interest in governmental and municipal data processing to the extent that he was named Chairman of an IFIP Task Group to investigate that topic. This resulted in the first IFIP Conference on "The Impact of New Technologies on Information Systems in Public Administration in the 80's" in Vienna, Austria in February 1983.

The Israeli Government, IPA, IFIP and JCIT IV suffered a great loss with the death of this vibrant man. We shall all miss his dedication, inspired hard work and wisdom.

As a colleague and friend of Dov's for over 20 years, I want to acknowledge his wise counsel, sage advice, highly constructive suggestions and pragmatic approach to problem solving. His friendship, loyalty, ebullient personality and kind and encouraging smile will be sorely missed by those of us who had the pleasure of knowing and working with him.

DIMITER DOBREV
(1932 - 1983)
IFIP TC 5 Representative of Bulgaria

Very unexpectedly died on March 22, 1983, Docent Dimiter Dobrev, IFIP TC 5 Representative of Bulgaria, one of the longest and most active Bulgarian members of the IFIP family. He left us in his best, mature and creative years. And we lost with him the scientist, the educator, the manager, the organizer, the friend, the man.

Dimiter Dobrev was born in Sofia on August 21, 1932, into a family of employees. His father, Minko Dobrev, had been Docent at the Medical Faculty of Sofia University; he died in 1939. Dimiter's mother, Minna Dobrev, a dental doctor, died in 1959.

In 1950, Dimiter Dobrev finished High School (Gymnasium) with 'distinction'. Five years later, he graduated from Sofia University in Applied Mathematics. Since 1956, he had been elected assistant professor at the chair for differential and integral computation and he was promoted senior assistant professor and head assistant professor. In 1963, he became head of the group on "theory of Finite Automata" at the Mathematical Institute with Computing Center of the Bulgarian Academy of Sciences (B.A.S.). Three years later he became Head of the Section "Theoretical Problems of Cybernetics". His habilitation was in 1968; his appointment lecture was on "The Impact of Present Computers on Numerical and Applied Mathematics". Since 1970, he had been Head of the Section "Fundamentals of Cybernetics and Control Theory" at the Center for Mathematics and Mechanics of B.A.S. From 1971 to 1972 he was Deputy Director of the Institute for Mathematics with Computation Center.

His work was a prototype for the combination of highly productive research work with active organizational, administrative and social engagement. He has been awarded for it with numerous Bulgarian decorations, distinctions and medals and also with many international diplomas and medals. Connected to his main work are his contributions to the development and effective application of computation techniques and mathematical methods in all areas of economy and society. Under his guidance as excellent teacher with great knowledge and culture, many students, doctors and young scientists grew into modern mathematics and informatics.

His research in functional analysis, Theory of Automata and Foundations of Mathematical Computation were highly esteemed in Bulgaria and abroad. Dimiter Dobrev participated actively in international organizations like IFIP, IIASA or KNVVT. He was the national representative in IFIP TC 5 and he worked indefatigably in the preparations of conferences and meetings, particularly for IFIP.

Unforgettable memories are left not only by the Mathematician Dobrev but also by the Man Dobrev with his sincereness, his devotion to scientific activity and his multiple culture.

KRISTIAN BECKMAN
(1933 - 1984)
First Chairman of IFIP TC 11

Kristian Beckman, the first chairman of IFIP TC 11 died on September 15, 1984. He was born in Stockholm, Sweden on November 6, 1933 and left us at an age of just over 50.

In the early sixties, he started to work in the field that we now recognize as computer security. At that time practically nobody in the computer business considered security something that had anything to do with computers or computer systems.

He started out as an consultant, but after just a few he joined SPADAB, the Swedish savings-bank information processing company as security manager. At SPADAB, he was responsible for EDP security and from the start he took a special interest in problems of physical security. At the beginning of 1983, he left SPADAB and started once again to work as a private consultant in the now commonly recognized field of computer security.

Kristian worked with security problems for nearly 20 years. When he started to work with the special security problems that concern computer systems, he often had to do a great deal of research as part of his work. When you are a pioneer, there is nobody around that can answer your questions - you will have to do it all by yourself.

In the 60's and also in the 70's, much of the research was needed because in those days the common understanding of security problems in the computer environment was very poor. You had to prove everything before you got the understanding you needed and this was the case within computer departments as well as among users.

One of the areas in which Kristian took special interest was the personal integrity of the system users and the computer department personnel. His goal was that, in case of a security investigation, no innocent person should come under suspicion of having committed a security violation. If you consider that goal for a moment you will soon realize that it is not so easy to reach as you might think at first.

In the beginning of 1980 a special interest group on computer security was founded within the Swedish Society for Information Processing, SSI. The group was dubbed SIG-SEC and was very active right from the beginning. One of the original members was Kristian Beckman. He was also one of the most active members and participated in different projects as well as in working conferences and public conferences. He often gave proof of his great knowledge and experience within the computer security field. He was a member of the program committee of SIG-SEC from the start until his international commitments became too time consuming to let him continue.

Starting in 1982 Kristian led the planning and later the realization of IFIP's first computer security conference. His original initiative was in SIG-SEC and forwarded to IFIP through the Swedish member organisation of IFIP, SSI. The conference, called IFIP Sec'83 was held in Stockholm in May 1983. Kristian's devoted work was important in making the conference a great success. Since then, IFIP has held another security conference, IFIP Sec'84, in Toronto, September 10-12, just a few days before Kristian left us. As a result of the great success of IFIP Sec'83 and IFIP Sec'84, there will be a new IFIP Sec in 1985. This time the conference will be held in Dublin between August 12 and 15. For this we must thank Kristian's initial initiative.

After having evaluated the results of the first IFIP Sec, IFIP founded a new technical committee in September 1983, the Technical Committee on Computer Security given the number 11. The first chairman appointed to lead the TC 11 was Kristian Beckman. He remained chairman until his death.

B. FRAEIJS DE VEUBEKE
(1917 - 1976)
IFIP TC 7 Member

It is with deep regret I must inform you that Professor B. Fraeijs de Veubeke passed away on September 16, 1976.

Professor de Veubeke was a member of TC 7 (System Modelling and Optimization) and very active in its affairs.

We shall miss him.

A.V. Balakrishnan, Chairman TC 7

AB I. JOHNSON
(1924 - 1977)
IFIP WG 5.2 Member

It is with deep regret we announce the death of Dean Ab I. Johnson on 8 October 1977 at the age of 53.

Dean Johnson was a member of WG 5.2 (Computer Aided Design). For more than two and one half decades at four different universities he initiated project after project to attract outstanding students to the engineering profession. A few weeks before he died he learned at a public ceremony that action had been initiated to establish the A.I. Johnson Scholarship for undergraduate students at the University of Western Ontario.

HANS BEKIC
(1936 - 1982)
IFIP WG 2.1 and 2.2 Member

Dr. Hans Bekic, member of WG 2.1 (since 1965) and later of WG 2.2, died in an accident in his much-beloved mountains in lower Austria on 24 October 1982. He leaves a widow and seven children.

Hans Bekic was born in Vienna on 19 May 1936. He studied mathematics and joined the IBM Laboratory, Vienna when it was founded in 1961. His main fields of work were programming languages and their formal definition, Algol 60 and Algol 68 as well as PL/1. His contributions to the IFIP Working Groups and his publications in the Algol Bulletin were devoted to these areas. Hans Bekic's modesty, his friendliness, his outstanding power of concentration and his helpfulness will always be remembered in the IFIP community.

Heinz Zemanek, IFIP Honorary Member

JULIAN DAVIES

We were greatly saddened to learn that Dr. Julian Davies died on 12 June 1985. Dr. Davies was a Professor at the University of Western Ontario, CDN, where he was involved in computer organisation for teaching, and in design and evaluation of interactive computer systems. He chaired the subgroup on Messaging for the Communications Impaired, in Working Group 6.5 (International Computer Message Systems). His efforts were discussed in the IFIP Newsletter of May 1984.

Julian's interest in the needs of the handicapped spanned many years of his life. He was deaf. At grammar school he was interested in electronics, thinking he might design hearing aids for a career. He came to the 1983 WG6.5 working meeting, and volunteered to head efforts to get a program under way on applying messaging to the needs of the handicapped. He chose to carry out this program through a publication which he named Handi-Communications. Julian published three issues of Handi-Communications before his untimely death.

WG6.5 will be searching for someone to carry on this task, so that Julian's work will not have been in vain.

Ronald P. Uhlig
Chairman of WG6.5

HOWARD HATHAWAY AIKEN
(1900 - 1973)
ICIP 1959 Conference Chairman

Howard Aiken, the designer of the first large-scale computer, died on a business trip on March 14, 1973 while sleeping in a hotel room in St. Louis. With him, the information processing community has lost one of its most important pioneers.

Howard Aiken was born on March 8, 1900 in Hoboken, N.J. and graduated as an electrical engineer from Wisconsin University in 1923. After more than one decade of working as an engineer with Madison Gas & Electric Co. and Westinghouse Electric Co. he took up his studies again and in 1939 he received his doctorate in mathematics at the Harvard University. In 1937 he started together with IBM engineers to plan his Model 1 (MARK 1), also called Automatic Sequence Controlled Calculator (ASCC). It took the team from 1939 to 1944 to build this model, and the result was a relay calculator of 15 m length and 0.3 sec addition time (6 sec multiplication time). MARK II, also called SSCC, was built in 1945 and had 13.000 relays. MARK III and MARK IV were already vacuum-tube calculators.

Between 1939 and 1961 Aiken was a member of the board of professors of Harvard University, and from 1946 to 1961 he was head of the Harvard Computation Laboratory which carries his name today.

He was editor and co-author of the "Annals of the Computation Laboratory of Harvard University", a work of more than 24 volumes, books on switching circuits and proceedings of international symposia on the theory of switching.

I have a vivid recollection of Howard Aiken. When in 1957 I attended the computer conference in Cambridge (Mass.) as a newcomer, I found in him a host who not only introduced me to the American computing community, but he also found a room in Cambridge for me, the poor European University Assistant, at the nowadays incredible price 4 $ per night. In 1962 I was invited to give a paper at his symposium on Switching Theory and Space Technology at Sunnyvale, Calif. And when I was at the election ceremony as an IEEE Fellow in March 1970, Aiken was also present, as he was awarded the Edison Medal (he had been IEEE Fellow since 1960). He invited me to Miami, but, unfortunately, I could never make use of his offer. Something more important, however, was realized. Having postponed it again and again. Aiken gave Dr. Tropp, head of the Computer History Project of the Smithsonian Institute in Washington the chance to record an interview of more than 8 hours on tape. Thus, Aiken's memories are not lost for history.

Aiken held honorary degrees from many universities. His numerous awards include "Les Palmes de l'Académie Française, Chevalier de la Légion d'Honneur, the Harry Goode Memorial Award" of AFIPS, "the Wetherill Medal" of the Franklin Institute and the "Edison Medal" of IEEE. He also was President of ICIP "International Conference on Information Processing, Paris 1959" and thus was connected with the foundation of IFIP.

In 1961 Aiken became professor for information processing technology at the University of Miami; this professorship was given to him under the condition that he himself could decide when he wanted to retire. Until his death Aiken did not make use of the offer. He was still active at the age of 73. He made the trip to St. Louis in connection with his consulting activities for Howard Aiken Industries Inc., based in New York, which he had founded as a consulting concern.

Aiken was a "driving individual", a genius whose colleagues had a hard time with him. One of them is quoted as saying: "He dreams up the most fantastic things and gets them done".

Aiken always had the sincere desire that the computer should be used in a sensible and human way. At the Farewell Dinner given to his honor at Harvard in 1961 he said "I hope to God this will be used to the benefit of mankind and not for its detriment".

Heinz Zemanek, IFIP President

BENJAMIN BARG
(1932 - 1974)
Office of Science and Technology, UN

It is with deep regret that the International Federation for Information Processing (IFIP) Council acknowledges the death of Dr. Benjamin Barg on January 4, 1974. Many members of the IFIP General Assembly and IFIP Council came to know Dr. Barg well through their participation with his work relating to the preparation of the UNO document E/4800 prepared in cooperation with the Office of Science and Technology of the United Nations. Dr. Barg was instrumental in bringing to the attention of the international computing community and securing their total support for the need expressed in the United Nations of accelerating the rate of growth of the developing countries through electronic data processing. It is largely due to his initiative, energy, intelligence and understanding that a response to this need was undertaken. His counsel and leadership will be sorely missed in the continuation of this work.

To his wife and children we offer our deep sympathy on their great loss.

VICTOR BROIDA
(1907 - 1976)
Founder of FIACC

Professor Victor Broida, internationally renowned specialist of automation and cybernetics and active initiator in the national and international professional life, died in Paris on 28 November 1976.

Professor Broida was born in Moscow on 25 December 1907. He studied at the Popov College in Moscow, at the Polytechnic Institute in Grenoble and at the Conservatoire des Arts et Métiers in Paris, From 1930 to 1936 he worked in industry, from 1954 to 1956 he was Professor at the University of Charleroi, until 1958 at the Conservatoire des Arts et Métiers. He wrote two books and many papers. An identification method carries his name, and for his teaching he was appointed Chevalier of the Legion d'Honneur.

Internationally he became renowned for his contributions to the scientific community. At the international conference of the VDI/VDE Fachgruppe for Automatic Control in Heidelberg, September 1956, 30 participants signed a declaration for the foundation of an International Federation for Automatic Control. On 12 September 1957, the first General Assembly of IFAC took place under the chairmanship of Professor Broida. From 1969 until 1972 he was IFAC President which included the responsibility for the 1972 IFAC Congress in Paris. Professor Broida was for many years Honorary Editor of the IFAC Bulletin.

In 1970, he succeeded in a further creation: an institution for the cooperation and coordination of those international federations which are concerned with automation and computers. Under the auspices of UNESCO, but driven by his energy, FIACC was founded, the "Five International Associations Coordinating Committee", and Professor Broida was its Chairman from 1970 to 1973. This institution has nothing else as a basis than a document of understanding, but the usefulness of coordination and cooperation is so evident that such a light basis was not only sufficient, but probably much stronger and more efficient than any juridically detailed foundation. The five constituents of FIACC are IMACS (formerly AICA), IFAC, IFORS, IMEKO and IFIP.

Professor Broida was also active in the Union of International Technical Associations (UATI), its President from 1975 to his death. From 1967 to 1970, he was Vice-President of FASFID (Fédération des Associations et Sociétés Françaises d'Ingénieurs Diplômés) and since 1973 he was Secretary-General of the European Federation of National Associations of Engineers.

The international scientific and technical community has lost in Professor Broida a pioneer of exceptional and cordial character. His energy, his open heart for all nations, his humanity and his loyalty to friends have made his death a big loss, and these qualities will make sure that his name will remain an abstract monument for a long time.

M. Cuénod, IFAC H. Zemanek, IFIP

SVERRE SEM-SANDBERG
(1930 - 1985)
IFIP Representative of Sweden
IFIP Vice-President 1970 - 1974

The Swedish Computer Society announced with deep regret the death of Mr. Sverre Sem-Sandberg, a major participant in IFIP activities.

Sverre Sem-Sandberg was born on September 14, 1930, in Oslo where he graduated from highschool in 1951. He studied at the Oslo Polytechnical Institute, at the Oslo University, at the Columbia University NY and at the University of California Los Angeles. He was there a lecturer on semi-conductor theory and trasistor circuit design from 1956 to 1958.Then he returned to Norway and became a research associate at the Electronics Department of the Royal Institute of Industrial Research. In 1958 he joined L.M. Ericsson in Stockholm and so the Norwegian became a key figure of Swedish information processing, staying with this company for the remainder of his life. He started in the research department, charged with problems in transistor circuits, in telephone switching and in railway signalling. In 1964 he was assigned to Dr. C. Jacobaeus - until the latter retired in 1976 - and subsequently had many responsibilities in all aspects of communications, terminals, office automation, consulting and analysis. In Sweden, Sverre was a pioneer, pointing out fields that would assume importance in the future. As early as 1970 he established the first Special Interest Group for artificial intelligence within the Swedish Society for Information Processing (SSI). At L.M. Ericsson, Sverre finally was Senior Systems Consultant. His illness forced him out of a stream of activities in 1984/1985, and he died on June 7, 1985.

He served in many international bodies such as ISO, CCITT, IEC or ICC; his last major role was as a member of the programme committee for the CCITT conference held in Sydney in 1984. In the Swedish Society for Information Processing he served on the board from 1968 to 1978 and during this period he was also the Swedish representative to IFIP and to the Nordic Data Union. His heart was in TC6 on Data Communication and its working groups (he was also a key figure in IFIP's Affiliate Member ICCC, International Council for Computer Communication), but Sverre served in IFIP in many committees and activities, e.g. in the activity planning committee and in the TC3 review committee. Sverre was IFIP Vice-President from 1970 to 1974 (from 1971 to 1974 he was also President of SSI), chairman of the IFIP finance committee from 1975 to 1977 and Trustee from 1976 to 1978. During his term as Vice-President he helped with unusual strength to make the IFIP Congress 74 a success, attending many meetings, giving advice and encouraging the work. We cleared the problems during the first stage, and from then on it was a real pleasure to work with him and his crew, headed by Per Svenonius, and the result was - the responsible president is proud to say this - one of the most successful IFIP Congresses, including the first MEDINFO and the First International Computer Chess Championship.

Knut Hernaes - Heinz Zemanek

FRED MARGULIES
(1917 - 1986)
IFIP TC9 Chairman

Very unexpectedly on February 10, 1986, at his working desk at the Technical University Vienna, Professor Margulies died. He had retired as a Trade Union employee, but was very active in IFAC, IFIP, the Austrian Computer Society and as a teacher at the University of Technology.

Fred Margulies was born on October 4, 1917, in Vienna and he studied Machine Engineering, and later on, Modern Computer Technolgy. From 1947 to 1951 he was technical employee, but then he entered the Trade Union organization where he assumed numerous positions. His special field was automation, information processing and their social impacts. Between 1961 and 1967 he was a member of the central board of his union.

Fred Margulies arranged a series of symposia, common events of the unions and the university; the culmination of his involvement in conferences, however, was the First IFIP Conference on Human Choice and Computers, 1974 in Vienna. This conference was so characteristic of him that it could be said that it had his personal stamp, although he does not appear as key organizer in the proceedings. For the first time in history of information processing, at this event, Trade Union representatives, social scientists and computer scientists met in order to discuss the common areas of their problems and to determine a common language to talk to each other. Only on the basis of co-operation and confidence between him and me could this conference be ventured and become an international success. Without it, the IFIP Technical Committee TC 9 could not have come into existence or at least not until much later.

In IFAC, Fred Margulies was from 1977 to 1984 Honorary Secretary and Editor of the Newsletter; from 1972 to 1978 he was vice-chairman and chairman of the IFAC Committee for the Social Effects of Automation. In IFIP he was vice-chairman of TC9 from its foundation in 1976, and in 1982, in a moment of special difficulties, he took over as interim chairman, until Professor H. Sackman followed one year later. He was very active and highly regarded in TC9 as an exemplary member.

In the Austrian Computer Society, he was a founding member and a member of the executive board; during the last years he chaired the International Liason Committee. His last big contribution was the program for the 10 Years Anniversary Celebrations of the society, where he aimed at an analysis of the present situations and future direction of Austrian informatics. The proceedings of this event prove that he achieved what he had intended.

Information processing and the Trade Union movement have lost a unique personality, a man of concilation and of human communication who has achieved amazingly much by bringing people together. No need to assure that his memory will be preserved - we will sorely miss him for quite some time.

H. Zemanek

THE IFIP
SILVER SUMMARY

The IFIP Silver Summary

IFIP AT A GLANCE

YEAR	PRESIDENT	CONGRESS IN	FORMATION OF	SPECIAL GROUP	AFFILIATE MEMBERS	NUMBER OF MEMBERS
1959	AIKEN	PARIS	IFIP TC 1			15
1962	AUERBACH	MUNICH	TC 2 TC 3			20
1965	- "" -	NEW YORK				25
1968	SPEISER	EDINBURGH	TC 4	IAG		28
1971	DORODNICYN	LJUBLJANA	TC 5 TC 6			33
1974	ZEMANEK	STOCKHOLM	TC 7 TC 8			36
1977	TANAKA	TORONTO	TC 9 TC 10	IMIA	IAPR	37
1980	BOBILLIER	TOKYO MELBOURNE			IASC ICCC	39
1983	- "" -	PARIS	TC 11		EUROMICRO	44 (49)
1986	ANDO	DUBLIN			FACE IJCAII	45 (58)

WHAT IS IFIP ?

The INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING is a multinational federation of professional and technical organisations (or national groupings of such organisations) concerned with information processing. From any one country, only one such organisation – which must be representative of the national activities in the field of information processing – can be admitted as a Full Member. In addition a regional group of developing countries can be admitted as a Full Member. On January 1, 1986, 45 national organisations were Full Members of the Federation, representing 58 countries.

The aims of IFIP are to promote information science and technology by:

- fostering international co-operation in the field of information processing;
- stimulating research, development and the application of information processing in science and human activity;
- furthering the dissemination and exchange of information about the subject;
- encouraging education in information processing.

IFIP is dedicated to improving worldwide communication and increased understanding among practitioners of all nations about the role information processing can play in all walks of life.

Information technology is a potent instrument in today's world, affecting people in everything, from their education and work to their leisure and in their homes. It is a powerful tool in science and engineering, in commerce and industry, in education and administration. It is truly international in its scope and offers a significant opportunity for developing countries. IFIP helps to bring together workers at the leading edge of the technology to share their knowledge and experience, and acts as a catalyst to advance the state of the art.

IFIP came into official existence in January, 1960. It was established to meet a need, identified at the first International Conference on Information Processing which was held in Paris in June, 1959, under the sponsorship of UNESCO.

ORGANISATIONAL STRUCTURE

The Federation is governed by a GENERAL ASSEMBLY, which meets once every year and consists of one representative from each Member organisation. The General Assembly determines policy and strategy and takes decisions on important matters, such as admissions, elections and budget and the programme of activities.

The day-to-day work of IFIP is directed by its Officers: the President, Vice-Presidents, Secretary and Treasurer, who are elected by the General Assembly and together constitute the EXECUTIVE BOARD.

The COUNCIL, consisting of the Officers and up to eight Trustees elected from the General Assembly, meets twice a year and takes decisions which become necessary between General Assembly meetings.

The headquarters of the Federation are in Geneva, Switzerland where the IFIP Secretariat administers its affairs.

AFFILIATIONS OF IFIP

IFIP was founded under the auspices of UNESCO. Its official relationship with that organisation is classified as category B (« able to advise in a particular field »). IFIP established official relations with the World Health Organisation in February, 1972 and maintains informal relationships with other members of the UN family.

IFIP has the status of a Scientific Affiliate of the International Council of Scientific Unions (ICSU).

In 1970, IFIP together with four sister Federations, IFAC, IFORS, IMACS and IMEKO, established a « Five International Associations Co-ordinating Committee » (FIACC) which provides a basis for the cordial and successful co-ordination of a variety of activities of mutual interest.

IFIP collaborates with IBI (Intergovernmental Bureau for Informatics) and also participates in an advisory capacity in the work of CCITT, the International Telegraph and Telephone Consultative Committee.

TECHNICAL COMMITTEES

Technical work, which is the heart of IFIP's activity, is managed by a series of nine Technical Committees (TC). Each TC supervises a number of Working Groups (WG) which deal with specialised aspects of the field of interest of their parent TC.

Each Technical Committee is composed of representatives of IFIP Member organisations (one per organisation). Working Groups consist of specialists who are individually appointed by their peers independent of nationality.

The following Technical Committees and Working Groups are active:

TC 2 PROGRAMMING
- WG 2.1 Algol
- WG 2.2 Formal Description of Programming Concepts
- WG 2.3 Programming Methodology
- WG 2.4 System Implementation Languages
- WG 2.5 Numerical Software
- WG 2.6 Data Bases and Database Semantics
- WG 2.7 Operating System Interfaces

TC 3 EDUCATION
- WG 3.1 Informatics Education at the Secondary Education Level
- WG 3.2 Advanced Curriculum Projects in Information Processing
- WG 3.3 *being revised*
- WG 3.4 Vocational Education and Training
- WG 3.5 Informatics in Primary/Elementary Education

TC 5 COMPUTER APPLICATIONS IN TECHNOLOGY
- WG 5.2 Computer-Aided Design
- WG 5.3 Discrete Manufacturing
- WG 5.4 Common and/or Standardized Hardware/Software Techniques
- WG 5.6 Maritime Industries
- WG 5.7 Automation of Production Planning and Control
- WG 5.8 Product Specification and Product Documentation

TC 6 DATA COMMUNICATION
- WG 6.1 Architecture and Protocols for Computer Networks
- WG 6.4 Local Computer Networks
- WG 6.5 International Computer Message Systems

TC 7 MODELLING AND OPTIMIZATION
- WG 7.1 Modelling and Simulation
- WG 7.2 Computational Techniques in Distributed Systems
- WG 7.3 Computer System Modelling

TC 8 INFORMATION SYSTEMS
- WG 8.1 Design and Evaluation of Information Systems
- WG 8.2 The Interaction of Information Systems and the Organisation
- WG 8.3 Decision Support Systems
- WG 8.4 Office Systems

TC 9 RELATIONSHIP BETWEEN COMPUTERS AND SOCIETY
- WG 9.1 Computers and Work
- WG 9.2 Social Accountability

TC 10 DIGITAL SYSTEMS DESIGN
- WG 10.1 System Concepts and Characteristics
- WG 10.2 Digital Systems Descriptions and Design Tools
- WG 10.3 Software/Hardware Interrelation
- WG 10.4 Reliable Computing and Fault Tolerance
- WG 10.5 Very Large Scale Integration « VLSI »

TC 11 SECURITY AND PROTECTION IN INFORMATION PROCESSING SYSTEMS
- WG 11.1 Security Management
- WG 11.2 Office Automation
- WG 11.4 Crypto Management

IFIP SPECIAL INTEREST GROUPS

IFIP sponsors a Special Interest Group which provides a forum for members of professional organisations in the fields of medicine and information technology.

- IMIA - INTERNATIONAL MEDICAL INFORMATICS ASSOCIATION OF IFIP

The following Working Groups are active:
WG 1 Information Sciences and Medical Education
WG 3 Testing and Validation for ECG Analysis Programmes
WG 4 Data Protection in Health Information Systems
WG 5 Ambulatory Care Information Systems
WG 6 The Coding and Classification of Health Data
WG 7 Biomedical Pattern Recognition
WG 8 Nursing Informatics
WG 9 Medical Informatics in Developing Countries
WG 10 Hospital Information Systems

IMIA is responsible for the organisation of MEDINFO.

IFIP AND DEVELOPING COUNTRIES

The IFIP Committee for International Liaison (ICIL) is charged with developing IFIP's relationships with other international organisations having an interest in information processing. In particular IFIP aims to assist developing countries in their application of information processing and cooperates with UNESCO to achieve this. Responsibility for planning and overseeing this work rests with the IFIP Committee: Informatics for Development (ICID) which includes representatives from developing countries.

ICID's programme of work includes the distribution of IFIP publications, regional activities and training courses and seminars. Facilities have been offered for people from developing countries to participate in IFIP conferences and TC 3, in particular, has contributed to a number of educational projects.

AFFILIATE MEMBERS

Six international associations concerned with specialised aspects of information processing have become Affiliate Members of IFIP.

- IAPR - International Association for Pattern Recognition
- IASC - International Association for Statistical Computing
- ICCC - International Council for Computer Communication
- EUROMICRO - European Association for Microprocessing and Microprogramming
- FACE - The International Federation of Associations of Computer Users in Engineering, Architecture and Related Fields
- IJCAII - International Joint Conference on Artificial Intelligence, Inc.

FURTHER INFORMATION

Further information about IFIP and its activities may be obtained from the IFIP Secretariat, 3 rue du Marché, CH-1204 Geneva, Switzerland.
Tel.: (022) 282649. Telex 428472 ifip ch.

WHAT IS FIACC?

ABOUT FIACC

The Five International Associations Coordinating Committee (FIACC) was formed in 1970 by IFAC, IFIP, IFORS, IMACS, and IMEKO as a medium for the coordination of activities of the five "Sister Federations" (or "Associations"), and to promote cooperation between them.

The 1950's had seen a rapid development of new disciplines, that were at the interface between the older, more traditional branches of science and engineering, and the newer technologies based on electronics, computers, and control systems that had recently emerged. Given the international nature of research, the need for cooperation brought about, within a short time span and the formation, independent of one another, of the five Associations.

With the progress in those disciplines, it soon became evident that the boundaries between their respective interests were becoming blurred. To their credit, those who were in charge at the time resisted the temptation to engage in fruitless discussions of territory rights, and many workshops and conferences on specialized topics where overlap was evident became joint events between two or more Associations.

The formation of FIACC in 1970 came as the natural next step, and resulted in a collaboration that has been successful in every respect.

FIACC will accept into its membership established international federations of national societies which operate in a relevant field of technology. Federations are considered to be international in scope if they embrace a high proportion of all countries which are active in that technology and if their membership is not limited to any particular region of the world.

The General Secretariat of FIACC is assumed by the Secretariat of IMEKO:

FIACC
Gy. Striker, Honorary Secretary
1371 Budapest, POB 457
Hungary

The following have served as President of FIACC since its foundation:

1970–1973	V. Broida (France)
1973–1975	H. Zemanek (Austria)
1975–1977	A. Jensen (Denmark)
1977–1979	S. Carlisle (UK)
1979–1981	R. Vichnevetsky (USA)
1981–1983	T. Vamos (Hungary)
1983–1985	K. Ando (Japan)

OBJECTIVES AND WORKING PRINCIPLES

FIACC was established to perform purely advisory functions and all its activities consist in dispensing information and making recommendations to its constituent Associations and to outside bodies.

The coordinating function of FIACC is limited to the public activities of the constituent Associations, such as congresses, symposia, colloquia, seminars, and publications. That coordination is primarily attained through oral and written exchange of information at and between meetings of FIACC based on informative data received from the constituent Associations.

FIACC meets once yearly and informs the general public and the competent division of UNESCO through appropriate documents about the activities of FIACC.

FIACC Federations do not take any account of the political, social, or economic aspects of their member societies because FIACC is totally dedicated to the transfer of scientific and technical information and experience. The members of FIACC encourage membership of societies in developing countries, provided such societies properly represent the national interests in the field of that Federation.

FIACC FOUNDATION MEETING, Paris 1970

from left to right: H. Zemanek (IFIP), FIACC Vice-Chairman
V. Broida (IFAC), FIACC Chairman
Gy. Striker (IMEKO), FIACC Hon. Secretary

International Federation of Automatic Control

IFAC Secretariat
Schlossplatz 12
A-2361 Laxenburg
Austria

WHAT IS IFAC

The International Federation of Automatic Control (IFAC), founded in September, 1957, is a multinational federation of National Member Organizations (NMOs), each one representing the engineering and scientific societies concerned with automatic control in its own country. Applications for membership in IFAC, addressed to the IFAC Council, should be mailed to the IFAC Secretariat.

The official languages of IFAC are: English, French, German, Russian and Spanish, with English accepted as the working language.

AIMS OF IFAC

The purpose of IFAC is to promote the science and technology of automatic control in the broadest sense in all systems including engineering, physical, biological, social or economic in both theory and application. IFAC is also concerned with the impact of automatic control on society. IFAC has neither political not economic aims.

According to article 3 of its Constitution, the aim of IFAC is to promote the science and technology of automatic control and systems engineering in cooperation with national and other international organizations, by

1. Organizing and sponsoring technical meetings such as congresses, conferences, symposia, and workshops
2. Producing technical publications
3. Any other means consistent with this constitution.

International Congresses of IFAC are held every 3 years. Between Congresses, IFAC sponsors many symposia and workshops covering particular aspects of automatic control.

IFAC publications include proceedings of IFAC congresses and symposia, monographs as well as brochures of particular interest, such as guidelines for authors and session chairmen, for organizers of symposia and congresses, etc.

Information on IFAC activities appears in the IFAC newsletter. The official journal of IFAC is "Automatica".

The Federation plays an active role in public affairs, making its broad technical expertise available to the United Nations family and other international and regional organizations. IFAC maintains technical liaison with agencies, such as the Office for Science and Technology of the United Nations, and it nominates representatives to serve as advisors and consultants on a task basis.

FROM IFAC'S HISTORY

In September 1956 the "VDI/VDE-Fachgruppe Regelungstechnik" organized at Heidelberg an International Conference on Automatic Control. At this Conference, 30 participants signed a declaration in which the necessity of creating an international organization of automatic control was clearly motivated. The signatories pledged to promote the formation of national organizations - if not already existing at that time.

At the end of the Heidelberg Conference a Provisional Committee was established under the chairmanship of V. Broida (France) to work out a constitution for the planned International Federation of Automatic Control and to organize the first General Assembly of IFAC.

On September 12, 1957, the first General Assembly convened at the constitutive meeting of IFAC in Paris. Delegates from 18 countries representing their national organizations assembled at the Conservatoire National des Arts et Metiers under the chairmanship of V. Broida (France). They voted on the Constitution and By-laws, they appointed a chairman.

STRUCTURE

The present IFAC Constitution and By-Laws were adopted by the General Assembly of IFAC in Kyoto on August 24, 1981. Copies of the Constitution and By-Laws as well as any information about IFAC and its activities are available from the IFAC Secretariat.

The supreme body of IFAC is the General Assembly (GA), consisting of delegations of all National Member Organizations (NMOs), each NMO being entitled to one vote. Normally the GA is convened at a congress of IFAC. The GA elects the members of the Council.

The management of the Federation is vested in the Council which consists of the President, the President Elect, two Vice-Presidents, the Immediate Past President, the Treasurer, and a number of Ordinary Members, elected by the GA. The members of the Council, like all other IFAC officers, serve in a personal capacity and not as the representatives of any member organizations. Their services are voluntary and unpaid. Each Ordinary Member of the Council should, however, be from a different member organization of IFAC in order to assure a wide representation of NMOs in Council.

The President legally represents IFAC.

The Council appoints an Honorary Secretary who supervises the work of the Secretariat, rendering all necessary administrative assistance to the President and to the Council, keeps contact with NMOs and Technical Committees (TCs) and keeps record of all IFAC events.

COMMITTEE STRUCTURE

At present there exist the following IFAC Technical Committees:

TC 1	Applications (APCOM)
TC 2	Biomedical Engineering (BIOMED)
TC 3	Components and Instruments (COMPON. & INSTR.)
TC 4	Computers (COMPUT)
TC 5	Developing Countries (DECOM)
TC 6	Economic and Management Systems (EMSCOM)
TC 7	Education (EDCOM)
TC 8	Manufacturing Technology (MAN.TECH)
TC 9	Mathematics of Control (MOC)
TC 10	Social Effects of Automation (SOC.EFF)
TC 11	Space (SPACE)
TC 12	Systems Engineering (SECOM)
TC 13	Terminology and Standards (TERM. & STAND.)
TC 14	Theory (THEORY)

I.F.O.R.S.

INTERNATIONAL FEDERATION OF OPERATIONAL RESEARCH SOCIETIES
FÉDÉRATION INTERNATIONALE DES SOCIÉTÉS DE RECHERCHE OPÉRATIONNELLE

IFORS Secretariat
IMSOR, Bldg. 349
Technical University of Denmark
2800 Lyngby, Denmark

WHAT IS IFORS

THE INTERNATIONAL FEDERATION OF OPERATIONAL RESEARCH SOCIETIES: I.F.O.R.S.

IFORS is an international organization of national societies whose primary object is the advancement of Operational Research.

AIMS OF IFORS

Its aims are the development of Operational Research as a unified science and its advancement in all nations of the world.

FROM IFORS's HISTORY

IFORS was formed in 1959 and its initial membership consisted of the Operations Research Society of America, the Operational Research Society of the United Kingdom, and the Societe Francaise de Recherche Operationnelle.

As of October, 1983 IFORS has 35 National Societies and six Kindred Societies.

COMMITTEES

Besides the ADMINISTRATIVE COMMITTEE (President, up to three Vice-Presidents, the most recent living Past-President, the Hon. Treasurer, the Secretary), IFORS has three STANDING COMMITTEES and a SUB-COMMITTEE which are responsible for the everyday operation of IFORS:

The External Affairs Committee: which is responsible for creating, developing, and maintaining relationships with international organizations.

Publications Committee: which is responsible for planning, management and financial control of all professional and technical publications of IFORS.

The Plans and Programmes Committee: which is responsible for preparing a long-range plan for future IFORS activities.

The Education Sub-Committee: which is responsible for the development of a program for assisting developing countries in their Systems Analysis and Operational Research capabilities.

TRIENNIAL INTERNATIONAL CONFERENCES

IFORS Triennial International Conferences

IFORS organizes an international Conference every third year. Such a conference has a specific theme. The IFORS President seeks a Host Society which is responsible for the organization. Past and Future Triennial Conferences:

1957	Oxford (UK)
1960	Aix-en-Provence (France)
1963	Oslo (Norway)
1966	Boston (USA)
1969	Venice (Italy)
1972	Dublin (Ireland)
1975	Tokyo/Kyoto (Japan)
1978	Toronto (Canada)
1981	Hamburg (Federal Republic of Germany)
1984	Washington, D.C. (USA)

IFORS PUBLICATIONS

IAOR International Abstracts in Operations Research.

The IAOR is a Journal designed to provide the full coverage of Operational Research. It published abstracts of papers published in specialty journals as well as in allied fields. Over 50 journals are covered extensively through cover to cover screening by voluntary contributing editors. The IAOR also contains detailed cross-indexing sections.

IFORS Bulletin

The objective of this publication is to disseminate information on IFORS and IFORS activities, to exchange information on society activities among IFORS National and Kindred Members, and to keep OR groups which have not yet formed a society, and other persons interested in IFORS informed of OR activities.

Proceedings.

Proceedings of Triennial and other Conferences.

ACTION IN DEVELOPING COUNTRIES

IFORS is presently making a special effort to promote Operational Research in developing countries. The following are being implemented:

- Key people in developing countries are distributing copies of the IAOR for the purpose of stimulating interest in OR and IFORS.

- Documentation concerning IFORS is being circulated in developing countries.

- Information concerning research and teaching scholarships in OR for promoting exchanges among developed and developing countries is being gathered.

- People in developing countries having difficulty finding a paper abstracted in the IAOR can contact the Chairman of IFORS Publications Committee who will do his best to make the paper available.

- A book entitled "Systems Analysis and Operations Research: A Tool for Policy and Program Planning for Developing Countries" is available.

INTERNATIONAL ASSOCIATION FOR MATHEMATICS AND COMPUTERS IN SIMULATION

ASSOCIATION INTERNATIONALE POUR LES MATHEMATIQUES ET CALCULATEURS EN SIMULATION

IMACS Secretariat (European Region)
ERM Electricite
30 Avenue de la Renaissance
B1040 Bruxelles, Belgium

IMACS Secretariat (American / Pacific Region)
Dept. of Computer Science
Rutgers University
New Brunswick, New Jersey 08903 USA

WHAT IS IMACS

The International Association for Mathematics and Computers in Simulation (IMACS) is an Association of individuals and of scientific societies concerned with the techniques of computer simulation, scientific computing and the allied branches of applied mathematics.

AIMS OF IMACS

The aims of IMACS are:

- to promote the science and technology of computer simulation and scientific computation. Areas of concern include mathematical modelling, numerical analysis and approximation theory, computer hardware and software for scientific computation, applications in every field of science and engineering.
- to promote International cooperation in those areas.

In order to achieve these aims, IMACS is engaged in

- the organization of international symposia and conferences
- the publication of a journal, of technical documents and of conference proceedings
- the establishment of permanent Technical Committees
- the dissemination of general information pertaining to the scientific community which it serves.

FROM THE HISTORY OF IMACS

In 1955, the Belgian Society of Engineers in Telecommunications and Electronics (SITEL) organized in Brussels an International Meeting on Analogue Computation. From this meeting emerged the International Association for Analogue Computation (AICA) which was legally established at the beginning of the following year, operating under Belgian law. The change of name of the Association to IMACS took place in 1976, to reflects the evolution in the technology of computers that had occurred in the intervening years.

STRUCTURE AND MEMBERSHIP

IMACS is incorporated under the Belgian law.

IMACS has three types of membership:

Affiliated members - consisting of scientific societies, National IMACS groups, Committees and Institutions that pursue scientific objectives consistent with those of IMACS. Affiliated Member Organizations serve as coordinators between IMACS and the scientific community which they represent.

Individual Members - consisting of professionals and scientists concerned with scientific computing and computer simulation.

Associated (Scientific or Industrial members) - consisting of Scientific or Industrial institutions which are interested in the technical, scientific and professional objectives of IMACS.

The Association is governed by an international Board of Directors, which are elected by the membership on the occasion of each General Assembly. General Assemblies are held concurrently with the Association's General Congress, every three years.

The Board of Directors appoints an Advisory Committee. This committee includes the delegate members who represent Societies, Groups, and Institutions that are affiliated members of IMACS.

CONGRESSES

According to the Constitution of IMACS, a General Congress takes place every three years. Past and future IMACS Congresses are:

1955	Brussels (Belgium)
1958	Strasbourg (France)
1961	Opatija (Yugoslavia)
1964	Brighton (Great Britain)
1967	Lausanne (Switzerland)
1970	Munich (Germany)
1973	Prague (Czechoslavakia)
1976	Delft (The Netherlands)
1979	Sorrento (Italy)
1982	Montreal (Canada)
1985	Oslo (Norway)

TECHNICAL COMMITTEES

In order to maintain a coherent program of activity,, IMACS has established Technical Committees. Each Technical Committee (IMACS TC) is devoted to a specific area of interest of the Association. The activities of the TC's consist mostly of organizing symposia, conferences, and workshops. Some of the Technical Committees have their own Newsletter.

IMACS TC's which are currently active are:

TC 1	Simulation of Electrical Machines
TC 3	Simulation Software
TC 4	Parallel Computation
TC 5	Modelling and Simulation of Biological Systems
TC 6	Partial Differential Equations
TC 7	Nuclear Power Plants Modeling and Simulation
TC 8	Energy Systems Modeling
TC 9	Integral Equations
TC 10	Ordinary Differential Equations
TC 11	Stochastic Systems Modelling

NATIONAL COMMITTEES

National IMACS Committees have been established in many countries with the objective of maintaining better contact with the local scientific community.

Countries in which National IMACS Committees exist include

- Czechoslavakia
- France
- Greece
- Hungary
- Israel
- USA
- USSR

IMACS is represented in many of the other countries by the affiliation with IMACS of corresponding national scientific societies.

PUBLICATIONS

IMACS maintains an active program of publications. These consist mostly of conference proceedings and collections of research papers. The journal "Mathematics and Computers in Simulation" (Transactions of IMACS) is published bi-monthly.

INTERNATIONAL MEASUREMENT CONFEDERATION
МЕЖДУНАРОДНАЯ КОНФЕДЕРАЦИЯ ПО ИЗМЕРИТЕЛЬНОЙ ТЕХНИКЕ И ПРИБОРОСТРОЕНИЮ
INTERNATIONALE MESSTECHNISCHE KONFÖDERATION
CONFEDERATION INTERNATIONALE DE LA MESURE

IMEKO Secretariat
POB 457
1371 Budapest, Hungary

WHAT IS IMEKO

The International Measurement Confederation – IMEKO – is a federation of national scientific and technical societies concerned with measurement science, technology and instrumentation. These technical and scientific societies – or committees – are the national Member Organizations (MO) of IMEKO. Official languages of IMEKO are: English, French, German, and Russian.

The seat of the IMEKO SECRETARIAT is in Budapest, Hungary.

IMEKO is associated with four international bodies:

UNESCO – United Nations Educational Scientific and Cultural Organization (Consultive Status)

UNIDO – United National Industrial Development Organization (Consultive status "C")

UATI – Union of International Technical Associations

and FIACC

AIMS OF IMEKO

– To promote the international exchange of scientific and technical information relating to developments in measuring techniques, instrument design and manufacture, and in the application of instrumentation in scientific research and in industry;

– to facilitate cooperation among scientists and engineers in studying problems in this field;

– to arrange IMEKO Congresses at regular intervals (triennially);

– to organize symposia on special topics;

– to establish permanent working technical committees;

– to promote the publication of congress and symposia proceedings;

– to cooperate with other international organizations on matters of common interest and to join international organizations whose aims are consistent with those of IMEKO.

FROM IMEKO'S HISTORY

The initiative to establish an international organization on measurement technique and instrumentation was raised during the first International Measurement Conference held in Budapest, 1958, which was organized by the Hungarian Scientific Society fo Measurement and Automation. Twelve scientific societies from as many countries joined in this initiative, and with the participation of the delegates from these societies a Permanent Preparatory Committee was founded, which met first in Budapest in 1959, to prepare the 2nd International Measurement Conference, also held in Budapest in 1961. During this 2nd Conference further societies joined this activity, the number of the participating societies became 14.

The Swedish Society invited the 3rd conference to Stockholm in 1964. At the meeting of the Permanent Preparatory Committee held concurrently with the Congress in Stockholm, a draft of the constitution and By-laws of IMEKO was prepared. The Charter and the Constitution and By-laws of IMEKO - the full name of which was chosen to be INTERNATIONAL MEASUREMENT CONFEDERATION - was signed at the next meeting of the International Preparatory Committee in Warsaw, June 1965, by representatives of 14 Member Organizations.

According to the Constitution, the governing body of IMEKO was renamed as General Council, in which every Member Organization (MO) is represented by two members.

The Constitution was amended in 1972, when the officers - President, Secretary General, Treasurer - were elected. New changes in the Constitution were introduced in 1979.

STRUCTURE

As laid down in the Constitution, the officers of IMEKO are:

President - Secretary General - Treasurer - Immediate Past President

Permanent Organizations of IMEKO:

General Council (GC) which is the supreme governing body.

The GC consists of on or two delegates from each MO. Each MO has one vote. The GC holds its sessions yearly.

Secretariat, headed by the Secretary General.

The Secretariat is the executive body of IMEKO. The Secretariat has the task of carrying out the decisions of the GC and conducts its activity in accordance with the decisions of the GC.

All officers are nominated from among the active membership of an MO. No two officers may be nominated from the same MO. No person may serve twice as President.

The President act as Chairman of the GC and represents IMEKO.

The Secretary General conducts the work of the Secretariat.

The Treasurer supervises the financial activities of IMEKO.

The Immediate Past President acts as a councellor to the active officers, especially to the President. Term of office is three years. All officers serve voluntarily and are unpaid.

IMEKO operates several Technical Committees (TC) which are established on the basis of the proposal of an MO and approved by the General Council after hearing the recommendation of an appropriate standing committee. The General Council has to approve the scope of the committee, its Chairman and the Secretary. Members to the various TCs may be appointed by the MOs.

TECHNICAL COMMITTEES

TC1	Higher Education
TC2	Photon-Detectors
TC3	Measurement of Force and Mass
TC4	Microwave Measurement (not working at present)
TC5	Hardness Measurement
TC6	Vocabulary Committee
TC7	Measurement Theory
TC8	Metrology
TC9	Flow Measurement
TC10	Technical Diagnostics
TC11	Metrological Requirements in Developing Countries
TC12	Temperature Measurement

TC13 Measurements in Biology and Medicine
TC14 Measurement of Geometrical Quantities

IMEKO CONGRESSES

1958 and 1961 Budapest (Hungary)
1964 Stockholm (Sweden)
1967 Warsaw (Poland)
1970 Versailles (France)
1973 Dresden (GDR)
1976 London (Great Britain)
1979 Moscow (USSR)
1982 Berlin (WesLt)
1985 Prague (Czechoslavakia)

PERIODICAL PUBLICATIONS

"MEASUREMENT"	Journal (1983 -) quarterly.
"IMEKO Bulletin"	semi-annually (1972 -)

FIACC CONGRESSES 1955 TO 1990

	IFORS	IMEKO	IFIP	IFAC	IMACS
1955					BRUSSELS
1956					
1957	OXFORD				
1958		BUDAPEST			STRASBOURG
1959			PARIS		
1960	AIXenPROV			MOSCOW	
1961		BUDAPEST			OPATIJA
1962			MUNICH		
1963	OSLO			BASEL	
1964		STOCKHOLM			BRIGHTON
1965			NEW YORK		
1966	BOSTON			LONDON	
1967		WARSAW			LAUSANNE
1968			EDINBURGH		
1969	VENICE			WARSAW	
1970		VERSAILLES			MUNICH
1971			LJUBLJANA		
1972	DUBLIN			PARIS	
1973		DRESDEN			PRAGUE
1974			STOCKHOLM		
1975	TOKYO/KYOTO			CAMBRIDGE	
1976		LONDON			DELFT
1977			TORONTO		
1978	TONRONTO			HELSINKI	
1979		MOSCOW			SORRENTO
1980			TOKYO/MELBOURNE		
1981	HAMBURG			KYOTO	
1982		BERLIN			MONTREAL
1983			PARIS		
1984	WASHINGTON DC			BUDAPEST	
1985		PRAGUE			OSLO
1986			DUBLIN		
1987	BUENOS AIRES			MUNICH	
1988		HOUSTON			
1989			SAN FRANCISCO		
1990				RIGA	

IFIP Charts

HISTORY OF IFIP MEETINGS

		COUNCIL				COUNCIL		
1960	01	JUN 16-17	ROM	Rome				
1961	02	FEB 14-16	DA	Darmstadt	03	OCT 23-26	CPH	Copenhagen
1962	04	MAR 21-24	FA	Feldafingen	05	AUG 23-24	MUC	Munich ©$_2$
1963					06	SEP 05-07	GO	Gola
1964	07	MAY 13-16	PRG	Prague	08	NOV 18-19	ROM	Rome
		COUNCIL				COUNCIL AND GENERAL ASSEMBLY		
1965	09	MAY 21-22	NYC	New York ©$_3$	10	NOV 04-05	NCE	Nice
1966	11	APR 27-28	LON	London	12	NOV 04-05	JRS	Jerusalem
1967	13	APR 04-06	MAD	Madrid	14	OCT 30-01	MEX	Mexico City
1968	15	APR 01-02	TBS	Tbilisi	16	JUL 31-03	EDI	Edinburgh ©$_4$
1969	17	MAR 03-04	BRU	Brussels	18	OCT 27-31	PRG	Prague
1970	19	MAY 08-09	AC	Atlantic City	20	OCT 26-30	AMS	Amsterdam 10YR
1971	21	MAR 01-02	BL	Bled	22	AUG 17-21	LJU	Ljubljana ©$_5$
1972	23	APR 05-07	VIE	Vienna	24	OCT 23-27	SOF	Sofia
1973	25	APR 09-10	MUC	Munich	26	OCT 15-19	TOR	Toronto
1974	27	FEB 25-26	HEL	Helsinki	28	JUL 30-02	STO	Stockholm ©$_6$
1975	29	MAR 24-26	TYO	Tokyo	30	OCT 20-24	RIO	Rio de Janeiro
1976	31	MAR 18-19	DRE	Dresden	32	OCT 11-15	TAS	Tashkent
1977	33	MAR 09-11	LON	London	34	AUG 01-06	TOR	Toronto ©$_7$
1978	35	FEB 01-03	BOM	Bombay	36	SEP 12-15	OSL	Oslo
1979	37	MAR 26-28	BTS	Bratislava	38	SEP 21-24	LON	London EUROIFIP
1980	39	MAR 12-14	SOF	Sofia	40	OCT 04-13	TYO	Tokyo/Melbourne ©$_8$
1981	41	MAR 14-16	AH	Anaheim CA	42	SEP 22-25	DUB	Dublin
1982	43	MAR 03-05	HEL	Helsinki	44	SEP 22-24	ROM	Rome
1983	45	MAR 21-23	PEK	Peking	46	SEP 15-18	PAR	Paris ©$_9$
1984	47	MAR 13-15	CPT	Cape Town	48	SEP 19-21	VAR	Varna
1985	49	APR 25-28	MUC	Munich 25YR	50	SEP 01-07	TYO	Tokyo
1986	51	MAR 10-14	LIS	Lisbon	52	AUG 29-31	DUB	Dublin ©$_{10}$

©$_3$ Third IFIP Congress

CHART 1

IFIP MEMBERSHIP AND REPRESENTATIVES 1960 to 1985

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

59 60 1961 1962 63 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985

PAR ROM DA CPH FA MUC GO PRA ROM NYC NCE LON JRS MAD MEX TBS EDI BRU PRA AC AMS BL LJU VIE SOF MUC TOR HEL STO TYO RIO DRE TAS LON TOR BOM OSL BTS LON SOF TYO AH DUB HEL ROM PEK PAR CPT VAR MUC TYO LIS DUB

FOUNDING MEMBERS 1960

B LINSMAN ··· RIBBENS ··· NAVEZ ···
CDN GOTLIEB ··· HULL ··· HUME ··· BOYD ··· FINCH ···
CS KRYZE ··· PLANDER ··· GVOZDJAK ··· (1)
DK BECH ··· HERBORG-NIELSEN ··· MELBY ···
SF LAASONEN ··· ANDERSIN ··· TUORI ··· KONTINEN ··· HAGLUND ···

D WALTHER ··· BAUER ··· SAMELSON ··· PILOTY ··· BRAUER ···
J YAMASHITA ··· GOTO ··· YAMAUTI · DEGAWA ··· GOTO ··· ANDO ···
NL vanWIJNGAARDEN ··· van der POEL ··· van der SLUIS ··· VERRIJN-STUART ···
E SANTESMASES ··· MORENO-DIAZ ··· ECED S. ··· PORTAENCASA ··· SENDIN ··· (2)
S COMET ··· LANGEFORS ··· SEM-SANDBERG ··· HERNAES ···

F CARTERON ··· RENARD ··· FOUROT ···
CH SPEISER ··· BOBILLIER ··· BAUKNECHT ··
UK WILKES ··· GILL ··· DOUGLAS ··· MORRIS ···
USA AUERBACH ··· PASTA ··· HARDER ··· TANAKA ··· FREEMAN · GLASER ···
SU DORODNICYN ···

AUS 61 16 BENNETT ··· COHN ··· BENNETT ··· GOLDSWORTHY ···
PL 61 17 LUKASZEWICZ ···
RA 61 18 CIANCAGLINI ··· MILCHBERG ··· | BASSO-DASTUGUE ··· (3)
I 61 19 GHIZETTI ··· DADDA ··· SACERDOTI ···
N 62 20 GARWICK ··· ØVERGAARD ··· KEILHAU ··· SØLVBERG ··· ROLSTADAS ···

BR 64 21 ANDREADE ··· KOSCHNITZKI ··· ONIGA ··· KONISHI ·· MANUEL · LANDIM ·· MATTOSO ··· OLIVEIRA ··· RADONZ ···
IL 64 22 CHEVION ··· RABIN ··· RAVIV ···
A 64 23 ZEMANEK ··· ZICH ···
MEX 64 24 BELTRAN ··· |
BG 65 25 ILIEV ··· SENDOV ···

H 66 26 KADAR ··· KALMAN ··· KOVACS ···
C 67 27 ALVAREZ-MARCER ··· MARTINEZ-MARTINEZ ··· OLIVEIRA ···
YU 67 28 TOMOVIC ··· ZELEZNIKAR ··· ALEKSIC ··· (4)
RCH 69 29 FRIEDMANN ··· DURAN ··· | (CLEI)
GDR 70 30 LEHMANN ···

DZ 70 31 MENTALECHETA ··· (5)
GH 70 32 DOE ··· QUIST ··· |
ZA 71 33 MARTING ··· HENDERSON ··· van der VEER ··· LE ROUX ···
IND 73 34 NARASIMHAN ··· BALASUBRAHMANIAN ··
NZ 74 35 COX ··· SCOULAR ··· POTTER ···

IRL 74 36 DEMPSEY ··· MARCHAND ··· DALTON ···
ET 77 37 SARHAN ···
IQ 78 38 ABOUD ···
K 78 39 PARK ··· LEE ···
TN 78 40 GRIBAA ··· KAMOUN ···

PRC 79 41-3=38 GUO ···
MA 79 42-3=39 BENMOKHTAR ···
WRN 81 43-3=40 LONGE ··· JAIYESIMI ···
P 81 44-3=41 SIMOES-MONTEIRO · PENEDO ···
SYR 81 45-3=42 MUNAJED ···
SEARCC 82 46-3=43(48) IAU ···
GR 83 47-3=44(49) TRAPEZANOGLOU ···
CLEI 84 48-3=45(58) (6)

SEARCC 1982

IND (1+5)

HK
RI
MAL
PI
SGP
T
PAK (1+6) 1984

CLEI 1984

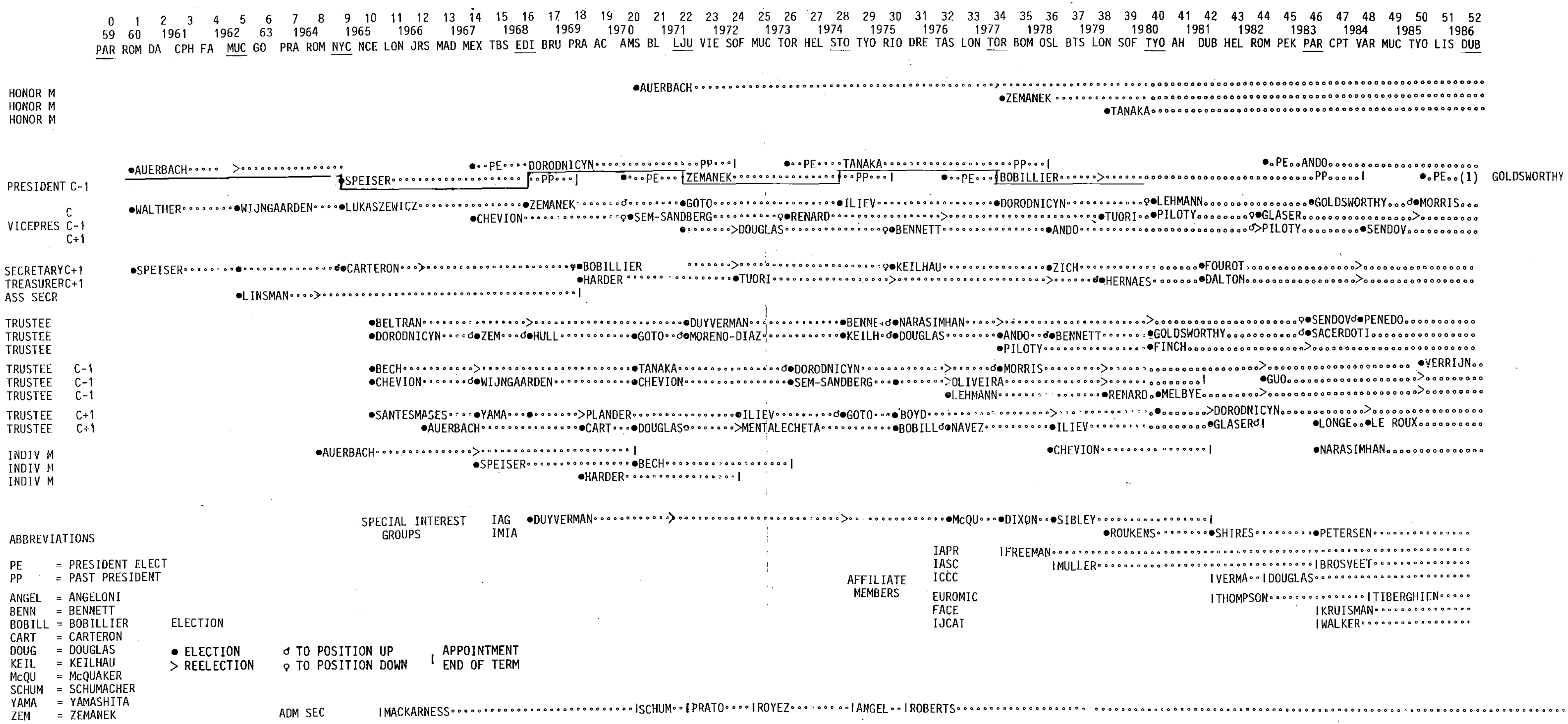
RA
BR

BOL
RCH
COL
EQ
PY
PE
U
YV

(1) UNCOVSKY
(2) ALVAREZ
(3) MONTEVERDE
(4) MANDZIC
(5) AMEUR-MOUSSA
(6) VIDART

CHART 2

IFIP HONORARY MEMBERS
IFIP OFFICERS
INDIVIDUAL MEMBERS
SPECIAL INTEREST GROUPS
AFFILIATED MEMBERS
ADMIN. SECRETARIES/MANAGER
1960 to 1985



ABBREVIATIONS

PE = PRESIDENT ELECT
PP = PAST PRESIDENT

ANGEL = ANGELONI
BENN = BENNETT
BOBILL = BOBILLIER
CART = CARTERON
DOUG = DOUGLAS
KEIL = KEILHAU
McQU = McQUAKER
SCHUM = SCHUMACHER
YAMA = YAMASHITA
ZEM = ZEMANEK

ELECTION

● ELECTION
> REELECTION

♂ TO POSITION UP
♀ TO POSITION DOWN

| APPOINTMENT
END OF TERM

CHART 3

IFIP TECHNICAL COMMITTEES AND WORKING GROUP OFFICERS
PART A
TC 1 to TC 4
1960 to 1985

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

59 60 1961 1962 63 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985

PAR ROM DA CPH FA MUC GO PRA ROM NYC NCE LON JRS MAD MEX TBS EDI BRU PRA AC AMS BL LJU VIE SOF MUC TOR HEL STO TYO RIO DRE TAS LON TOR BOM OSL BTS LON SOF TYO AH DUB HEL ROM PEK PAR CPT VAR MUC TYO LIS DUB

TC 1		TOOTILL, WILDE, WIJNGAARDEN
	Secr	GOULD
WG 1.1		GOULD
TC 2		ZEMANEK, STEEL, PAUL, MASON
	VChm	PECK
	Secr	UTMAN, FROCK-PRUTS, GALLITANO, POCOCK
WG 2.1		vanderPOEL, PAUL, PECK, DEWAR, KING
	VChm	
	Secr	BOURNE, KING, FEATHER/BLUM
WG 2.2		STEEL, NEUHOLD
	VChm	NEUHOLD
	Secr	WALK, BLUM
WG 2.3		WOODGER, HORNING, WOODGER
	VChm	WOODGER, HORNING
	Secr	TURSKI, HEHNER/HENDERSON, HENDERSON
WG 2.4		WULF, GOOS, WAITE
	VChm	VODA
	Secr	WICHMANN, CARTER
WG 2.5		POOL, EINARSSON, REID
	VChm	EINARSSON, RICE
	Secr	FORD, CHATELIN
WG 2.6		NIJSSEN, MEERSMAN
	VChm	STEEL
	Secr	DATE, FALKENBERG, GRIETHUYSEN
WG 2.7		HERTWICK, BEECH
	VChm	JARDINE, GRAM
	Secr	POCOCK
TC 3		BECH, BUCKINGHAM, WOLBERS, HEBENSTREIT, BRAUER
	VChm	ATCHISON, HEBENSTREIT, ATCHISON/BRAUER, ATCHISON
	Secr	PENKOV/ATCHISON, PENKOV/BRATTVAG, WIECHERS
WG 3.1		CHEVION, ATCHISON, LOVIS, BOLLERSLEV
	VChm	
	Secr	
WG 3.2		BUCKINGHAM, ATCHISON
	VChm	
	Secr	
WG 3.3		CHARP, LEWIS
	VChm	
	Secr	
WG 3.4		BERGER, RAYMONT, BARTA
	VChm	
	Secr	
WG 3.5		LOVIS
	VChm	
	Secr	PARIS
TC 4		GREMY, ROUKENS, IMIA
	VChm	
	Secr	vanEGMOND †
WG 4.1		HUSAK, GREMY
	VChm	
	Secr	ANDERSON
WG 4.2		W.SCHNEIDER
	VChm	GRIESSER
	Secr	KAESTNER
WG 4.3		ZYWIETZ
	VChm	
	Secr	
WG 4.4		GRIESSER
	VChm	W.SCHNEIDER
	Secr	DANIELSSON

CHART 3

IFIP TECHNICAL COMMITTEES AND WORKING GROUP OFFICERS
PART B
TC5 to TC 7
1960 to 1985

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985

PRA AC AMS BL LJU VIE SOF MUC TOR HEL STO TYO RIO DRE TAS LON TOR BOM OSL BTS LON SOF TYO AH DUB HEL ROM PEK PAR CPT VAR MUC TYO

TC 5 HARDER WILLIAMS VLIETSTRA ROLSTADAS
VChm ROLSTADAS SMIT
Secr LUH FRANSSON
WG 5.1 LUH J.B.SCHNEIDER
VChm
Secr
WG 5.2 VLIETSTRA WARMAN GUEDJ WARMAN BO
VChm ALLAN III GUEDJ WARMAN
Secr LOKY PREGITZER SOS
WG 5.3 HATVANY KOCHAN CRESTIN
VChm BJORKE NEMES
Secr McPHERSON McWATERS
WG 5.4 WILLIAMS MALAGARDIS
VChm
Secr
WG 5.5 GILLES
VChm
Secr
WG 5.6 LIND KUO MEE
VChm KUO
Secr
WG 5.7 ROLSTADAS FALSTER
VChm DOUMEINGTS
Secr FALSTER AUGUSTIN
WG 5.8 MUSGRAVE
VChm
Secr

TC 6 CURRAN UNCAPHER POUZIN DANTHINE UHLIG
VChm DAVIES
Secr
WG 6.1 CERF BARBE McKENZIE SUNSHINE
VChm
Secr McKENZIE
WG 6.2 SAMUELSON
VChm
Secr
WG 6.3 BAIR SHACKEL
VChm
Secr
WG 6.4 HOPKINS RAVASIO
VChm SPRATT
Secr
WG 6.5 UHLIG SCHICKER
VChm
Secr

TC 7 BALAKRISHNAN STOER LUCERTINI
VChm LUCERTINI
Secr
WG 7.1 KARPLUS BALAKRISHNAN
VChm
Secr
WG 7.2 LIONS LASIECKA
VChm GLOWINSKI
Secr
WG 7.3 GREEN GELENBE KOBAYASHI SEVCIK
VChm GELENBE KOBAYASHI HERZOG REISER
Secr KOBAYASHI HERZOG SEVCIK LAVENBERG

CHART 3

IFIP TECHNICAL COMMITTEES
AND WORKING GROUP OFFICERS
PART C
TC 8 to TC 11
1960 to 1985

```
                 31  32  33  34  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50
                   1976    1977    1978    1979    1980    1981    1982    1983    1984    1985
                DRE TAS LON TOR BOM OSL BTS LON SOF TYO AH  DUB HEL ROM PEK PAR CPT VAR MUC TYO

TC 8     LANGEFORS♦♦♦♦♦♦♦♦♦♦♦VERRIJN-STUART♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦BRACCHI♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦
VChm                                                                       •DAVIS•••••••••••••••••••
Secr                                           METAXIDES/OLLE••••••••••••••OLLE•••••••••••••••••••••
      WG 8.1        H.J.SCHNEIDERoooooooooooooooooooooooooooooooooSØLVBERGooooooooooooooooooooooooooo
      VChm                                                                             WASSERMAN••
      Secr          SEIBT••••••••••••••••••KLEIN/WASSERMAN•••••BUBENKO••••••••••••••••••••••••••••
      WG 8.2        LUCASoooooooooooooooooooLANDooooooooooooooooooooooooooMUMFORDoooooooooooooooWELKE
      CVhm                                      WELKE•••••••••••••••••SWANSON•••••••••••OPELLAND
      Secr
      WG 8.3                                                          METHLIEooooooooooooooooooo
      VChm                                                                                  LEE••
      Secr                                                            SPRAGUE/HAWGOOD••••••••••
      WG 8.4                                                                             VERRIJN
      VChm
      Secr                                                                               MUELLER
          TC 9          GOTLIEB♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦BROTH♦♦♦MARGULIES♦SACKMAN♦♦♦♦♦♦♦♦
          VChm          MARGULIES••••••••••••••••••••••••••••••••••••               LEVRAT••••••••••
          Secr
               WG 9.1               JONASSONoooooooooooooooBRIEFSoooooooooooooooooooooooooooooooooo
               VChm
               Secr
               WG 9.2               KLINGoooooooooooooooooooooooooooooooooooooooooSIZERoooooooooooo
               VChm                 BRUNNSTEIN•••••••••••••••••BROTH•••SIZER•••••
               Secr
          TC 10         PILOTY♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦ASPINALL♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦
          VChm                                                  PILOTY•••••••••••••••••••••••••••
          Secr                 ASPINALL•••••••••••••••••••••••DEWAR•••••••••••••••••••••••••••••
               WG 10.1         BLAUUWooooooooooooooooooooooooooo     ooooooooooooooooooooooooooooo
               VChm
               Secr                     CARREZ••••••••••••••••••••••••••••••••••••••••••••••••••
               WG 10.2                  BARBACCIoooooooooooooooooooooooooooooooooooHARTENSTEINo
               VChm                     BORRIONE••••••••••••••••••••••••••••••••••••••••UEHARA•
               Secr                     HARTENSTEIN•••••••••••••••••••••••••••••••••••REINETTO
               WG 10.3                  JENSENooooooooooooooooooooooooREIJNSoooooooooooooooooooo
               VChm                     LELANN••••••••••••••
               Secr                     MYERS••••••••••••••••••••••••BARTON••••••••••••••CAPRIE
               WG 10.4                              AVIZIENISoooooooooooooooooooooooooooMEYER
               VChm                                     COSTES•••••••••••••••••••••••••TOHMA
               Secr
               WG 10.5                                  MICHAELSONoooooooooooooooooooHÜRBST
               VChm
               Secr                                     McLEAN••NEWMAN•••••••••••••••••••
          TC 11                                                     BECKMAN†    HOVING♦♦
          VChm                                                                  WARE••••
          Secr
               WG 11.1                                                          FINCHooo
               WG 11.2                                                          BOUNDooo
               WG 11.4                                                          FAKooooo
```

IFIP STANDING COMMITTEE CHAIRMEN

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986

CPH FA MUC GO PRA ROM NYC NCE LON JRS MAD MEX TBS EDI BRU PRA AC AMS BL LJU VIE SOF MUC TOR HEL STO TYO RIO DRE TAS LON TOR BOM OSL BTS LON SOF TYO AH DUB HEL ROM PEK PAR CPT VAR MUC TYO LIS DUB

SC1 ADMISS — LANGEFORS...GOTLIEB...LINSMAN...RENARD...KEILHAU...NARASIMHAN...MELBYE...GUO...

SC2 FINANCES — vWIJNG...LAASONEN...LINSMAN...HARDER...BOBILLIER...vdPOEL...SEM-SANDBERG...BOYD...TUORI...MELBYE...HERNAES...MELBYE...

SC3 STATUTES — CARTERON...TANAKA...LEHMANN...

SC4 ACTIV PL — ZEMANEK...TANAKA...RENARD...vdVEER...GOLDSWORTHY...

SC5 CONGR OR — FREEMAN...THOMSEN.MEIER...KOORY...GENUYS... . . . FINCH...

SC6 FUTURE P — vWIJNGAARDEN...LUKASZEWICZ...CHEVION... TANAKA...

SC7 ICIL — BAUER...TANAKA...

SC8 ICID — BECH...CHEVION... KALMAN...NARASIMHAN...

SC9 AWARDS — SANTESMASES... ZEMANEK.HARDER...BOBILLIER...ZICH...FOUROT...

SC10 PUBL INF — POPPLEWELL..GILL...BARNES...HERBERT... RIBBENS...NAVEZ...MORRIS...

SC11 PUBLIC — WILKES...GILL...vWIJNGAARDEN...KRONEBERG...SAMELSON.ZEMANEK...SCHUCHMANN...

PUBLICATIONS OFFICER — KRONEBERG... . . . . DUNCAN...

CONGRESS OFFICER — NAVEZ...

NEWSLETTER EDITOR — ROSENFELD...

IFIP STANDING COMMITTEES

SC1 ADMISSIONS COMMITTEE

SC2 FINANCE COMMITTEE

SC3 STATUTES AND BYLAWS COMMITTEE

SC4 ACTIVITY PLANNING COMMITTEE

SC5 CONGRESS GUIDELINES COMMITTEE

SC6 FUTURE PLANNING COMMITTEE

SC7 IFIP COMMITTEE FOR INTERNATIONAL LIAISON (ICIL)

SC8 IFIP COMMITTEE: INFORMATICS FOR DEVELOPMENT (ICID)

SC9 INTERNAL AWARDS COMMITTEE

SC10 PUBLIC INFORMATION COMMITTEE

SC11 PUBLICATIONS COMMITTEE

EXAMPLES FOR AD-HOC OR OTHER SHORT TIME COMMITTEES

Nominations Committees for President, Vice-Presidents, Trustees etc.
Site Selection Committee for a Congress
IFIP 25th Anniversary Committee

IFIP History Commission

Footnote: The Numbers SC1 through SC11 are not used in IFIP, but they could be introduced.

IFIP PUBLIC INFORMATION COMMITTEE

Graham Morris
IFIP Vice-President
London, United Kingdom

Having reached this page in the book readers will be aware of both the technical nature of IFIP's work and of the good relationships which exist between workers inside IFIP at the human and technical levels. Towards the end of the 1970's IFIP became increasingly aware that the knowledge of IFIP's working which existed within the IFIP community was not paralleled externally. IFIP Member Societies from the Nordic countries were particularly concerned about this and made a very forcible case for improved communication from IFIP to its Member Societies and to their individual members.

The Public Information Committee (PIC) was set up to tackle this problem and over the last six years has introduced a variety of material designed to improve the understanding of IFIP.

The first step was to combine two earlier publications into one comprehensive annual, the IFIP Information Bulletin, giving comprehensive detail about all of IFIP's activities. It gives details of IFIP Member Societies and their representatives, together with the IFIP Officers and Council and the membership of IFIP committees. It gives the aims and scope for all the Technical Committees and lists their members as well as those of the Working Groups. A comprehensive list of all of IFIP's publications makes increasingly impressive reading, and there is a variety of other information of interest to IFIP workers.

A simple brochure entitled "*What is IFIP*" was introduced to publicise IFIP and its activities and especially to help in the promotion of IFIP Congresses. The most recent issue is reproduced at the beginning of this section.

These two publications helped to improve the understanding of IFIP but still did not go far enough to explain in comparatively lay terms the technicalities of IFIP's work. PIC tackled this by commissioning a series of articles describing the activities of our Technical Committees, written by Kenneth Owen, one-time Technology Editor of the London "Times". At the time of writing eight such articles have been published and two Technical Committees remain to be covered. When that has been achieved it will probably be time to start the cycle all over again to cover what has been achieved since the series began.

Probably the most important publication introduced by PIC has been the IFIP Newsletter edited since its introduction in 1983 by Jack Rosenfeld. This is a quarterly publication giving up-to-date diary information about all of IFIP's activities together with reports on the conferences and meetings wich have already taken place.

PIC felt it important to assist General Assembly members and TC Chairmen to give presentations to their parent societies about IFIP and accordingly a slide presentation complete with lecture notes was produced. This has been put to effective use on many occasions and was updated in 1985.

Among the minor activities of PIC has been the production of an IFIP tie for general use as well as a special edition to mark IFIP's 25th anniversary, distributed in Munich.

How successful has PIC been in making IFIP better known? Without doubt a great deal has been achieved within IFIP itself and its immediate circle of contacts. The spread of information into more public domains depends not only on PIC but also very much on the way that our national representatives on Technical Committees and Working Groups and the Member Societies they represent work to communicate with their own members.

PIC PUBLICATIONS

THE KENNETH OWEN PAPERS

#1 (TC 3)
Informatics and Education: IFIP's New Initiatives
June 1982; 7 pp.

#2 (TC 6)
Data Communications: IFIP's International "Network" of Experts
August 1982; 6 pp.

#3 (TC 10)
Very Large Scale Complexity: The Challenge of Systems Design.
October 1982; 4 pp.

#4 (TC 8)
Formal Methods in an Informal World.
IFIP Explores the Structure of Information Systems.
May 1983; 5 pp.

#5 (TC 4 / IMIA)
Health Informatics: The Vital Work of IMIA.
July 1983; 5 pp.

#6 (TC 2)
The Art and Science of Programming.
IFIP's Community of Experts Tackle Key Problem Areas.
October 1983; 4 pp.

#7 (TC 5)
Computers in Industry.
From Design Office to Shop-Floor: The Work of IFIP's TC 5.
December 1984; 5 pp.

#8 (TC 11)
Computer Security: IFIP Addresses the Practical Issues.
October 1985; 4 pp.

IFIP BULLETINS

#1	JAN 1970	#10	MAY 1976
#2	AUG 1970	#11	MAR 1977
#3.	MAR 1971	#12	DEC 1977
#4	DEC 1971	#13	DEC 1978
#5	MAY 1972	#14	JAN 1980
#6	DEC 1972	#15	FEB 1981
#7	AUG 1973	#16	MAR 1982
#7A	JAN 1974	#17	APR 1983
#8	JUN 1974	#18	JUN 1984
#9	JUL 1975	#19	DEC 1985

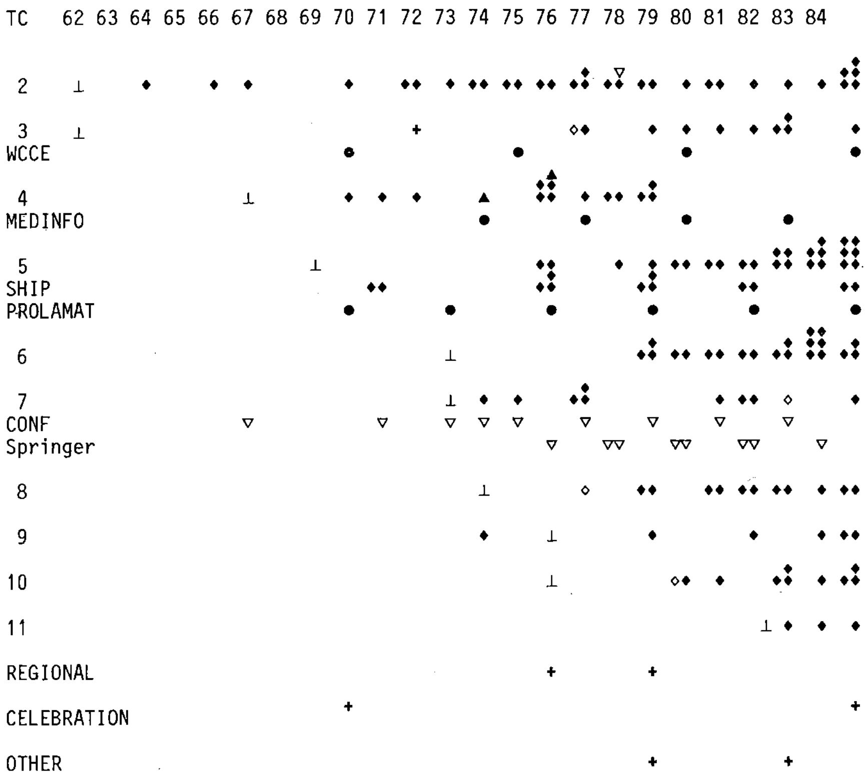
IFIP NEWS

#1	APR 1978
#2	AUG 1978
#3	DEC 1978
#4	NOV 1979

IFIP NEWSLETTER

VOL.1	#1	NOV 1983	VOL.2	#1	MAR 1985
	#2	FEB 1984		#2	JUN 1985
	#3	MAY 1984		#3	SEP 1985
	#4	SEP 1984		#4	DEC 1985
	#5	DEC 1984			

PUBLICATIONS DIAGRAM



⊥ ESTABLISHM OF TC ▽ SPRINGER BOOK ● WORLD or JOINT CONFERENCE ▲ TC 4 SERIES

◇ TWO TC's INVOLVED + OTHER CONFERENCE ♦ WORKING CONFERENCE NORTH HOLLAND

CONFERENCE PROCEEDINGS

IFIP WORKING CONFERENCE PUBLICATIONS POLICY
(Compact Version - March 1986 update)

An IFIP WORKING CONFERENCE becomes legal by the approval of the IFIP Activity Planning Board. This approval automatically includes the obligation to publish CONFERENCE PROCEEDINGS under the IFIP COPYRIGHT and conforming to the Publication Policy as resolved and voted for by the IFIP General Asembly.

Each IFIP WORKING CONFERENCE, therefore, is obliged to publish its PROCEEDINGS

* as a SERVICE to the Information Processing Community
* as a DOCUMENTATION of the work done in IFIP and its bodies
* as a CONTRIBUTION to the IFIP image
* as a contribution to the balance of IFIP finances

to cover the expenses of TCs and WGs and loans for WORKING CONFERENCES by the return from the royalties.

The PROCEEDINGS are

* published by the IFIP Publishers, North-Holland
  Exceptions are possible and have been approved, but must remain rare and specific.
* under IFIP COPYRIGHT (NO EXCEPTIONS)
  The new copyright legislation requires that all authors sign the IFIP copyright form distributed and re-collected by the editor of the proceedings.
* in the established IFIP book formats
* in ENGLISH
* with a CHARACTERISTIC TITLE
  The subject must be clearly recognizable from the title, and consistant with other existing and possibly future titles in the series.
* of appropriate SIZE
  too small (say below 400 pages) volumes bring higher costs per page, too large (say above 800 pages) volumes result in higher prices per volume - not always a service to the reader in quality and orientation.

The EDITOR, responsible for the Proceedings, is appointed by the Organizing Committee in agreement with the Programme Committee. The Editor's name is given,if possible, when asking for conference approval, or else identified to the Secretariat as soon as possible. The Publisher routes the Draft Publishing Contract to the Editor(s), the TC Chairman, and the Publications Officer for comment and approval. The final, approved Publishing Contract is signed by the Secretary and the President of IFIP and by the Publisher.

IFIP PUBLICATIONS COMMITTEE

H.-R. Schuchmann and Heinz Zemanek

From the table "Standing Committees" it can be seen that the IFIP Publications Committee (PC) is as old as IFIP. The founding president, himself a 'specialist' in publications - his publishing house had an extraordinary reputation at its time in American information processing - recognized the importance of IFIP publications for the professional image of IFIP and its finances. He, together with the first chairman, Prof. M.W. Wilkes, set the standards. Today they are described in detail by an IFIP document "Publications Policy", of which a compact version folows as an appendix - and they proved to be sound and successful during the past 25 years. There is only one possible advice to be derived: to keep to those standards.

The History of the IFIP Publications Committee

First, we quote the early minutes' references to the PC.

6th Council Meeting, Gola, Norway, September 1963, item 7.4:
"A Publication Committee was formed, and S. Gill was appointed chairman. This committee will make arrangements to publish the vocabulary."

8th Council Meeting, Rome, November 1964, item 11:
"S. Gill submitted a report on the activities of the Publications Committe which was accepted by the Council. It was decided that the Executive Body should re-draft the guiding rules for contracts with publishers. (Note: Much of the work by the Publications Committee has been taken up under other agenda items.)"

9th Council Meeting, New York City, May 1965, item 11.1 and 11.2:
"A. van Wijngaarden distributed and read the report of the Publications Committee and submitted a dummy copy of the vocabulary. The publications which are now under preparation

are the following: English version of the vocabulary and the proceedings of the Vienna Conference on 'Formal Language Description Languages'."

At the 12th Council Meeting, Madrid, April 1967, the first sales report was given. A. van Wijngaarden, chairman of the Publications Committee, reported on the sales up to the end of 1966 as follows:

IFIP Congress '62 proceedings	1736 copies
IFIP/ICC Vocabulary	2166 copies
Proceedings on Microminiaturization	900 copies

Next, here is a list of the PC chairmen with their approximate office years:

M.V. Wilkes	1961-1963
S. Gill	1963-1965
A. van Wijngaarden	1965-1970
D. Kroneberg	1970-1974
K. Samelson	1974-1976
H. Zemanek	1976-1984
H.-R. Schuchmann	since 1984

Like all other standing committees, the PC was composed in principle of General Assembly members. However, there were always other people involved: the representatives of the IFIP publishing houses, for instance, or special members like Dieter Kroneberg. He had been one of the sub-editors of the proceedings of ICIP 59, published by UNESCO; he served as PC-chairman and then, until his retirement, as IFIP Publications Officer.

The relationship between IFIP and its publishing houses has always been good, cordial and fruitful. This does not mean continuous perfect agreement. At times there were complaints (in both directions) and there were lots of arguments. Publishing is a business relation, and if there is not action and counter-action, it is not a sound business. After so many years of cooperation - with both houses, North-Holland and Springer - and due to the continuity of acting people, a mutual knowledge and confidence has developed which is a better basis for success than any advanced formal agreement. Almost a quarter century of these relations is a good reason to express, on behalf of all IFIP, the thanks to the publishers who play a role more important, than most people involved in IFIP publications realize and appreciate.

In the early years only a few books appeared, but the growth became apparent. On the average, this growth - measured in volumes per year published - amounts to about 15 % per year. But this growth also required a careful administrative work. The PC mainly had to ensure that all rules were followed, the necessary officers informed and the legal and financial aspects checked. For this purpose, the General Assembly established the position of the Publications Officer. Later, the idea of the 'routing sheet' was added, a standard form collecting and documenting the necessary data and signatures, so that the president has them together when he finally signs the contract.

Lately, an important change in the membership of the PC has been implemented which should be observed everywhere in IFIP - because there may be many further similar changes advisable or necessary. The majority of the members now are no longer General Assembly members but are with TCs or WGs. It is they who brought with them a lot of experience in IFIP events and publications. By this change, publications are more visibly and effectively a matter of the technical contributors to IFIP rather than of the member societies' formal representatives. Publications have become the technical contributor's own business. The change was intended to bridge the gap between the (many more) technical contributors and the General Assembly members. This gap should totally disappear again (it is an unavoidable consequence of the growth of IFIP) and similar measures are a help.

The main work of IFIP Publications Committee is with the organizers of conferences and - even more, of course - with the authors of the proceedings who are obliged to transfer their copyright to IFIP. The impressive number of books will become visible, when the cumulative list of IFIP papers of all proceedings will soon appear. It can be said that it is the family of IFIP authors who finance - via the royalties - an important percentage of IFIP's income for the benefit of it's activities and the information processing profession. This giant benevolent activity (certainly not without benefit also for the contributors) is a socio-technical monument of its own. Again a word of thanks of all IFIP is in order, and this extends of course to the editors of the volumes (of this large number of IFIP contributors a list is included in this volume).

The IFIP publishers

The main publisher, since the IFIP Congress '62 in Munich, is North-Holland in Amsterdam, a house of tradition in scientific quality books, today a branch of the ELSEVIER trust. They have published seven congress proceedings - only New York '65 was an exception - and more than 125 working conference volumes.

The second IFIP publisher is Springer Verlag Berlin-Heidelberg, Germany, who published some IFIP books similar to the North-Holland standard, but whose main share is the Lecture Note series, which are less costly (also meaning less royalties). They bring IFIP into libraries, which buy fewer individual books but rather subscribe to the complete series.

Control of receipt of the royalties is routine for the books of the IFIP publishing houses; in the exceptional cases of other publishers, the PC has experienced great difficulty in receiving proper reporting and royalties. The overall experience is: only one publisher may be too narrow, two publishers are alright - all further ones and all exceptions mean disproportionally more work for the PC and for the Secretariat.

It appears from what was just described that IFIP does not have a binding over-all contract with the IFIP publishers but that each case is handled on its own, meaning a little more work, but the freedom of both sides to say yes or no. This principle - it must be expressively noted - has also proven to be optimal.

The IFIP Books

The books published under IFIP copyright are listed, for instance, in IFIP Summaries or Bulletins, ordered into the following categories:

A IFIP Congress Proceedings

B World Conferences
- (I) Computer Education
- (II) Medical Information (MEDINFO)
- (III) Regional Conferences of bigger size

C Working Conferences (with North Holland)
- (I) Working Conferences with Springer

D IFIP TC 7 Conferences (with Springer)
- (I) Proceedings of other conferences (with North Holland)
- (II) Collected Papers (with Springer)

E Joint Conferences
- (I) Prolamat
- (II) Shipping and Shipbuilding Symposia
- (III) Process Control Symposia
- (IV) Transportation Systèms Symposia
- (V) Other Joint Conferences

F Terminology

G ALGOL Publications

H Special Interest Groups Publications

I Special Publications

new: State-of-the-Art Reports (a Springer Series)

A few comments to some of these categories may be helpful.

The first group are the proceedings of intenational conferences with the triannual IFIP congress proceedings entitled "Information Processing" being the most well known. The copyright of the first of these volumes is still held by UNESCO and some attempt was made to also formerly indicate the international character of the new organisation: title page and abstracts were printed in the four languages English, French, Spanish and German. These proceedings quite soon became what the title suggests: an international cross section of computer technology and computer applications at the time of their appearance. In the retrospect they present a compendium of the rapidly changing state-of-the-art, not only in technical matters but also in the understanding of what computers are and how to use them best. The other international conference proceedings are more specific, either with respect to their subject area or their geographic scope.

A second group of publications consists of proceedings from working conferences. Each of them covers a quite specific topic in depth and thus follows a quite different approach than that of the Information Processing volumes. In late 1984 the WG 7.3/TC 6 proceedings on "Performance of Computer-Communications Systems" was realized as being volume 100 in the series. This gave rise to the idea of compiling the most significant technical papers from these many books into an anthology of IFIP contributions to the progress in computers in the field of scientific fundamentals, engineering, applications and socio-political aspects. The idea has not yet been implemented but still seems worthwhile for reconsideration.

Formally distinct from the working conference proceedings, but closely related to them with respect to their specific technical contents are the volumes issued by IMIA, the International Medical Informatics Association. IMIA, originally established in 1967 as IFIP TC4, became autonomous in 1978 as a Special Interest Group within IFIP.

A third major line of publications embraces the proceedings of various joint activities with other members of FIACC and with Affiliate Members.

Apart from some more specific books, a new and fourth major book series has been started in 1985. It is called State-of-the-Art Reports and is published by Springer. Despite some lengthy discussion befor its first appearance it is still in the phase of getting its final conceptual shape. The idea is to encourage TCs and WGs to prepare reference books on their technical areas as far as these have reached a certain state of maturity. After some time, a library on information processing could thus be compiled, which not only reflects the state of development in this field but also presents IFIP as a competent and actively participating engineering community mainly to students and professional newcommers. Volume 1 on "Computer Aided Manufacturing" (CAM), edited by D. Kochan, is available; volume 2 on "Computer Aided Production Management", to appear in late 1986, is under preparation. The PC currently attempts to establish a board of editors for this new series in order to promote the idea amongst the potential authors and editors and to assure the continuity of this publishing experiment.

In addition to books, IFIP currently is involved with six technical journals. "Computer in Industry" and "Computers & Security", which are the official platforms of TC 5 and TC11, respectively. Further there are "Information and Management", "Microprocessing and Microprogramming", "Computer Networks", and "Pattern Recognition Letters".

Reprint Policy

The first documented IFIP statement on its reprint policy is in the minutes of the 10th Meeting, the first 'General Assembly', Nice, November 1965:

> "Permission may be granted to reproduce all or parts of the material in any reputable technical, business or other magazine, journal or newspaper, provided that credit is given to the author and source and that acknowledgement is made that the copyright is held by IFIP".

This policy is still valid, but has become more strict, in accordance with changes in copyright laws. Written request is required for re-publication, and a restriction is made on reprinting within one year of the original publication. Exceptions are discussed between the Publisher and IFIP, and possibly granted, on basis of written request. In cases of republication in a commercial magazine, book series, etc., a fee may be required for the republication rights.

Reporting

The General Assembly as well as the Council are regularly informed about the progress of IFIP publications. Presently the following reports are given:

- Status Report
  Books newly appeared and books in production
- Royalty Report
  Royalties received are stated year by year and a detailed history book by book is maintained
- Promotion Report
  Our publishers print book lists and, in particular cases, specific flyers; they also present IFIP books at meetings, conferences and conventions at their booths; a survey of those efforts is given yearly.

A particular market is North America. IFIP seeks the help of AFIPS and its constituents for publicity and sales and we are grateful for each action of support.

Compact Journal

In 1977, the North-Holland first proposed to IFIP to establish an electronic journal, computer-stored and accessible via a network or on a computer readable storage medium. The contents would be compacts like the summaries of the papers in the IFIP proceedings (they by themselves would yield an interesting journal, if properly maintained and quickly collected), but also short news items of different kinds. The Publications Committee reacted positively, but it turned out that the goal is not easy to reach. Many technical and financial problems need solution before a final shape, technique and organization can be reached - indeed new problems come still up and much more time may be needed. Presently, the Compact Journal appears as an experimental paper-journal of North-Holland, preparing the ground.

IFIP Bibliography

The following list of publications, ordered in the categories as mentioned earlier, under 'The IFIP Books', illustrates the active involment of IFIP in computer technology over the past 25 years.

IFIP PUBLICATIONS

A. IFIP CONGRESS PROCEEDINGS

INFORMATION PROCESSING 1959
Proceedings of the International Conference on Information Processing
(S. de Picciotto, Ed.) UNESCO, Paris, France, 1959
R. Oldenburg, Munich, Butterworths, London, 1960; out of print

INFORMATION PROCESSING 1962
Proceedings of the IFIP Congress, Munich, F.R.G., 1962
(C.M. Popplewell, Ed.)
North-Holland, Amsterdam, 1963; out of print

INFORMATION PROCESSING 1965
Proceedings of the IFIP Congress, New York, U.S.A. 1965
(W.A. Kalenich, Ed.)
Spartan Books, Washington D.C., Vol. 1, 1965; out of print, Vol. 2, 1966; out of print

INFORMATION PROCESSING 1968
Proceedings of the IFIP Congress, Edinburgh, Scotland, 1968
(A. J. Morrell, Ed.)
North-Holland, Amsterdam, 1969; out of print

INFORMATION PROCESSING 1971
Proceedings of the IFIP Congress, Ljubljana, Yugoslavia, 1971
(C. V. Freiman, J. E. Griffith,
J. L. Rosenfeld, Eds.)
North-Holland, Amsterdam, 1972; out of print

INFORMATION PROCESSING 1974
Proceedings of the IFIP Congress, Stockholm, Sweden, 1974
(J. Rosenfeld, Ed.)
North-Holland, Amsterdam, 1974; 1130 pp.

INFORMATION PROCESSING 1977
Proceedings of the IFIP Congress, Toronto, Canada, 1977
(B. Gilchrist, Ed.)
North-Holland, Amsterdam, 1977; out of print

INFORMATION PROCESSING 1980
Proceedings of the IFIP Congress, Tokyo, Japan/Melbourne, Australia, 1980
(S. H. Lavington, Ed.)
North-Holland, Amsterdam, 1980; 1084 pp.

INFORMATION PROCESSING 1983
Proceedings of the IFIP Congress, Paris, France, 1983
(R. E. A. Mason, Ed.)
North-Holland, Amsterdam, 1983; 1012 pp.

B. WORLD CONFERENCES

B. (I) COMPUTER EDUCATION

IFIP 1970 WORLD CONFERENCE ON COMPUTER EDUCATION
Proceedings of the IFIP First World Conference, Amsterdam, The Netherlands, 1970
(B. Scheepmaker, K. L. Zinn, Eds.)

COMPUTERS IN EDUCATION
Proceedings of the IFIP Second World Conference, Marseilles, France, 1975
(O. Lecarme, R. Lewis, Eds.)
North-Holland, Amsterdam, 1975; 1042 pp.

COMPUTERS IN EDUCATION
Proceedings of the IFIP Third World Conference, Lausanne, Switserland, 1981
(R. Lewis, E. D. Tagg, Eds.)
North-Holland, Amsterdam, 1981; 914 pp.

COMPUTERS IN EDUCATION
Proceedings of the IFIP Fourth World Conference, Norfolk, Virginia, U.S.A, 1985
(K. Duncan, D. Harris, Eds.)
North-Holland, Amsterdam, 1985; 1060 pp.

B (II) MEDINFO

MEDINFO 74
Proceedings of the IFIP First World Conference on Medical Informatics, Stockholm, Sweden, 1974
(J. Anderson, M. Forsythe, Eds.)
North-Holland, Amsterdam, 1974; out of print

MEDINFO 77
Proceedings of the IFIP Second World Conference on Medical Informatics, Toronto, Canada, 1977
(D. Shires, H. Wolf, Eds.)
North-Holland, Amsterdam, 1977; 1112 pp.

MEDINFO 80
Proceedings of the IFIP Third World Conference on Medical Informatics, Tokyo, Japan, 1980
(D. A. B. Lindberg, S. Kaihara, Eds.)
North-Holland, Amsterdam, 1980; Vol. 1 + Vol. 2; 1456 pp.

MEDINFO 83
Proceedings of the IMIA Fourth World Congress on Medical Informatics, Amsterdam, The Netherlands, 1983
(J. H. van Bemmel, M. J. Ball, O. Wigertz, Eds.)
North-Holland, Amsterdam, 1983; Vol. 1 + Vol. 2; 1395 pp.

B (III) REGIONAL CONFERENCES

COMPUTER EDUCATION FOR DEVELOPMENT
Based on 'The Rio Symposium on Computer Education for Developing Countries' sponsored by IFIP TC 3, Rio de Janeiro, Brazil, 1972
(Claudia Bussel, Ed.)
Copies may be obtained from: 1. North-Holland, Amsterdam, 2. AFIPS Headquarters, 3. Ao Livro tecnico S.A., Rio, 1972; 570 pp.

SEARCC 76
Proceedings of the First South East Asia Regional Computer Conference, Singapore, September 1976 (M. Joseph, F. C. Kohli, Eds.)
North-Holland, Amsterdam, 1977; out of print

EUROIFIP 79
IFIP European Conference on Applied Information Technology, London, U.K., September 1979
(P. A. Samet, Ed.)
North-Holland, Amsterdam, 1979; 768 pp.

C. WORKING CONFERENCE PROCEEDINGS

FORMAL LANGUAGE DESCRIPTION LANGUAGES FOR COMPUTER PROGRAMMING
Proceedings of the IFIP TC 2 Working Conference, Vienna, Austria, 1964
(T. B. Steel, Jr. Ed.)
North-Holland, Amsterdam, 1966; 1st repr. 1971; out of print

SYMBOL MANIPULATION LANGUAGES AND TECHNIQUES
Proceedings of the IFIP TC 2 Working Conference, Pisa, Italy, 1966
(D.G Bobrow, Ed.)
North-Holland, Amsterdam, 1968; 1st repr. 1971; out of print

SIMULATION PROGRAMMING LANGUAGES
Proceedings of the IFIP TC 2 Working Conference, Oslo, Norway, 1967
(J. N. Buxton, Ed.)
North-Holland, Amsterdam, 1968; 1st repr. 1974; out of print

INFORMATION PROCESSING OF MEDICAL RECORDS
Proceedings of the IFIP TC 4 Working Conference, Lyons, France, 1970
(J. Anderson, J. M. Forsythe, Eds,)
North-Holland, Amsterdam, 1970; out of print

ALGOL 68 IMPLEMENTATION
Proceedings of the IFIP TC 2 Working Conference, Munich, F.R.G., 1970
(J. E. L. Peck, Ed.)
North-Holland, Amsterdam, 1971; out of print

COMPUTER APPLICATION ON ECG AND VCG ANALYSIS
Proceedings of the IFIP TC 4 Working Conference, Hannover, F.R.G. 1971
(Chr. Zywietz, B. Schneider, Eds.)
North-Holland, Amsterdam, 1973; out of print

GRAPHIC LANGUAGES
Proceedings of the IFIP TC 2 Working Conference, Vancouver, Canada, 1972
(F. Nake, A. Rosenfeld, Eds.)
North-Holland, Amsterdam, 1972; out of print

MATHEMATICAL MODELS IN BIOLOGY AND MEDICINE
Proceedings of the IFIP TC 4 Working Conference, Varna, Bulgaria, 1972
(N. T. J. Bailey, Bl. Sendov, R. Tsanev, Eds.)
North-Holland, Amsterdam, 1974; out of print

PROGRAMMING TEACHING TECHNIQUES
Proceedings of the IFIP TC 2 Working Conference, Zakopane, Poland, 1972
(W. M. Turski, Ed.)
North-Holland, Amsterdam, 1973; out of print

COMPUTER-AIDED DESIGN
Proceedings of the IFIP TC 5 Working Conference, Eindhoven, The Netherlands, 1972
(J. Vlietstra, R. F. Wielinga, Eds.)
North-Holland, Amsterdam, 1973; out of print

MACHINE ORIENTED HIGHER LEVEL LANGUAGES
Proceedings of the IFIP TC 2 Working Conference, Trondheim, Norway, 1973
(W. L. van der Poel, L. A. Maarssen, Eds.)
North-Holland, Amsterdam, 1974; out of print

DATA BASE MANAGEMENT
Proceedings of the IFIP TC 2 Working Conference, Cargèse, Corsica, 1974
(J. W. Klimbie, Jr., K. L. Koffeman, Eds.)
North-Holland, Amsterdam, 1974; 1st repr. 1977; out of print

HUMAN CHOICE AND COMPUTERS
Proceedings of the IFIP TC 9 Conference, Vienna, Austria, 1974
(E. Mumford, H. Sackman, Eds.)
North-Holland, Amsterdam, 1975; 368 pp.

COMMAND LANGUAGES
Proceedings of the IFIP TC 2 Working Conference, Lund, Sweden, 1974
(C. Unger, Ed.)
North-Holland, Amsterdam, 1975; out of print

COMPUTER SIMULATION OF WATER RESOURCES SYSTEMS
Proceedings of the First IFIP TC 7 Working Conference on Modelling and Simulation of Water Resources, Ghent, Belgium, 1974
(G. C. Vansteenkiste, Ed.)
North-Holland, Amsterdam, 1975; out of print

DATA BASE DESCRIPTION
Proceedings of the IFIP TC 2 Special Working Conference, Wépion, Belgium, 1975
(B. C. M. Douqué, G. M. Nijssen, Eds.)
North-Holland, Amsterdam, 1976; out of print

SYSTEM SIMULATION IN WATER RESOURCES
Proceedings of the IFIP TC 7 Working Conference on Biosystems Simulation in Water Resources and Waste Problems, Bruges, Belgium, September 1975
(G. C. Vansteenkiste, Ed.)
North-Holland, Amsterdam, 1976; 428 pp.

MINICOMPUTER SOFTWARE
Proceedings of the IFIP TC 2 Working Conference, Keszthely, Hungary, September 1975
(J. R. Bell, C. G. Bell, Eds.)
North-Holland, Amsterdam, 1976; out of print

MODELLING IN DATA BASE MANAGEMENT SYSTEMS
Proceedings of the IFIP TC 2 Working Conference, Freudenstadt, F.R.G., January 1976
(G. M. Nijssen, Ed.)
North-Holland, Amsterdam, 1976; 1st repr. 1978; out of print

CAD SYSTEMS
Proceedings of the IFIP TC 5 Working Conference on Computer-Aided Design Systems, Austin, Texas, U.S.A., February 1976
(J. J. Allan III, Ed.)
North-Holland, Amsterdam, 1977; out of print

METHODOLOGY IN COMPUTER GRAPHICS (SEILLAC I)
Proceedings of the IFIP WG 5.2 Workshop, Seillac, France, 1976
(R. A. Guedj, H. A. Tucker, Eds.)
North-Holland, Amsterdam, 1979; 218 pp.

DECISION MAKING AND MEDICAL CARE: CAN INFORMATION SCIENCE HELP?
Proceedings of the IFIP TC 4 Working Conference, Dijon, France, May 1976
(F. T. de Dombal, F. Grémy, Eds.)
North-Holland, Amsterdam, 1976; 622 pp.

REALIZATION OF DATA PROTECTION IN HEALTH INFORMATION SYSTEMS
Proceedings of the IFIP WG 4.2 Working Conference, Kiel, F.R.G., June 1976
(G. Griesser, Ed.)
North-Holland, Amsterdam, 1977; 230 pp.

SYSTEMS FOR LARGE DATA BASES
Proceedings of the 2nd International IFIP TC 2 Conference, Brussels, Belgium, September 1976
(P. C. Lockemann, E. J. Neuhold, Eds.)
North-Holland, Amsterdam, 1977; 1st repr. 1978; out of print

INFORMATION SYSTEMS FOR PATIENT CARE
Proceedings of the IFIP TC 4 Working Conference, Amsterdam, The Netherlands, October 1976
(J. van Egmond, P. F. de Vries Robbé, A. H. Levy, Eds.)
North-Holland, Amsterdam, 1976; 492 pp.

TRENDS IN COMPUTER-PROCESSED ELECTROCARDIOGRAMS
Proceedings of the IFIP TC 4 Working Conference, Amsterdam, The Netherlands, November 1976
(J. H. van Bemmel, J. L. Willems, Eds.)
North-Holland, Amsterdam, 1977; 450 pp.

ARCHITECTURE AND MODELS IN DATA BASE MANAGEMENT SYSTEMS
Proceedings of the IFIP TC 2 Working Conference on Modelling in Data Base Management Systems, Nice, France, January 1977
(G. M. Nijssen, Ed.)
North-Holland, Amsterdam, 1977; 1st repr. 1979; 334 pp.

EDUCATION AND LARGE INFORMATION SYSTEMS
Proceedings of the IFIP TC 3 and TC 8 Working Conference on The Educational Requirements introduced by Large Information Systems, The Hague, The Netherlands, April 1977
(R. A. Buckingham, Ed.)
North-Holland, Amsterdam, 1977; 214 pp.

COMPUTATIONAL LINGUISTICS IN MEDICINE
Proceedings of the IFIP TC 4 Working Conference, Uppsala, Sweden, May 1977
(W. Schneider, A. L. Sågvall Hein, Eds.)
North-Holland, Amsterdam, 1977; 194 pp.

CONSTRUCTING QUALTIY SOFTWARE
Proceedings of the IFIP TC 2 Working Conference, Novosibirsk, U.S.S.R., May 1977
(P. G. Hibbard, S. A. Schuman, Eds.)
North-Holland, Amsterdam, 1978; 1st repr. 1980; 530 pp.; out of print

FORMAL DESCRIPTION OF PROGRAMMING CONCEPTS
Proceedings of the IFIP TC 2 Working Conference, St. Andrews, N.B., Canada, August 1977
(E. J. Neuhold, Ed.)
North-Holland, Amsterdam, 1978; 666 pp.; out of print

COMPUTER PERFORMANCE
Proceedings of the IFIP WG 7.3 International Symposium on Computer Performance Modelling, Measurement and Evaluation, New York, U.S.A., August 1977
(K. M. Chandy, M. Reiser, Eds.)
North-Holland, Amsterdam, 1977; out of print

MODELLING, IDENTIFICATION AND CONTROL IN ENVIRONMENTAL SYSTEMS
Proceedings of the IFIP TC 7 Working Conference on Modelling and Simulation of Land, Air and Water Resources Systems, Ghent, Belgium, August/September 1977
(G. C. Vansteenkiste, Ed.)
North-Holland, Amsterdam, 1978; out of print

INFORMATICS AND MATHEMATICS IN SECONDARY SCHOOLS, IMPACTS AND RELATIONSHIPS
Proceedings of the IFIP TC 3 Working Conference, Varna, Bulgaria, September 1977
(D. C. Johnson, J. D. Tinsley, Eds.)
North-Holland, Amsterdam, 1978; 168 pp.

ARTIFICIAL INTELLIGENCE AND PATTERN RECOGNITION IN COMPUTER AIDED DESIGN
Proceedings of the IFIP WG 5.2 Working Conference, Grenoble, France, March 1978
(JC. Latombe, Ed.)
North-Holland, Amsterdam, 1978; 520 pp.; out of print

COMPUTER AID TO DRUG THERAPY AND TO DRUG MONITORING
Proceedings ot the IFIP TC 4 Working Conference, Berne, Switzerland, March 1978
(H. Ducrot, M. Goldberg, R. Hoigne, P. Middleton, Eds.)
North-Holland, Amsterdam, 1978; 460 pp.

COMPUTER AIDED TOMOGRAPHY AND UTLRASONICS IN MEDICINE
Proceedings of the IFIP TC 4 Working Conference, Haifa, Israel, August 1978
(J. Raviv, J. F. Greenleaf, G. T. Herman, Eds.)
North-Holland, Amsterdam, 1979; 330 pp.

PERFORMANCE EVALUATION OF NUMERICAL SOFTWARE
Proceedings of the IFIP WG 2.5 Working Conference, Baden, Austria, December 1978
(L. D. Fosdick, Ed.)
North-Holland, Amsterdam, 1979; 348 pp.

FLOW CONTROL IN COMPUTER NETWORKS
(Sponsored by IFIP TC 6). Proceedings of the International Symposium, Versailles, France, February 1979
(J. -L Grange, M. Gien, Eds.)
North-Holland, Amsterdam, 1979; 438 pp.

POST-SECONDARY AND VOCATIONAL EDUCATION IN DATA PROCESSING
Proceedings of the IFIP TC 3 Working Conference, Amsterdam, The Netherlands, April 1979
(H. L. W. Jackson, G. Wiechers, Eds.)
North-Holland, Amsterdam, 1979; 207 pp.

FORMAL MODELS AND PRACTICAL TOOLS FOR INFORMATION SYSTEMS DESIGN
Proceedings of the IFIP TC 8 Working Conference, Oxford, U.K., April 1979
(H. J. Schneider, Ed.)
North-Holland, Amsterdam, 1979; 306 pp.

HOSPITAL INFORMATION SYSTEMS: THE ART, PROBLEMS, AND PROSPECTS
Proceedings of the IFIP TC 4 Working Conference, Capetown, South Africa, April 1979
(R. H. Shannon, Ed.)
North-Holland, Amsterdam, 1979; 422 pp.

METHODOLOGY OF INTERACTION (SEILLAC II)
Proceedings of the IFIP WG 5.2. Workshop, Seillac, France, May 1979
(R. A. Guedj, P. J. W. ten Hagen, F. R. A. Hopgood, H. A. Tucker, D. A. Duce, Eds.)
North-Holland, Amsterdam, 1980; 409 pp.

EVALUATION OF EFFICACY OF MEDICAL ACTION
Proceedings of the IFIP TC 4 Working Conference, Bordeaux, France, May 1979
(A. Alperovitch, F. T. de Dombal, F. Grémy, Eds.)
North-Holland, Amsterdam, 1979; 550 pp.

HUMAN CHOICE AND COMPUTERS, 2
Proceedings of the Second IFIP TC 9 Conference, Baden, Austria, June 1979
(A. Mowshowitz, Ed.)
North-Holland, Amsterdam, 1980; 314 pp.

OPTIMIZATION OF COMPUTER ECG PROCESSING
Proceedings of the IFIP TC 4 Working Conference, Halifax, Canada, June 1979
(H. K. Wolf, P. Macfarlane, Eds.)
North-Holland, Amsterdam, 1980; 356 pp.

THE INFORMATION SYSTEMS ENVIRONMENT
Proceedings of the IFIP WG 8.2 Working Conference, Bonn, F. R. G., June 1979
(H. C. Lucas Jr., F. F. Land, T. J. Lincoln, K. Supper, Eds.)
North-Holland, Amsterdam, 1980; 366 pp.

DATA BASE ARCHITECTURE
Proceedings of the IFIP TC 2 Working Conference, Venice, Italy, June 1979
(G. Bracchi, G. M. Nijssen, Eds.)
North-Holland, Amsterdam, 1979; out of print

DATA BASES IN THE HUMANITIES AND SOCIAL SCIENCES
Proceedings of the IFIP Working Conference, Hanover NH, August 1979
(J. Raben, G. Marks, Eds.)
North-Holland, Amsterdam, 1980; 342 pp.

COMPUTER ASSISTED LEARNING
Proceedings of the IFIP TC 3 Working Conference, Roehampton, U.K., September 1979
(R. Lewis, E. D. Tagg, Eds.)
North-Holland, Amsterdam, 1980; out of print. Heinemann Computers in Education, London, soft-cover

COMMAND LANGUAGE DIRECTIONS
Proceedings of the IFIP WG 2.7 Working Conference, Berchtesgaden, F.R.G., September 1979
(D. Beech, Ed.)
North-Holland, Amsterdam, 1980; 432 pp.

INTEGRATED OFFICE SYSTEMS – BUROTICS
Proceedings of the IFIP TC 6 International Workshop, Versailles, France, November 1979
(N. Naffah, Ed.)
North-Holland, Amsterdam, 1980; 284 pp.

DATA COMMUNICATION AND COMPUTER NETWORKS
Proceedings of the IFIP TC 6/CSI Conference, Bombay, India, February 1980
(S. Ramani, Ed.)
North-Holland, Amsterdam, 1981; 318 pp.

MICROCOMPUTERS IN SECONDARY EDUCATION
Proceedings of the IFIP TC 3 Working Conference, Sèvres, France, April 1980
(E. D. Tagg, Ed.)
North-Holland, Amsterdam, 1980; 162 pp.

FIRMWARE, MICROCOMPUTING AND RESTRUCTABLE HARDWARE
Proceedings of the IFIP TC 2 and TC 10 Working Conference, Linz, Austria, April/May 1980
(G. Chroust, J. Mühlbacher, Eds.)
North-Holland, Amsterdam, 1980; 230 pp.

LOCAL NETWORKS FOR COMPUTER COMMUNICATIONS
Proceedings of the IFIP WG 6.4 International Workshop, Zürich, Switzerland, August 1980
(A. West, P. Janson, Eds.)
North-Holland, Amsterdam, 1981; 484 pp.

PRODUCTION MANAGEMENT SYSTEMS
Proceedings of the IFIP TC 5 International Workshop, Trondheim, Norway, September 1980
(P. Falster, A. Rolstadas, Eds.)
North-Holland, Amsterdam, 1981; 230 pp.

MAN-MACHINE COMMUNICATION IN CAD/CAM
Proceedings of the IFIP WG 5.2. and WG 5.3 Working Conference, Tokyo, Japan, October 1980
(T. Sata, E. A. Warman, Eds.)
North-Holland, Amsterdam, 1981; 216 pp.

COMPUTERS IN DEVELOPING NATIONS
Proceedings of the IFIP TC 9 International Seminar, Melbourne, Australia, October 1980
(J. M. Bennet, R. E. Kalman, Eds.)
North-Holland, Amsterdam, 1981; 286 pp.

COMPUTER MESSAGE SYSTEMS
Proceedings of the IFIP TC 6 International Symposium, Ottawa, Canada, April 1981
(R. Uhlig, Ed.)
North-Holland, Amsterdam, 1981; 476 pp.

NETWORKS FROM THE USER'S POINT OF VIEW
Proceedings of the IFIP TC 6 Working Conference – Comnet 81, Budapest, Hungary, May 1981
(L. Csaba, T. Szentiványi, K. Tarnay, Eds.)
North-Holland, Amsterdam, 1981; 650 pp.

TEACHING INFORMATICS COURSES
Proceedings of the IFIP WG 3.4 Working Conference, Vienna, Austria, July 1981
(H. L. W. Jackson, Ed.)
North-Holland, Amsterdam, 1982; 268 pp.

THE RELATIONSHIP BETWEEN NUMERICAL COMPUTATION AND PROGRAMMING LANGUAGES
Proceedings of the IFIP TC 2 Working Conference, Boulder, U.S.A., August 1981
(J. K. Reid, Ed.)
North-Holland, Amsterdam, 1982; 388 pp.

EVOLUTIONARY INFORMATION SYSTEMS
Proceedings of the IFIP TC 8 Working Conference, Budapest, Hungary, September 1981
(J. Hawgood, Ed.)
North-Holland, Amsterdam, 1982; 282 pp.

COMPUTER HARDWARE DESCRIPTION LANGUAGES AND THEIR APPLICATIONS
Proceedings of the IFIP TC 10 Working Conference, Kaiserslautern, F.R.G., September 1981
(M. Breuer, R. Hartenstein, Eds.)
North-Holland, Amsterdam, 1981; 362 pp.

FILE STRUCTURES AND DATA BASES FOR CAD
Proceedings of the IFIP WG 5.2 Working Conference, Seeheim, F.R.G., September 1981
(J. Encarnaçao, F. L. Krause, Eds.)
North-Holland, Amsterdam, 1982; 390 pp.

ENVIRONMENTAL SYSTEMS ANALYSIS AND MANAGEMENT
Proceedings of the IFIP WG 7.1 Working Conference, Rome, Italy, September 1981
(S. Rinaldi, Ed.)
North-Holland, Amsterdam, 1982; 840 pp.

ALGORITHMIC LANGUAGES
Proceedings of the IFIP TC 2 Symposium, Amsterdam, The Netherlands, October 1981
(J. W. de Bakker, J. C. van Vliet, Eds.)
North-Holland, Amsterdam, 1981; 458 pp.

CAD/CAM AS A BASIS FOR THE DEVELOPMENT OF TECHNOLOGY IN DEVELOPING NATIONS
Proceedings of the IFIP WG 5.2 Working Conference, Sao Paulo, Brazil, October 1981
(J. L. Encarnaçao, O. F. F. Torres, E. A. Warman, Eds.)
North-Holland, Amsterdam, 1981; 450 pp.

COMPUTER APPLICATIONS IN FOOD PRODUCTION AND AGRICULTURAL ENGINEERING
Proceedings of the IFIP TC 5 Working Conference, Havana, Cuba, October 1981
(R. E. Kalman, J. Martinez, Eds.)
North-Holland, Amsterdam, 1982; 346 pp.

AUTOMATED TOOLS FOR INFORMATION SYSTEMS DESIGN
Proceedings of the IFIP WG 8.1 Working Conference, New Orleans, U.S.A., January 1982
(H.-J. Schneider, A. I. Wasserman, Eds.)
North-Holland, Amsterdam, 1982; 283 pp.

INVOLVING MICROS IN EDUCATION
Proceedings of the IFIP TC 3 and Univ. of Lancaster Joint Working Conference, Lancaster, U.K., March 1982
(R. Lewis, E. D. Tagg, Eds.)
North-Holland, Amsterdam, 1982; 258 pp.

LOCAL COMPUTER NETWORKS
Proceedings of the IFIP TC 6 International In-Depth Symposium, Florence, Italy, April 1982
(P. C. Ravasio, G. Hopkins, N. Naffah, Eds.)
North-Holland, Amsterdam, 1982; 568 pp.

INFORMATION SYSTEMS DESIGN METHODOLOGIES, A Comparative Review.
Proceedings of the IFIP TC 8 Working Conference, Noordwijkerhout, The Netherlands, May 1982
(T. W. Olle, H. G. Sol, A. A. Verrijn Stuart, Eds.)
North-Holland, Amsterdam, 1982; 658 pp.

PROTOCOL SPECIFICATION, TESTING AND VERIFICATION
Proceedings of the IFIP WG 6.1 Second International Workshop, Idyllwild, Cal., U.S.A., May 1982
(C. Sunshine, Ed.)
North-Holland, Amsterdam, 1982; 581 pp.

CAD SYSTEM FRAMEWORK
Proceedings of the IFIP WG 5.2 Working Conference, Røros, Norway, June 1982
(K. Bö, F. Lillehagen, Eds.)
North-Holland, Amsterdam, 1983; 378 pp.

FORMAL DESCRIPTION OF PROGRAMMING LANGUAGES, II
Proceedings of the IFIP TC 2 Working Conference, Garmisch-Partenkirchen, F.R.G., June 1982
(D. Bjørner, Ed.)
North-Holland, Amsterdam, 1983; 468 pp.

MATHEMATICAL MODELING IN IMMUNOLOGY AND MEDICINE
Proceedings of the IFIP TC 7 Working Conference, Moscow, U.S.S.R., July 1982
(G. I. Marchuk, L. N. Belykh, Eds.)
North-Holland, Amsterdam, 1983; 406 pp.

PROCESSES AND TOOLS FOR DECISION SUPPORT
Proceedings of the IFIP WG 8.3 and IIASA Joint Working Conference, Schloss Laxenburg, Austria, July 1982
(H. G. Sol, Ed.)
North-Holland, Amsterdam, 1983; 268 pp.

ADVANCES IN PRODUCTION MANAGEMENT SYSTEMS
Proceedings of the IFIP WG 5.7 Working Conference, Bordeaux, France, August 1982
(G. Doumeingts, W. A. Carter, Eds.)
North-Holland, Amsterdam, 1984; 542 pp.

MODELLING AND DATA ANALYSIS IN BIOTECHNOLOGY AND MEDICAL ENGINEERING
Proceedings of the IFIP WG 7.1 Working Conference, Ghent, Belgium, August-September 1982
(G. C. Vansteenkiste, P. C. Young, Eds.)
North-Holland, Amsterdam, 1983; 398 pp.

SYSTEMS DESIGN FOR, WITH, AND BY THE USERS
Proceedings of the IFIP WG 9.1 Working Conference, Riva del Sole, Italy, September 1982
(U. Briefs, C. Ciborra, L. Schneider, Eds.)
North-Holland, Amsterdam, 1983; 470 pp.

THE IMPACT OF NEW TECHNOLOGIES ON INFORMATION SYSTEMS IN PUBLIC ADMINISTRATION IN THE 80's
Proceedings of the First IFIP Conference on Governmental and Municipal Data Processing, Vienna, Austria, February 1983
(H. Kraus, Ed.)
North-Holland, Amsterdam, 1983; 430 pp.

PROGRAMMING LANGUAGES AND SYSTEM DESIGN
Proceedings of the IFIP TC 2 Working Conference, Dresden. G.D.R., March 1983
(J. Bormann, Ed.)
North-Holland, Amsterdam, 1983; 260 pp.

COMPUTER APPLICATIONS IN PRODUCTION AND ENGINEERING, CAPE '83
Proceedings of the IFIP TC 5/FACE/IFORS International Conference, Amsterdam, The Netherlands, April 1983
(E. A. Warman, Ed.)
North-Holland, Amsterdam, 1983; 1174 pp.

SATELLITE AND COMPUTER COMMUNICATIONS
Proceedings of the IFIP TC 6/AFCET/SEE International Symposium, Versailles, France, April 1983
(J. L. Grangé, Ed.)
North-Holland, Amsterdam, 1983; 392 pp.

EDUCATION FOR SYSTEM DESIGNER/USER COOPERATION
Proceedings of the IFIP TC 3/TC 9 Working Conference, Salzburg, Austria, April 1983
(U. Briefs, E. D. Tagg, Eds.)
North-Holland, Amsterdam, 1985; 142 pp.

SYSTEM DESCRIPTION METHODOLOGIES
Proceedings of the IFIP TC 2 Working Conference, Kecskemet, Hungary, May 1983
(D. Teichroew, G. David, Eds.)
North-Holland, Amsterdam, 1985; 616 pp.

SECURITY, IFIP/Sec '83
Proceedings of the First IFIP Security Conference, Stockholm, Sweden, May 1983
(V. Fak, Ed.)
North-Holland, Amsterdam, 1983; 364 pp.

COMPUTER HARDWARE DESCRIPTION LANGUAGES AND THEIR APPLICATIONS
Proceedings of the IFIP WG 10.2 International Symposium, Pittsburgh, Pennsylvania, U.S.A., May 1983
(T. Uehara, M. Barbacci, Eds.)
North-Holland, Amsterdam, 1983; 254 pp.

PROTOCOL SPECIFICATION, TESTING AND VERIFICATION, III
Proceedings of the IFIP WG. 6.1 International Workshop, Rüschlikon, Switzerland, May-June 1983
(H. Rudin, C. H. West, Eds.)
North-Holland, Amsterdam, 1983; 544 pp.

INFORMATICS EDUCATION FOR ALL STUDENTS AT UNIVERSITY LEVEL
Proceedings of the IFIP WG 3.2 Working Conference, Delft, The Netherlands, June-July 1983
(F. B. Lovis, E. D. Tagg, Eds.)
North-Holland, Amsterdam, 1984; 238 pp.

INFORMATICS IN ELEMENTARY EDUCATION
Proceedings of the IFIP WG 3.1 Working Conference, Malente, F.R.G., July 1983
(J. D. Tinsley, E. D. Tagg, Eds.)
North-Holland, Amsterdam, 1984; 240 pp.

INFORMATION SYSTEMS DESIGN METHODOLOGIES, A Feature Analysis
Proceedings of the IFIP WG 8.1 Working Conference, York, U.K., July 1983
(T. W. Olle, H. G. Sol, C. J. Tully, Eds.)
North-Holland, Amsterdam, 1983; 276 pp.

BEYOND PRODUCTIVITY: INFORMATION SYSTEMS DEVELOPMENT FOR ORGANIZATIONAL EFFECTIVENESS
Proceedings of the IFIP WG 8.2 Working Conference, Minneapolis, Minnesota, U.S.A., August 1983
(Th. M. A. Bemelmans, Ed.)
North-Holland, Amsterdam, 1984; 454 pp.

VLSI '83
Proceedings of the IFIP TC 10/WG 10.5 International Conference, Trondheim, Norway, August 1983
(F. Anceau, E. J. Aas, Eds.)
North-Holland, Amsterdam, 1983; 496 pp.

PDE SOFTWARE: MODULES, INTERFACES AND SYSTEMS
Proceedings of the IFIP TC 2 Working Conference, Soderköping, Sweden, August 1983
(B. Engquist, T. Smedsaas, Eds.)
North-Holland, Amsterdam, 1984; 484 pp.

REGIONAL COMPUTER COOPERATION IN DEVELOPING COUNTRIES
Proceedings of the IFIP International Workshop, Stockholm, Sweden, September 1983
(R. E. Kalman, Ed.)
North-Holland, Amsterdam, 1984; 270 pp.

METHODOLOGIES FOR COMPUTER SYSTEM DESIGN
Proceedings of the IFIP WG 10.1 Working Conference, Lille, France, September 1983
(W. K. Giloi, B. D. Shriver, Eds.)
North-Holland, Amsterdam, 1985; 353 pp.

RING TECHNOLOGY LOCAL AREA NETWORKS
Proceedings of the IFIP WG 6.4 Workshop, Kent, U.K., September 1983
(I. N. Dallas, E. B. Spratt, Eds.)
North-Holland, Amsterdam, 1984; 280 pp.

PRODUCTION MANAGEMENT SYSTEMS: Strategies and Tools for Design
Proceedings of the IFIP WG 5.7 Working Conference, Vienna, Austria, September 1983
(H. Hübner, Ed.)
North-Holland, Amsterdam, 1984; 180 pp.

OPTIMIZATION IN COMPUTER-AIDED DESIGN
Proceedings of the IFIP WG 5.2 Working Conference, Lyon, France, October 1983
(J. S. Gero, Ed.)
North-Holland, Amsterdam, 1985; 382 pp.

INTEGRATION OF CAD/CAM
Proceedings of the IFIP WG 5.2/WG 5.3 Working Conference, Gaussig, G.D.R., November 1983
(D. Kochan, Ed.)
North-Holland, Amsterdam, 1984; 296 pp.

COMPUTER APPLICATIONS IN FOOD PRODUCTION AND AGRICULTURAL ENGINEERING – II
Proceedings of the IFIP TC 5 Working Conference, New Delhi, India, March 1984
(A. Balasubrahmanian, Ed.)
North-Holland, Amsterdam, 1985; 230 pp.

CONCURRENT LANGUAGES IN DISTRIBUTED SYSTEMS: HARDWARE SUPPORTED IMPLEMENTATION
Proceedings of the IFIP WG 10.3 Workshop, Bristol, U.K., March 1984
(G. L. Reijns, E. L. Dagless, Eds.)
North-Holland, Amsterdam, 1985; 172 pp.

PERFORMANCE OF COMPUTER-COMMUNICATIONS SYSTEMS
Proceedings of the IFIP WG 7.3/TC 6 Second International Symposium, Rüschlikon, Switzerland, March 1984
(W. Bux, H. Rudin, Eds.)
North-Holland, Amsterdam, 1984; 570 pp.

COMPUTER MESSAGE SERVICES
Proceedings of the IFIP WG 6.5 Working Conference, Nottingham, U.K., May 1984
(H. T. Smith, Ed.)
North-Holland, Amsterdam, 1984; 350 pp.

THE ROLE OF PROGRAMMING IN TEACHING INFORMATICS
Proceedings of the IFIP TC 3 Working Conference, Paris, France, May 1984
(M. Griffiths, E. D. Tagg, Eds.)
North-Holland, Amsterdam, 1985; 222 pp.

THE IMPACT OF INFORMATICS ON VOCATIONAL AND CONTINUING EDUCATION
Proceedings of the IFIP WG 3.4 Working Conference, Jerusalem, Israel, May 1984
(B.Z. Barta, B. H. Raab, Eds.)
North-Holland, Amsterdam, 1985; 240 pp.

COMPUTER COMMUNICATIONS – AFRICOM 84
Proceedings of the IFIP TC 6 First African Conference, Tunis, Tunisia, May 1984
(F. Kamoun, Ed.)
North-Holland, Amsterdam, 1985; 400 pp.

PROTOCOL SPECIFICATION TESTING AND VERIFICATION, IV
Proceedings of the IFIP WG 6.1 International Workshop, Skytop Lodge, Pennsylvania, U.S.A., June 1984
(Y. Yemini, R. Strom, S. Yemini, Eds.)
North-Holland, Amsterdam, 1985; 728 pp.

KNOWLEDGE REPRESENTATION FOR DECISION SUPPORT SYSTEMS
Proceedings of the IFIP WG 8.3 Working Conference, Durham, U.K., July 1984
(L. B. Methlie, R. Sprague, Eds.)
North-Holland, Amsterdam, 1985; 276 pp.

INFORMATICS AND TEACHER TRAINING
Proceedings of the IFIP WG 3.1 Working Conference, Birmingham, U.K., July 1984
(F. B. Lovis, E. D. Tagg, Eds.)
North-Holland, Amsterdam, 1984; 264 pp.

MODELLING PRODUCTION MANAGEMENT SYSTEMS
Proceedings of the IFIP WG 5.7 Working Conference, Copenhagen, Denmark, August 1984
(P. Falster, R. B. Mazumder, Eds.)
North-Holland, Amsterdam, 1985; 262 pp.

COMPUTER SECURITY: A GLOBAL CHALLENGE, IFIP/SEE '84
Proceedings of the Second IFIP Security Conference, Toronto, Ontario, Canada, September 1984
(J. H. Finch, E. G. Dougall, Eds.)
North-Holland, Amsterdam, 1985; 600 pp.

KNOWLEDGE ENGINEERING IN COMPUTER-AIDED DESIGN
Proceedings of the IFIP WG 5.2 Working Conference, Budapest, Hungary, September 1984
(J. S. Gero, Ed.)
North-Holland, Amsterdam, 1985; 434 pp.

WOMEN, WORK AND COMPUTERIZATION: OPPORTUNITIES AND DISADVANTAGES
Proceedings of the IFIP WG 9.1 Working Conference, Riva del Sole, Tuscany, Italy, September 1984
(A. Olerup, L. Schneider and E. Monod, Eds.)
North-Holland, Amsterdam, 1985; 380 pp.

NETWORKS IN OFFICE AUTOMATION
Proceedings of the IFIP TC 6 International In-Depth Symposium, Sofia, Bulgaria, September 1984
(K. L. Boyanov, Ed.)
North-Holland, Amsterdam, 1985; 292 pp.

CAN INFORMATION TECHNOLOGY RESULT IN BENEVOLENT BUREAUCRACIES?
Proceedings of the IFIP TC 9/WG 9.2 Working Conference, Namur, Belgium, January 1985
(L. Yngström, R. Sizer, J. Berleur, R. Laufer, Eds.)
North-Holland, Amsterdam, 1985; 250 pp.

DATABASE SEMANTICS (DS-1)
Proceedings of the IFIP WG 2.6 Working Conference, Hasselt, Belgium, January 1985
(T. B. Steel, Jr., R. Meersman, Eds.)
North-Holland, Amsterdam, 1986; 334 pp.

FORMAL MODELS IN PROGRAMMING
Proceedings of the IFIP TC 2 Working Conference, Vienna, Austria, January/February 1985
(E. J. Neuhold, G. Chroust, Eds.)
North-Holland, Amsterdam, 1985; 446 pp.

DECENTRALIZED PRODUCTION MANAGEMENT SYSTEMS
Proceedings of the IFIP WG 5.7 Working Conference, Munich, F.R.G., March 1985
(S. Augustin, R. Gündling, J. Ohanian, Eds.)
North-Holland, Amsterdam, 1985; 138 pp.

DATA COMMUNICATIONS IN THE ISDN ERA
Proceedings of the IFIP TC 6 International Conference, Tel-Aviv, Isreal, March 1985
(Y. Perry, Ed.)
North-Holland, Amsterdam, 1985; 195 pp.

INFORMATION SYSTEMS: THEORETICAL AND FORMAL ASPECTS
Proceedings of the IFIP WG 8.1 Working Conference, Sitges, Barcelona, Spain, April 1985
(A. Sernadas, J. Bubenko Jr., A. Olivé, Eds.)
North-Holland, Amsterdam, 1985; 246 pp.

PROTOCOL SPECIFICATION, TESTING AND VERIFICATION, V
Proceedings of the IFIP WG 6.1 International Workshop, Toulouse-Moissas, France, June 1985
(M. Diaz, Ed.)
North-Holland, Amsterdam, 1986; 556 pp.

CAD/CAM/CAE FOR INDUSTRIAL PROGRESS
Proceedings of the IFIP TC 5 International Conference, Bangalore, India, June 1985
(V. Rajaraman, Ed.)
North-Holland, Amsterdam, 1986; 308 pp.

FIFTH GENERATION COMPUTER ARCHITECTURES
Proceedings of the IFIP TC 10 Working Conference, Manchester, U.K., July 1985
(J. V. Woods, Ed.)
North-Holland, Amsterdam, 1986; 366 pp.

COMPUTER SECURITY, IFIP/Sec '85
Proceedings of the Third IFIP Security Conference, Dublin, Ireland, August 1985
(J. B. Grimson and H. J. Kugler, Eds.)
North-Holland, Amsterdam, 1985; 456 pp.

ADVANCES IN PRODUCTION MANAGEMENT SYSTEMS 85
Proceedings of the IFIP WG 5.7 Working Conference, Budapest, Hungary, August 1985
(E. Szelke, J. Browne, Eds.)
North-Holland, Amsterdam, 1986; 408 pp.

VLSI 85: VLSI DESIGN OF DIGITAL SYSTEMS
Proceedings of the IFIP TC 10/WG 10.5 International Conference, Tokyo, Japan, August 1985
(E. Hörbst, Ed.)
North-Holland, Amsterdam, 1986; 444 pp.

COMPUTER HARDWARE DESCRIPTION LANGUAGES AND THEIR APPLICATIONS
Proceedings of the IFIP WG 10.2 International Conference, Tokyo, Japan, August 1985
(C. J. Koomen, T. Moto-Oka, Eds.)
North-Holland, Amsterdam, 1985; 520 pp.

COMPARATIVE WORLDWIDE NATIONAL COMPUTER POLICIES
Proceedings of the Third IFIP TC 9 Conference, Stockholm, Sweden, September 1985
(H. Sackman, Ed.)
North-Holland, Amsterdam, 1986; approx. 460 pp.

COMPUTER MESSAGE SYSTEMS – 85
Proceedings of the IFIP TC 6 International Symposium, Washington, D.C., U.S.A., September 1985
(R. P. Uhlig, Ed.)
North-Holland, Amsterdam, 1986; 442 pp.

COMPUTER NETWORKING AND PERFORMANCE EVALUATION
Proceedings of the IFIP WG 7.3 International Seminar, Tokyo, Japan, September 1985
(T. Hasegawa. H. Takagi, Y. Takahashi, Eds.)
North-Holland, Amsterdam, 1986; 530 pp.

FOUNDATION FOR HUMAN-COMPUTER COMMUNICATION
Proceedings of the IFIP WG 2.6 Working Conference, Rome, Italy, September 1985
(K. Hopper, A. I. Newman, Eds.)
North-Holland, Amsterdam, 1986; approx 524 pp.

COMPUTER NETWORK USAGE: RECENT EXPERIENCES
Proceedings of the IFIP Working Conference, COMNET '85, Budapest, Hungary, October 1985
(L. Csaba, K. Tarnay, T. Szentiványi, Eds.)
North-Holland, Amsterdam, 1986; approx. 832 pp.

C (I) WORKING CONFERENCE PROCEEDINGS – SPRINGER

DISTRIBUTED PARAMETER SYSTEMS, MODELLING AND IDENTIFICATION
Proceedings of the IFIP TC 7 Working Conference, Rome, Italy, June 1976
(A. Ruberti, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vol. 1), 1978; 463 pp.

MODELLING AND OPTIMIZATION OF COMPLEX SYSTEMS
Proceedings of the IFIP TC 7 Working Conference, Novosibirsk, U.S.S.R., July 1978
(G. I. Marchuk, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vol. 18), 1979; 299 pp.

STOCHASTIC DIFFERENTIAL SYSTEMS
Proceedings of the IFIP WG 7.1 Working Conference, Vilnius, Lithuania, U.S.S.R., August 1978
(B. Grigelionis, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vol. 25), 1980; 372 pp.

GLOBAL MODELLING
Proceedings of the IFIP WG 7.1 Working Conference, Dubrovnik, Yugoslavia, September 1980
(S. Krcevinac, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vol.35), 1981; 243 pp.

STOCHASTIC DIFFERENTIAL SYSTEMS
Proceedings of the IFIP WG 7.1 Working Conference, Visegrád, Hungary, September 1980
(M. Arató, D. Vermes, A. V. Balakrishnan, Eds.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vol. 36), 1981; 256 pp.

ADVANCES IN FILTERING AND OPTIMAL STOCHASTIC CONTROL
Proceedings of the IFIP WG 7.1 Working Conference, Cocoyoc, Mexico, February 1982
(W. H. Fleming, L. G. Gorostiza, Eds.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vol. 42), 1982; 397 pp.

THEORY AND APPLICATION OF RANDOM FIELDS
Proceedings of the IFIP WG 7.1 Working Conference, Bangalore, India, January 1982
(G. Kallianpur, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vol. 49), 1983 ; 296 pp.

STOCHASTIC DIFFERENTIAL SYSTEMS
Proceedings of the Fourth IFIP WG 7.1 Working Conference, Marseille-Luminy, France, March 1984
(M. Metivier, E. Pardoux, Eds.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vol. 69), 1985; 319 pp.

D. PROCEEDINGS OF IFIP TC 7 CONFERENCES – SPRINGER

COLLOQUIUM ON METHODS OF OPTIMIZATION
Proceedings of the Second IFIP Conference on Methods of Optimization, Novosibirsk, U.S.S.R., 1968
(N. N. Moiseev, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Mathematics, Vol. 112), 1970; 293 pp.

SYMPOSIUM ON OPTIMIZATION
Proceedings of the Third IFIP Conference on Optimization, Nice, France, 1969
(A. V. Balakrishnan et al., Eds.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Mathematics, Vol. 132), 1970; 350 pp.

FIFTH CONFERENCE ON OPTIMIZATION TECHNIQUES
Rome, Italy, 1973 (R. Conti, A. Ruberti, Eds.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Computer Science, Vols. 3 + 4), 1973; Part 1, 565 pp., out of print; Part. 2, 389 pp.

OPTIMIZATION TECHNIQUES
Proceedings of the Sixth IFIP Conference on Optimization Techniques, Novosibirsk, U.S.S.R., 1974
(G. I. Marchuk, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Computer Science, Vol. 27), 1975;

OPTIMIZATION TECHNIQUES
Modelling and Optimization in the Service of Man. Proceedings of the Seventh IFIP Conference, Nice, France, September 1975
(J. Cea, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Computer Science, Vols. 40 + 41), 1976; Part 1, 854 pp. ; Part 2, 852 pp.

OPTIMIZATION TECHNIQUES
Proceedings of the Eighth IFIP Conference on Optimization Techniques, Würzburg, F.R.G., September 1977
(J. Stoer, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vols. 6 + 7), 1978; Part 1, 541 pp. ; Part 2, 525 pp.

OPTIMIZATION TECHNIQUES
Proceedings of the 9th IFIP Conference on Optimization Techniques, Warsaw, Poland, 1979
(K. Iracki, K. Malanowski, S. Walukiewicz, Eds.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vols. 22 + 23), 1980; Part 1, 585 pp. ; Part 2, 636 pp.

SYSTEM MODELLING AND OPTIMIZATION
Proceedings of the 10th IFIP Conference on Optimization Techniques, New York, U.S.A., August/September 1981
(R. F. Drenick, F. Kozin, Eds.)
Springer-Verlag, Berlin, Heidelberg, New York (Lecture Notes in Control and Information Sciences, Vol. 38), 1982; 904 pp.

SYSTEM MODELLING AND OPTIMIZATION
Proceedings of the 11th IFIP Conference on Optimization Techniques, Copenhagen, Denmark, July 1983
(P. Thoft-Christensen, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York, Tokyo (Lecture Notes in Control and Information Sciences, Vol. 59), 1984; 943 pp

SYSTEM MODELLING AND OPTIMIZATION
Proceedings of the 12th IFIP Conference on Optimization Techniques, Budapest, Hungary, September 1985
(A. Prékopa, B. Strazicky, J. Szelezsàn, Eds.)
Springer-Verlag, Berlin, Heidelberg, New York, Tokyo (Lecture Notes in Control and Information Sciences), in prep.

D (I) PROCEEDINGS OF OTHER CONFERENCES

THE SKYLINE OF INFORMATION PROCESSING
Proceedings of the 10th Anniversary Celebrations of the International Federation for Information Processing (IFIP), Amsterdam, The Netherlands, October 1970
(H. Zemanek, Ed.)
North-Holland, Amsterdam, 1972; out of print

SELECTED TOPICS IN INFORMATION PROCESSING IFIP-INFOPOL-1976
Proceedings of the International IFIP TC 7/INFOPOL Conference, Warsaw, Poland, March 1976
(J. Madey, Ed.)
North-Holland, Amsterdam, 1977; out of print

MODELLING AND PERFORMANCE EVALUATION OF COMPUTER SYSTEMS
Proceedings of the International Workshop, Ispra (Varesa), Italy, October 1976
(H. Beilner, E. Gelenbe, Eds.)
North-Holland, Amsterdam, 1977; 1st repr. 1978; 526 pp.

MEASURING, MODELLING AND EVALUATING COMPUTER SYSTEMS
Proceedings of the TC 7 Third International Symposium, Bonn, F.R.G., October 1977
(H. Beilner, E. Gelenbe, Eds.)
North-Holland, Amsterdam, 1977; 1st repr. 1980; 480 pp.

TELEINFORMATICS '79
(Sponsored by IFIP TC 6). Proceedings of the International Conference on Teleinformatics, Paris, France, June 1979
(E. J. Boutmy, A. Danthine, Eds.)
North-Holland, Amsterdam, 1979; out of print

REGIONAL COMPUTER COOPERATION IN DEVELOPING COUNTRIES
Proceedings of the IFIP International Workshop, Stockholm, Sweden, September 1983
(R. E. Kalman, Ed.)
North-Holland, Amsterdam, 1984; 270 pp.

HUMAN - COMPUTER INTERACTION – INTERACT '84
Proceedings of the IFIP Conference organised by the Task Group on Human-Computer Interaction – formerly IFIP WG 6.3, London, U.K., September 1984
(B. Shackel, Ed.)
North-Holland, Amsterdam, 1985; 998 pp.

D. (II) COLLECTED PAPERS

PROGRAMMING METHODOLOGY
A Collection of Articles by Members of IFIP WG 2.3
(D. Gries, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York, 1978; 451 pp.

COMPUTERIZATION AND WORK. A READER ON SOCIAL ASPECTS OF COMPUTERIZATION
A Collection of Articles by Members of IFIP WG 9.1
(U. Briefs, J. Kjaer, J. L. Rigal, Eds.)
Springer-Verlag, Berlin, Heidelberg, New York, Tokyo, 1985; 172 pp.

CAM: DEVELOPMENTS IN COMPUTER-INTEGRATED MANUFACTURING
(D. Kochan, Ed.)
Springer-Verlag, Berlin, Heidelberg, New York, Tokyo, 1986; 289 pp.

TRENDS IN INFORMATION SYSTEMS
An Anthology of Papers from Conferences of IFIP TC 8
(B. Langefors, A. A. Verrijn Stuart, G. Bracchi, Eds.)
North-Holland, Amsterdam, 1986; 486 pp.

A QUARTER CENTURY OF IFIP: The IFIP Silver Summary
Proceedings of the 25th Anniversary Celebration of IFIP, Munich, F.R.G., 27 March 1985
(H. Zemanek, Ed.)
North-Holland, Amsterdam, 1986; approx 500 pp.

E. JOINT CONFERENCE AND SYMPOSIA PUBLICATIONS

E (I) PROLAMAT CONFERENCES

NUMERICAL CONTROL PROGRAMMING LANGUAGES
Proceedings of the First International IFIP/IFAC PROLAMAT Conference, Rome, Italy 1969
(W. H. P. Leslie, Ed.)
North-Holland, Amsterdam, 1970; out of print

COMPUTER LANGUAGES FOR NUMERICAL CONTROL
Proceedings of the Second International IFIP/IFAC PROLAMAT Conference, Budapest, Hungary, 1983
(J. Hatvany, Ed.)
North-Holland, Amsterdam, 1973; out of print

ADVANCES IN COMPUTER-AIDED MANUFACTURE
Proceedings of the Third International IFIP/IFAC PROLAMAT Conference, Stirling, Scotland, June 1976
(D. McPherson, Ed.)
North-Holland, Amsterdam, 1977; out of print

ADVANCED MANUFACTURING TECHNOLOGY
Proceedings of the Fourth International IFIP/IFAC PROLAMAT Conference, Ann Arbor, Michigan, U.S.A., May 1979
(P. Blake, Ed.)
North-Holland, Amsterdam, 1980; 494 pp.

ADVANCES IN CAD/CAM
Proceedings of the Fifth International IFIP/IFAC PROLAMAT Conference, Leningrad, U.S.S.R., May 1982
(T. M. R. Ellis, O. I. Semenkov, Eds.)
North-Holland, Amsterdam, 1983; 738 pp.

SOFTWARE FOR DISCRETE MANUFACTURING
Proceedings of the Sixth International IFIP/IFAC PROLAMAT Conference, Paris, France, June 1985
(J. P. Crestin, J. F. McWaters, Eds.)
North-Holland, Amsterdam, 1986; 622 pp.

E (II) SHIPPING AND SHIPBUILDING SYMPOSIA

SHIP-OPERATION-AUTOMATION
(Computer Applications in Shipping and Shipbuilding – Vol. 1)
Proceedings of the IFAC/IFIP Symposium, Oslo, Norway, 1973
(Y. Fujita, K. Lind, T. J. Williams, Eds.)
North-Holland, Amsterdam, 1974; 1st repr. 1975; out of print

COMPUTER APPLICATIONS IN THE AUTOMATION OF SHIPYARD OPERATION AND SHIP DESIGN
(Computer Applications in Shipping and Shipbuilding – Vol. 2)
Proceedings of the IFIP/IFAC/JSNA Joint Conference, Tokyo, Japan, 1973
(Y. Fujita, K. Lind, T. J. Williams, Eds.)
North-Holland, Amsterdam, 1974; out of print

AUTOMATION IN OFFSHORE OIL FIELD OPERATIONS
(Computer Applications in Shipping and Shipbuilding – Vol. 3)
Proceedings of the IFAC/IFP Symposium, Bergen, Norway, June 1976
(F. L. Galtung, K. Røsandhaug, T. J. Williams, Eds.)
North-Holland, Amsterdam, 1976; out of print

COMPUTER APPLICATIONS IN THE AUTOMATION OF SHIPYARD OPERATION AND SHIP DESIGN II
(Computer Applications in Shipping and Shipbuilding – Vol. 4)
Proceedings of the IFIP/IFAC/SSI/City of Gothenburg Scandinavian Joint Conference, Gothenburg, Sweden, June 1976
(A. Jacobsson, F. Borgström, T. J. Williams, Eds.)
North-Holland, Amsterdam, 1976; out of print

SHIP OPERATION AUTOMATION II
(Computer Applications in Shipping and Shipbuilding – Vol. 5)
Proceedings of the IFAC/IFIP Symposium, Washington, D.C., U.S.A., August/September 1976
(M. Pitkin, J. J. Roche, T. J. Williams, Eds.)
North-Holland, Amsterdam, 1976; out of print

COMPUTER APPLICATIONS IN THE AUTOMATION OF SHIPYARD OPERATION AND SHIP DESIGN III
(Computer Applications in Shipping and Shipbuilding – Vol. 6)
Proceedings of the IFIP/IFAC Conference, University of Strathclyde, Glasgow, Scotland, June 1979
(C. Kuo, K. J. McCallum, T. J. Williams, Eds.)
North-Holland, Amsterdam, 1979; 430 pp.

SHIP OPERATION AUTOMATION III
(Computer Applications in Shipping and Shipbuilding – Vol. 7)
Proceedings of the IFIP/IFAC Symposium, Tokyo, Japan, November 1979
(J. Vlietstra, Ed.)
North-Holland, Amsterdam, 1980; 346 pp.

AUTOMATION FOR SAFETY IN SHIPPING AND OFFSHORE PETROLEUM OPERATIONS
(Computer Applications in Shipping and Shipbuilding – Vol. 8)
Proceedings of the IFIP/IFAC Symposium, Oslo, Norway, June 1980
(A. B. Aune, J. Vlietstra, Eds.)
North-Holland, Amsterdam, 1980; 486 pp.

COMPUTER APPLICATIONS IN THE AUTOMATION OF SHIPYARD OPERATION AND SHIPYARD DESIGN IV
(Computer Applications in Shipping and Shipbuilding – Vol. 9)
Proceedings of the IFIP/IFAC Conference, Annapolis, Maryland, U.S.A., June 1982
(D. F. Rogers, B. C. Nehrling, C. Kuo, Eds.)
North-Holland, Amsterdam, 1982; 368 pp.

SHIP OPERATION AUTOMATION IV
(Computer Applications in Shipping and Shipbuilding – Vol. 10)
Proceedings of the IFIP/IFAC Symposium, Genoa, Italy, September 1982
(E. Volta, Ed.)
North-Holland, Amsterdam, 1983; 332 pp.

COMPUTER APPLICATIONS IN THE AUTOMATION OF SHIPYARD OPERATION AND SHIP DESIGN V
(Computer Applications in Shipping and Shipbuilding – Vol. 11)
Proceedings of the IFIP/IFAC Conference, Trieste, Italy, September 1985
(P. Banda, C. Kuo, G. Di Filippo, Eds.)
North-Holland, Amsterdam, 1985; 470 pp.

AUTOMATION FOR SAFETY IN SHIPPING AND OFFSHORE PETROLEUM OPERATIONS
(Computer Applications in Shipping and Shipbuilding – Vol. 12)
Proceedings of the IFIP/IFAC Symposium, Trondheim, Norway, June 1985
(A. J. Thunem, C. Kuo, Eds.)
North-Holland, Amsterdam, 1986; in prep.

E (III) PROCESS CONTROL SYMPOSIA

DIGITAL COMPUTER APPLICATIONS TO PROCESS CONTROL
Proceedings of the First IFAC/IFIP Symposium, Stockholm, Sweden, 1964
(W. E. Miller, Ed.)
Instrument Society of America (ISA) 1965; 593 pp.

DIGITAL COMPUTER APPLICATIONS TO PROCESS CONTROL
Proceedings of the Second IFAC/IFIP Symposium, Menton, France, 1967
Instrument Society of America (ISA), 1969.

DIGITAL COMPUTER APPLICATIONS TO PROCESS CONTROL
3rd IFAC/IFIP Conference, Helsinki, Finland, 1971
Instrument Society of America (ISA), Pittsburgh, London, Tokyo, 1971.

DIGITAL COMPUTER APPLICATIONS TO PROCESS CONTROL
Proceedings of the 4th IFAC/IFIP Conference, Zürich, Switzerland, 1974

DIGITAL COMPUTER APPLICATIONS TO PROCESS CONTROL
Proceedings of the 5th IFAC/IFIP International Conference, The Hague, The Netherlands, June 1977
(H. R. van Nauta Lemke, H. B. Verbruggen, Eds.)
North-Holland, Amsterdam, 1977; out of print

E (IV) TRANSPORTATION SYSTEM SYMPOSIA

USE OF DIGITAL COMPUTERS FOR TRAFFIC CONTROL AND REGULATION
Preprints of the IFAC/IFIP Conference, Versailles, France, 1970
AFCET, c/o Mr. Boulanger, 9 booklets

TRAFFIC CONTROL AND TRANSPORTATION SYSTEMS
Proceedings of the Second IFAC/IFIP/IFORS Symposium, Monte Carlo, Monaco, 1974
(AFCET, Ed.)
North-Holland, Amsterdam, 1974; out of print

CONTROL IN TRANSPORTATION SYSTEMS
Proceedings of the 3rd IFAC/IFIP/IFORS Symposium, Columbus, Ohio, August 1976
Instrument Society of America (ISA).

E (V) OTHER JOINT CONFERENCES

MICROMINIATURISATION IN AUTOMATIC CONTROL EQUIPMENT AND IN DIGITAL COMPUTERS
Proceedings of the IFAC/IFIP Conference, Munich, F.R.G., 1965
(J. Berghammer, Ed.)
R. Oldenbourg, Munich, 1966; 822 pp.

MECHANIZED INFORMATION STORAGE, RETRIEVAL AND DISSEMINATION
Proceedings of the FID/IFIP Conference, Rome, Italy, 1967
(K. Samuelson, Ed.)
North-Holland, Amsterdam, 1968; out of print

DIGITAL CONTROL OF LARGE INDUSTRIAL SYSTEMS
IFAC/IFIP Symposium, Toronto, Canada, 1968

REGULATION AND CONTROL IN PHYSIOLOGICAL SYSTEMS
Proceedings of the IFAC/IFIP/IFORS Symposium, Rochester, N.Y., U.S.A., 1973
(Iberall, Guyton, Eds.)
Instruments Society of America (ISA), Pittsburgh, London, Tokyo, 1973.

PERFORMANCE OF COMPUTER SYSTEMS
Proceedings of the 4th International Symposium on Modelling and Performance Evaluation of Computer Systems, Vienna, Austria, February 1979
(M. Arato, A. Butrimenko, E. Gelenbe, Eds.)
North-Holland, Amsterdam, 1979; 576 pp.

F. PUBLICATIONS ON TERMINOLOGY

GUIDE TO CONCEPTS AND TERMS IN DATA PROCESSING
(I. H. Gould, Ed.)
North-Holland, Amsterdam

IFIP/ICC VOCABULARY OF INFORMATION PROCESSING
North-Holland, Amsterdam, 1966; out of print

IFIP FACHWÖRTERBUCH DER INFORMATIONSVERARBEITUNG
North-Holland, Amsterdam, 1968; out of print

IFIP-SACHWÖRTERBUCH DER DATENVERARBEITUNG
(I. H. Gould)
Teubner Verlagsges., Leipzig, 1977; 171 pp. Verlag Harri Deutsch, Thun und Frankfurt, 1977; 171 pp.

G. PUBLICATIONS ON ALGOL

REVISED REPORT ON THE ALGORITHMIC LANGUAGE ALGOL 60
(P. Naur, Ed.) In:
Numerische Mathematik 4 (1963), Communications of the ACM 6 (1963), The Computer Journal 5 (1963).

REPORT ON SUBSET ALGOL 60 IFIP. REPORT ON INPUT-OUTPUT PROCEDURES FOR ALGOL 60
In: Communications of the ACM 7 No 10, ALGOL Bulletin 16 (1964).

REPORT ON THE ALGORITHMIC LANGUAGE ALGOL 68
(A. van Wijngaarden, Ed.) In:
Mathematisch Centrum, Amsterdam, MR 101 (1969), Numerische Mathematik 14 (1969), Kibernetika (Akad. Nauk Ukr. S.S.R.) (1969/1970), Naukai Yzkustuo, Sofia (1971), Akademie-Verlag, Berlin (1972), Hermann, Paris (1972).

ALGOL 68 IMPLEMENTATION
(see under C: Working Conference Proceedings)

INFORMAL INTRODUCTION TO ALGOL 68
(C. H. Lindsey, S. G. van der Meulen, Eds.)
North-Holland, Amsterdam, Revised edition 1977, 370 pp.

ALGOL BULLETIN
(P. Naur, F. Duncan, C. H. Lindsey, Eds.)
Dr. C. H. Lindsey, Dept. of Computer Science, The University, Manchester M 13 9 PL, U.K.

REVISED REPORT ON THE ALGORITHMIC LANGUAGE ALGOL 68
(A. van Wijngaarden, et al., Eds.) In: Acta Informatica 5, pts 1, 2 + 3 (1975).

MODIFIED REPORT ON THE ALGORITHMIC LANGUAGE ALGOL 60
(R.M. De Morgan, I. D. Hill, B. A. Wichmann, Eds.) The Computer Journal, Vol. 19, No 4 (1976).

ALGOL 68
(J. Maluszynski, K. Piasecki, Eds.) Introduction to ALGOL 68 and Revised Report on it – in Polish
Wydawnictwa Naukowo-Techniczne, Warszawa 1980; 483 pp.

H. SPECIAL INTEREST GROUP PUBLICATIONS

IMIA PUBLICATIONS

– See Section B for «MEDINFO» World Conferences

• IFIP MEDICAL INFORMATICS MONOGRAPH SERIES

No 1 EDUCATION IN INFORMATICS OF HEALTH PERSONNEL
(J. Anderson, F. Grémy, J. C. Pagès, Eds.)
North-Holland, Amsterdam, 1974; out of print

No 2 HEALTH INFORMATICS CANADIAN EXPERIENCE
(J. F. Brandejs)
North-Holland, Amsterdam, 1976; out of print

• IMIA WORKING CONFERENCES

– See Section C for «TC 4» Working Conferences

THE COMPUTER IN THE DOCTOR'S OFFICE
Proceedings of the IMIA Working Conference, Hannover, F.R.G., April 1980
(O. Rienhoff, M. E. Abrams, Eds.)
North-Holland, Amsterdam, 1980; 372 pp.

CHANGES IN HEALTH CARE INSTRUMENTATION DUE TO MICROPROCESSOR TECHNOLOGY
Proceedings of the IMIA Working Conference, Rome, Italy, February 1980
(F. Pinciroli, J. Anderson, Eds.)
North-Holland, Amsterdam, 1981; 336 pp.

THE IMPACT OF COMPUTER TECHNOLOGY ON DRUG INFORMATION
Proceedings of the IMIA Working Conference, Uppsala, Sweden, October 1981
(P. Manell, S. G. Johansson, Eds.)
North-Holland, Amsterdam, 1982; 276 pp.

USES OF COMPUTERS IN AIDING THE DISABLED
Proceedings of the IMIA Working Conference, Haifa, Israel, November 1981
(J. Raviv, Ed.)
North-Holland, Amsterdam, 1982; 460 pp.

HEALTH INFORMATICS IN DEVELOPING COUNTRIES
Proceedings of the IMIA World Congress, Mexico City, Mexico, February 1982
(A. Fernandez Perez de Talens, E. Molino Ravetto, D. B. Shires, Eds.)
North-Holland, Amsterdam, 1983; 362 pp.

COMMUNICATION NETWORKS IN HEALTH CARE
Proceedings of the IMIA Working Conference, Ulvsunda Palace, Sweden, June 1982
(H. E. Peterson, A. I. Isaksson, Eds.)
North-Holland, Amsterdam, 1982; 380 pp.

DATA PROTECTION IN HEALTH INFORMATION SYSTEMS
Proceedings of the IMIA Working Conference, Kiel, F.R.G., September 1982
(G. Griesser, J. P. Jardel, D. J. Kenny, K. Sauter, Eds.)
North-Holland, Amsterdam, 1983; 264 pp.

THE IMPACT OF COMPUTERS ON NURSING
Proceedings of the IMIA Working Conference, Harrogate and London, U.K., September 1982
(M. Scholes, Y. Bryant, B. Barber, Eds.)
North-Holland, Amsterdam, 1983; 610 pp.

MEETING THE CHALLENGE: INFORTMATICS AND MEDICAL EDUCATION
Proceedings of the IMIA Working Conference, Chamonix, France, March 1983
(J.-C. Pagès, A. H. Levy, F. Grémy, J. Anderson, Eds.)
North-Holland, Amsterdam, 1983: 380 pp.

THE APPLICATIONS OF COMPUTERS IN CARDIOLOGY: STATE OF THE ART AND NEW PERSPECTIVES
Proceedings of the IMIA International Symposium, Menorca, Spain, May 1984
(G. Martin Quetglas, P. W. Macfarlane, A. Fernandez Perez de Talens and J. Cosin Aguilar, Eds.)
North-Holland, Amsterdam, 1984; 428 pp.

ROLE OF INFORMATICS IN HEALTH DATA CODING AND CLASSIFICATION SYSTEMS
Proceedings of the IMIA Working Conference, Citowa, Ontario, Canada, September 1984
(R. A. Côté, D. J. Protti, J. R. Scherrer, Eds.)
North-Holland, Amsterdam, 1985; 410 pp.

NURSING USES OF COMPUTERS AND INFORMATION SCIENCE
Proceedings of the IMIA International Symposium, Calgary, Alberta, Canada, May 1985
(K. J. Hannah, E. J. Guillemin, D. N. Conklin, Eds.)
North-Holland, Amsterdam, 1985; 390 pp.

COMPUTER ECG ANALYSIS: TOWARDS STANDARDIZATION
Proceedings of the IMIA Working Conference, Brussels, Belgium, June 1985
(J. L. Willems, J. H. van Bemmel, C. Zywietz, Eds.)
North-Holland, Amsterdam, 1985; 400 pp.

HUMAN-COMPUTER COMMUNICATIONS IN HEALTH CARE
Proceedings of the IMIA Second Stockholm Conference, Stockholm, Sweden, June 1985
(H. E. Peterson, W. Schneider, Eds.)
North-Holland, Amsterdam, 1986; 326 pp.

MEDICAL DECISION MAKING: DIAGNOSTIC STRATEGIES AND EXPERT SYSTEMS
Proceedings of the IMIA Working Conference, Prague, Czechoslovakia, Sept./Oct. 1985
(J. H. Van Bemmel, F. Grémy, J. Zvarova, Eds.)
North-Holland, Amsterdam, 1985; 402 pp.

• OTHER IMIA PUBLICATIONS

DATA PROTECTION IN HEALTH INFORMATION SYSTEMS, CONSIDERATIONS AND GUIDELINES
Edited on behalf of IMIA WG 4
(G. Griesser, A. Bakker, J. Danielsson, J. C. Hirel, D. J. Kenny, W. Schneider, A. I. Wassermann, Eds.)
North-Holland, Amsterdam, 1980; 244 pp.

I. SPECIAL PUBLICATIONS

COMPUTER EDUCATION FOR TEACHERS IN SECONDARY SCHOOLS
Aims and Objectives in Teacher Training 1972 – prepared by IFIP Working Group 3.1 with the co-operation of OECD and the help of invited participants.
* Copies may be obtained from: 1. IFIP Secretariat, Geneva, 2. The British Computer Society, 3. AFIPS Headquarters

PREPARATION DES ENSEIGNANTS DES ECOLES SECONDAIRES A L'INFORMATIQUE
French translation of «Computer Education for Teachers in Secondary Schools, An Outline Guide»
(Groupe Romand pour l'Etude des Techniques d'Instruction et B. Levrat, Eds.)
Université de Genève, 1211 Genève 4

USE OF THE COMPUTER IN TEACHING AND LEARNING
1974 – prepared by IFIP WG 3.3
Copies may be obtained from: 1. IFIP Secretariat, Geneva, 2. The British Computer Society,
* 3. AFIPS Headquarters

AN INTERNATIONAL CURRICULUM FOR INFORMATION SYSTEM DESIGNERS
IFIP TC 3
(J. N. G. Brittan, Ed.)
IBI, 1974

ELEMENTS OF INFORMATION AND INFORMATION PROCESSING FOR TEACHERS IN SECONDARY SCHOOLS
1977 – prepared by IFIP WG 3.1
* Copies may be obtained from: 1. CITEMA, Pza del Conde de Valle de Suchii 8, Madrid, Spain, 2. IFIP Secretariat, Geneva, 3. The British Computer Society

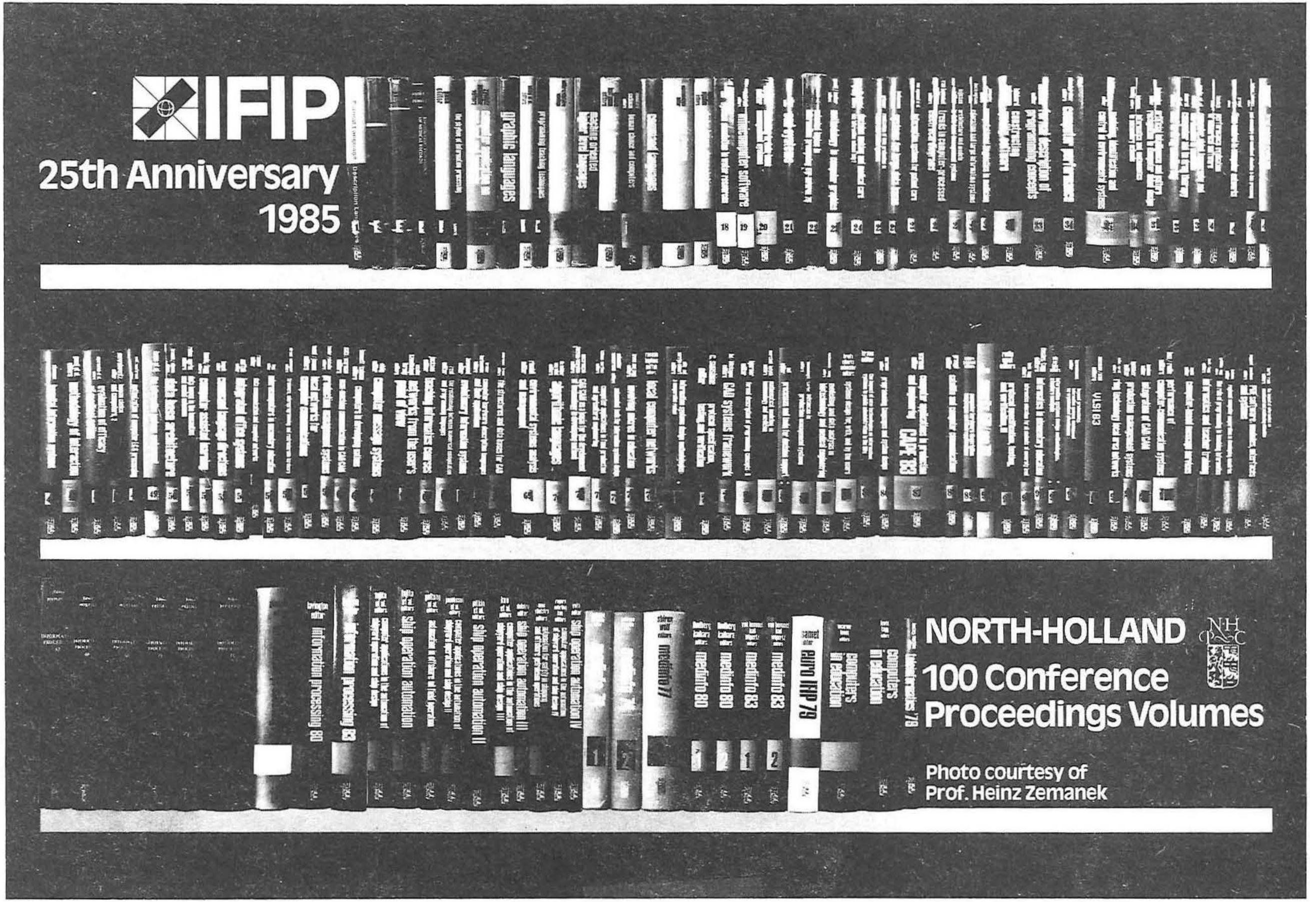
COMPUTER EDUCATION FOR TEACHERS IN SECONDARY SCHOOLS – ANALYSIS AND ALGORITHMS
1977 – prepared by IFIP WG 3.1
* Copies may be obtained from: 1. IFIP Secretariat, Geneva, 2. The British Computer Society, 3. AFIPS Headquarters

M.O.L. BULLETIN Nb 4
Proceedings of the First Meeting of the WG on Machine Oriented Higher Level Languages WG 2.4
(J. D. Ichbiah, P. M. Cousot, Eds.)
IRIA, 1974

M.O.L. BULLETIN Nb 7
Bulletin of the WG on Machine Oriented Higher Level Languages WG 2.4
(P. Cousot, Ed.)
IRIA, 1977

GLOSSARY OF TERMS IN TECHNICAL DIAGNOSTICS
IMEKO, 1979

* **Direct enquiries to: IFIP Secretariat, Geneva.**


IFIP
25th Anniversary
1985
NORTH-HOLLAND
100 Conference
Proceedings Volumes
Photo courtesy of
Prof. Heinz Zemanek

PEOPLE

The distinction for services rendered to IFIP shall be the

SILVER CORE

It shall begranted by the IFIP General Assembly, on recommendation of the Awards Committee, conforming to the rules defined below.
In exceptional cases, the IFIP President may propose candidates to the General Assembly without adherence to the rules.

Eligible for nomination are all those living persons who have served during a period of six years or more, and have been present at no less than 50% of the meetings, in the following positions or any equivalent

- General Assembly Member or Member of an IFIP Standing Committee,
- Chairman (and since 1975 also Vice-Chairman or Secretary) of a Technical Committee or Working Group;

eligible after having completed their work are the

- Chairman of the Programme Committee of an IFIP Congress and the
- Editor of the Proceedings of an IFIP Congress;

eligible are those who have served two times as

- Member of the Programme Committee of an IFIP Congress or as
- Chairman of the Organization Committee of an IFIP Congress;

eligible are Editors of two (or more) volumes of
IFIP Working Conference Proceedings and equivalent publications
(if there is more than one editor, the shares are counted).

Combinations of the above conditions as determined by the IFIP President.

(This formulation of the rules is a slightly simplified version of the ones in the IFIP Standing Orders which need reshaping.)

IFIP SILVER CORE HOLDERS BY THE YEAR

1974

W.F. ATCHISON (US)
I.L. AUERBACH (US)
F.L. BAUER (D)
N.I. BECH (DK)
R.A. BUCKINGHAM (GB)
J. CARTERON (F)
D. CHEVION (IL)
A.A. DORODNICYN (SU)
S.D. DUYVERMAN (NL)
H. FREEMAN (US)
F. GENUYS (F)
S. GILL (GB)
V. GLUSHKOV (SU)
C.C. GOTLIEB (CDN)
E. GOTO (J)
I.H. GOULD (GB)
F. GREMY (F)
E.L. HARDER (US)
Th. HERBORG-NIELSEN (DK)
A.S. HOUSEHOLDER (US)
J.N.P. HUME (CDN)
L. ILIEV (BG)
I. KADAR (H)
D. KRONEBERG (D)
P. LAASONEN (SF)
B. LANGEFORS (S)
M. LINSMAN (B)
L. LUKASZEWICZ (PL)
W.L. van der POEL (NL)
M. PAUL (D)
J.E.L. PECK (CDN)
J.G. SANTESMASES (E)
S. SEM-SANDBERG (S)
A.P. SPEISER (CH)
T.B. STEEL Jr (US)
W.M. TURSKI (PL)
A. van WIJNGAARDEN (NL)
M.V. WILKES (GB)
M. WOODGER (GB)
H. YAMASHITA (J)

1977

A.V. BALAKRISHNAN (US)
J.M. BENNETT (AUS)
P.A. BOBILLIER (CH)
Sylvia CHARP (US)
P.J. DIXON (CDN)
A.S. DOUGLAS (GB)
J.M. FORSYTHE (GB)
J. HATVANY (H)
N.J. LEHMANN (DDR)
C.H. LINDSEY (GB)
D.I. PLANDER (CS)
Ph. RENARD (F)
J.L. ROSENFELD (US)
Bl. SENDOV (BG)
Yu.D. SHMYGLEVSKY (SU)
R.I. TANAKA (US)
J. TUORI (SF)
G.C. VANSTEENKISTE (B)
J. VLIETSTRA (NL)
T.J. WILLIAMS (US)
H. ZEMANEK (A)

1979

J. van EGMOND (B)

1980

J.J. ALLAN III (US)
J. ANDERSON
G.N. BOYD (CDN)
M.A. ECED S. (E)
A.P. ERSHOV (SU)
E. FREDRIKSSON (NL)
E. GELENBE (F)
B. GILCHRIST (US)
R. GLOWINSKI (US)
G. GRIESSER (US)
L. GVOZDJAK (CS)
J. HEBENSTREIT (F)
W.J. KARPLUS (US)
H. KEILHAU (N)
H. KOBAYASHI (US)
S.H. LAVINGTON (GB)
K. LIND
J.L. LIONS (F)
Ria LUCAS (IAG Secr)
J.Y.S. LUH (US)
G.I. MARCHUK (SU)
D. McPHERSON
R. NARASIMHAN (IND)
E.J. NEUHOLD (A)
G.M. NIJSSEN
R. PILOTY (D)
G.C. ROBERTS Secr
J. ROUKENS (B)
K. SAMELSON (D)
H.-J. SCHNEIDER
F.H. SUMNER (GB)
Ch. ZYWIETZ

1981

D.H. WOLBERS (NL)

1983

K. ANDO (J)
D. ASPINALL (
Ö. BJÖRKE
E.K. BLUM
P. FALSTER
F.R. HERTWECK
U. HERZOG (D)
R. KLING
D. KOCHAN (DDR)
B. LEVRAT (CH)
R.E.J. LEWIS
F.B. LOVIS
F. MARGULIES (A)
R.E.A. MASON
G.J. MORRIS (GB)
N. NAFFAH (F)
J.E.D. NAVEZ (B)
T.W. OLLE
R.A. POCKOCK
L. POUZIN
A. PREGITZER
J. RAVIV (IL)
P.G. RAYMONT (F)
A. ROLSTADAS (N)
G. SACERDOTI (I)
D.B. SHIRES (US)
J. STOER (D)
T. SZENTIVANYI (H)
E.D. TAGG
D.C. TSICHRITZIS (US)
R.P. UHLIG
A.A. VERRIJN-STUART (NL)
P. VODA
E.A. WARMAN
O. ZICH (A)

A LITTLE JOKE

Meetings sometimes are redundant. So the participant has time to doodle or to play combinatorial games with words. Here is one - who finds himself?

IFOMITTEE FOR GENERASSEMBLYFFICIENCY

Members:

Prof. GOTOURINARDARASIMSARHANAKRISHNACERDOTILIEWOLBENSTREIYESIMIAUOEZENDIN
Acad. GLUSHKOMORRISPECKPAULANGEFARTERONAUROUKENSCOULAARSONEZNIKARACCIOLO
Prof. vanderVEER&POELIETSTRANAKAILHAUERBECHOBILLIERNASCOPILOTYLEHMANDORODNYZICHEVION
Mr. GOULDOBREWIJNGAARDIXONATVANYAMAISHITURSKRONEBAUERSHOWALKOTLIEBOUZINTZOFFEMAN
Acad. FREEMARTINGEZAMELSENDOWILKESTEELUHFINCHENUYSACKMANDERSONTESMASHMYGLEVSKY
Dr. BOYDOUGLAVOSDJAKADHARDERBORGNIELSEMSANDBERGERCOLINSMANUJEDKOVACSURSKI
Prof. BENNAVEZMANECARVALHUKASZEWILLIAMENTALECHKOVARCHANDPOTTLEROUXONTINENDIN
Prof. GUOLDSWORTHERRIJNSTUORTAENGLASERAVIVAGLUNDALTONDOGRIABOUDMOKHTABRAUERKNECHT

IFIP SILVER CORE HOLDERS AND GENERAL ASSEMBLY MEMBERS 1960 TO 1985

	H. ABOUD	(IQ)	GA
	T. ALEKSIC	(YU)	GA
SC80	J.J. ALLAN III	(US)	WG5.2
	R. ALVAREZ-MARCER	(C)	GA
	H.E. ANDERSIN	(SF)	GA
SC80	J. ANDERSON		WG4.1
SC83	K. ANDO	(J)	PE,P,PP 82-87 VP 78-82 T 77-78
	J. ANDRADE	(BR)	GA
SC83	D. ASPINALL		TC10
SC74	W.F. ATCHISON	(US)	TC3
SC74	I.L. AUERBACH	(US)	HM 70 IM 64-70 P 60-65
SC77	A.V. BALAKRISHNAN		TC7
	A. BALASUBRAHMANIAN	(IND)	GA
	J.R. BASSO-DASTUGUE	(RA)	GA
SC74	F.L. BAUER	(D)	GA TC2
	K. BAUKNECHT	(CH)	GA
SC74	N.I. BECH	(DK)	IM 70-73 T 65-70
	S.F. BELTRAN	(MEX)	T 65-71
	R. BENMOKHTAR	(MA)	GA
SC77	J.M. BENNETT	(AUS)	VP 75-78 T 74-75
SC83	Ö. BJÖRKE		WG5.3
SC83	E.K. BLUM		WG2.2
SC77	P.A. BOBILLIER	(CH)	PE,P,PP 76-84 SEC 69-75 T 75-76
SC80	G.N. BOYD	(CDN)	T 75-80
	W. BRAUER	(D)	GA TC3
	J. BROSVEET	IASC	
SC74	R.A. BUCKINGHAM		TC3
SC74	J. CARTERON	(F)	ST 65-69 T 69-70
SC77	Sylvia CHARP		TC3
SC74	D. CHEVION	(IL)	VP 67-70 T 65-67,70-73 IM 78-81
	H.R. CIANCAGLINI	(RA)	GA
	L.J. COHN	(AUS)	GA
	S. COMET	(S)	GA PC
	B.R. COX	(NZ)	GA
	L. DADDA	(I)	GA
	O.M. DALTON	(IRL)	TR 81-87
	Y. DEGAWA	(J)	GA
	J.F. DEMPSEY	(IRL)	GA
SC77	P.J. DIXON		IAG PC
SC74	A.A. DORODNICYN	(SU)	PE,P,PP 67-72 VP 77-80 T 65-67,73-77,80-87
SC77	A.S. DOUGLAS	(GB)	VP 71-75 T 70-71,75-77 ICCC
	J. DURAN-R.	(RCH)	GA
SC74	S.D. DUYVERMAN	IAG Founding Chairman T 71-74	
SC79p	J. van EGMOND		TC4
SC80	M.A. ECED-S.	(E)	GA
SC80	A.P. ERSHOV		PC
SC83	P. FALSTER		WG5.7
	J.H. FINCH	(CDN)	T 80-86
SC74	J.M. FORSYTHE		TC4
	J. FOUROT	(F)	SEC 81-87
SC80	E. FREDRIKSSON		Publ Comm - North Holland Publ Co
SC74	H. FREEMAN	(US)	PC IAPR
	N. FRIEDMANN	(RCH)	GA
	J.V. GARWICK	(N)	GA
SC80	E. GELENBE		WG7.3
SC74	F. GENUYS	(F)	PC
	A. GHIZZETTI	(I)	GA PC

SC80	B.	GILCHRIST	(US)	PC
SC74	S.	GILL	(GB)	GA
	G.	GLASER	(US)	VP 82-88 T 81-82
SC80	R.	GLOWINSKI		WG7.2
SC74	V.M.	GLUSHKOV		PC
	A.W.	GOLDSWORTHY	(AUS)	PE,P,PP 85-90 VP 83-85 T 80-83
SC74	C.C.	GOTLIEB	(CDN)	GA PC
SC74	E.	GOTO	(J)	VP 71-74 T 70-71,74-75
	M.	GOTO	(J)	GA
SC74	I.H.	GOULD		TC1
SC74	F.	GREMY		TC4
	Ms F.	GRIBAA	(TN)	GA
SC80	G.	GRIESSER		WG4.4 Ed
	P.X.	GUO	(PRC)	T 82-88
SC80	L.	GVOSDJAK	(CS)	GA
	H.	HAGLUND	(SF)	GA
SC74	E.L.	HARDER	(US)	TR 69-72 IM 69-72
SC77	J.	HATVANY		TC5
SC80	J.	HEBENSTREIT		TC3 PC
	D.S.	HENDERSON	(ZA)	GA WG2.3
SC74	Th.	HERBORG-NIELSEN	(DK)	GA
	K.	HERNAES	(S)	TR 79-81
SC83	F.R.	HERTWECK		WG2.7
SC83	U.	HERZOG		WG7.3
	A.S.	HOAGLAND	(US)	GA
SC74	A.S.	HOUSEHOLDER		PC
	T.E.	HULL	(CDN)	T 68-70
SC74	JNP.	HUME	(CDN)	GA
	R.	IAU	(SEARCC)	GA
SC74	L.	ILIEV	(BG)	VP 74-77 T 72-74,78-81
SC74	I.	KADAR	(H)	GA IAG
	R.E.	KALMAN	(H)	GA UNESCO
	F.	KAMOUN	(TN)	GA
SC80	W.J.	KARPLUS		WG7.1
SC80	H.	KEILHAU	(N)	SEC 75-78 T 74-75
SC83	R.	KLING		WG9.2
SC80	H.	KOBAYASHI		WG7.3
SC83	D.	KOCHAN		WG5.3
	N.	KONISHI	(BR)	GA
	K.	KONTINEN	(SF)	GA
	W.	KOSCHNITZKI	(BR)	GA
	P.	KOVACS	(H)	GA
SC74	D.	KRONEBERG		Publ Comm
	G.	KRUISMAN	FACE	
	J.	KRYZE	(CS)	GA PC
SC74	P.	LAASONEN	(SF)	GA PC
	E.	LANDIM	(BR)	GA
SC74	B.	LANGEFORS	(S)	GA PC
SC80	S.H.	LAVINGTON		ED
	B.C.	LEE	(K)	GA
SC77	N.J.	LEHMANN	(DDR)	VP 80-83 T 76-79
	H.W.	LE ROUX	(ZA)	T 84-87
SC83	B.	LEVRAT		Ed TC3
SC83	REJ.	LEWIS		WG3.3
SC80	K.	LIND		WG5.6
SC77	C.H.	LINDSEY		Ed
SC74	M.	LINSMAN	(B)	ASEC 62-69
SC80	J.L.	LIONS		WG7.2 PC Ed
	O.	LONGE	(WAN)	T 83-84
SC83	F.B.	LOVIS		WG3.1
	H.C.	LUCAS Jr		WG8.2

SC80	Ria	LUCAS		SEC IAG
SC80	JYS.	LUH		TC5 WG5.1
SC74	L.	LUKASZEWICZ	(PL)	VP 65-68 PC
	E.G.	deMANUEL	(BR)	GA
	A.M.G.	MARCHAND	(IRL)	GA
SC80	G.I.	MARCHUK		Ed
SC83	F.	MARGULIES		TC9
SC83	REA.	MASON		TC2 Ed
	J.	MARTINEZ-MARTINEZ	(C)	GA
	V.	MARTING	(ZA)	GA
	F.Q.	MATTOSO	(BR)	GA
SC80	D.	McPHERSON		WG5.3 Ed
	R.J.	McQUAKER		IAG
	A.	MELBYE	(DK)	T 80-88
	Y.	MENTALECHETA	(DZ)	T 71-75
	M.	MILCHBERG	(RA)	GA
	R.	MORENO-DIAZ	(E)	T 71-74
SC83	G.J.	MORRIS	(GB)	VP 85-88 T 77-85
	M.B.	MOUNAJED	(SYR)	GA
	M.E.	MULLER	IASC	
SC83	N.	NAFFAH		Ed PC
SC80	R.	NARASIMHAN	(IND)	IM 83-87 T 75-83
SC83	JED.	NAVEZ	(B)	T 76-78 Conference Officer
SC80	E.J.	NEUHOLD		WG2.2 Ed
SC80	G.M.	NIJSSEN		WG2.6 Ed
	O.	OLIVEIRA	(C)	GA
	R.C.	de OLIVEIRA	(BR)	T 75-81
SC83	T.W.	OLLE		TC8 Ed
	T.	ONIGA	(BR)	GA
	S.A.	ØVERGAARD	(N)	GA
	K.T.	PARK	(K)	GA
	J.R.	PASTA	(US)	GA PC
SC74	M.	PAUL		TC2
SC74	JEL.	PECK		TC2
	L.	PENEDO	(P)	T 83-87
	H.	PETERSON	IMIA	
SC80	R.	PILOTY	(D)	VP 80-84 T 77-80
SC77	D.I.	PLANDER	(CS)	T 68-72
SC83	Ros.	POCKOCK		TC2 WG2.7
SC74	W.L.	van der POEL	(NL)	GA WG2.1
	R.	PORTAENCASA	(E)	GA
	C.J.	POTTER	(NZ)	GA
SC83	Agn.	PREGITZER		WG5.2
	C.E.	QUIST	(GH)	GA
	M.	RABIN	(IL)	GA
	R.G.	RADÜNZ	(BR)	GA
SC83	J.	RAVIV	(IL)	GA
SC83	P.G.	RAYMONT		WG3.4
SC77	Ph.	RENARD	(F)	VP 73-79 T 79-80
	D.	RIBBENS	(B)	GA
SC80	G.C.	(Gwyneth) ROBERTS		IFIP Admin Manager
SC83	A.	ROLSTADAS	(N)	GA TC5
SC77	J.L.	ROSENFELD		IFIP Newsletter Editor Ed
SC80	J.	ROUKENS	IMIA	TC4
SC83	G.	SACERDOTI	(I)	T 83-87
SC80p	K.	SAMELSON	(D)	GA PC
SC74	J.G.	SANTESMASES	(E)	T 65-67
	A.E.	SARHAN	(ET)	GA
SC80	H.J.	SCHNEIDER		WG8.1 Ed
	T.A.	SCOULAR	(NZ)	GA

SC74	S.	SEM-SANDBERG	(S)	VP 70-73 T 73-75
	J.J.	SENDIN	(E)	GA
SC77	Bl.	SENDOV	(BG)	VP 84-87 T 83-84
SC83	D.B.	SHIRES	IMIA	
SC77	Yu.D.	SHMYGLEVSKY		PC
	E.H.	SIBLEY	IAG	
	A.J.	SIMOEZ-MONTEIRO	(P)	GA
	A.	van der SLUIS	(NL)	GA
	A.	SÖLVBERG	(N)	GA WG8.1
SC74	A.P.	SPEISER	(CH)	P,PP 65-69 IM 67-70
SC74	T.B.	STEEL Jr		TC2 Ed
SC83	J.	STOER		TC7
SC80	F.H.	SUMNER		PC
SC83	E.D.	TAGG		Ed
SC77	R.I.	TANAKA	(US)	HM 79 PE,P,PP 73-78 T 70-73
	L.R.	THOMPSON	EUROMICRO	
	J.	TIBERGHIEN	EUROMICRO	
	R.	TOMOVIC	(YU)	GA
	B.	TRAPEZANOGLOU	(GR)	GA
SC83	D.C.	TSICHRITZIS		PC
SC77	J.	TUORI	(SF)	VP 79-80 TR 72-79
SC74	W.M.	TURSKI		WG2.1 PC Ed
SC83	R.P.	UHLIG		WG6.5
SC77	G.C.	VANSTEENKISTE		Ed
	G.	van der VEER	(ZA)	GA TC6
	P.K.	VERMA	ICCC	
SC83	A.A.	VERRIJN-STUART	(NL)	T 85-88 TC8
SC77	J.	VLIETSTRA		TC5 PC
SC83	P.	VODA		WG2.4
	D.E.	WALKER	IJCAII	
SC83	E.A.	WARMAN		TC5 Ed
	A.	WALTHER	(D)	VP 60-62 PC
SC74	A.	van WIJNGAARDEN	(NL)	VP 62-65 T 67-70 TC1
SC74	M.V.	WILKES	(GB)	GA PC
SC77	T.J.	WILLIAMS		TC5
SC81	D.H.	WOLBERS		TC3
SC74	M.	WOODGER		TC2 PC
SC74	Y.	YAMASHITA	(J)	T 67-68
	N.	YAMAUTI	(J)	GA
	P.A.	ZELEZNIKAR	(YU)	GA
SC77	H.	ZEMANEK	(A)	HM 77 PE,P,PP 70-75 T 67-68
SC83	O.	ZICH	(A)	SEC 78-81
SC80	Chr.	ZYWIETZ		WG4.3 Ed

CONGRESS PROGRAMME COMMITTEE MEMBERS 1959–1986

	S.N. ALEXANDER	59
	H.E. ANDERSIN	80
	J. ARSAC	83
SC74	I.L. AUERBACH	59
SC74	F.L. BAUER	62
SC74	N.I. BECH	Chm 62
	C. BERTHET	8o
	D. BJÖRNER	83, Chm 86
	L. BOLLIET	77
	W. BUCHHOLZ	71
	G. CAPRIZ	83
SC74	J. CARTERON	59, 62
	J. COALES	59
	S. COMET	59
	A. DANTHINE	86
	P. DEUSSEN	80
SC77	P.J. DIXON	77
	B. DÖMÖLKI	86
SC74	A.A. DORODNICYN	62
	Ph. DREYFUS	59
	E. DURAND	59
SC80	A.P. ERSHOV	68,VChm 80
	G. ESTRIN	68
	E.A. FEIGENBAUM	71
SC74	H. FREEMAN	Chm 74, VChm 77
	C.E. FROEBERG	62
	A.L. FURTADO	86
	H. GALLAIRE	86
	J. GARWICK	62
SC74	F. GENUYS	Chm 68, VChm 71
	A. GHIZZETTI	59, 62
SC74	V.M. GLUSHKOV	65,68, Chm 71, VChm 74
SC74	C.C. GOTLIEB	68, VChm 71, 74
SC74	E. GOTO	80
	M. GOTO	59
SC74	E.L. HARDER	62
SC80	J. HEBENSTREIT	74
	P. HENRICI	68
SC74	A.S. HOUSEHOLDER	59, VChm 65, 68
	H. HÜNKE	86
	S. IGARACHI	77
	R.A. KARP	74
	V.E. KOTOV	83, 86
	J. KRYZE	62
SC74	P. LAASONEN	62
	G.N. LANCE	80
SC74	B. LANGEFORS	Chm 65, VChm 68
SC74	M. LINSMAN	62
SC80	J.L. LIONS	65
	M.G. LOSANO	80
	J.F. LUBIN	74
SC74	L. LUKASZEWICZ	62
	C. MANNEBACK	59
	E.G. MANNING	VChm 77
	H.D. MILLS	77
	U. MONTANARI	86
	R. MORI	83, 86

SC83	N.	NAFFAH	83
	P.	NAMIAM	59
SC80	R.	NARASIMHAN	86
	N.	NEGROPONTE	80
	W.M.	NEWMAN	83
	T.H.	NIELSEN	71
	T.	OHLIN	83
	D.	PANOV	59
	J.R.	PASTA	65
	C.J.	PEREIRA	80
SC74	W.L.	vanderPOEL	59, VChm 62
	R.	dePOSSEL	59
	I.C.	PYLE	68
	C.J.	vanRIJSBERGEN	83
	R.	RIND	59
	T.	SAKAI	74
SC80p	K.	SAMELSON	71
SC74	J.G.	SANTESMASES	62
	J.W.	SCHMIDT	83
	C.S.	SCHOLTEN	59
	H.	SCHORR	83
SC77	Bl.	SENDOV	71
SC77	Y.	SHMYGLEVSKY	VChm 74, 77
	A.D.	SMIRNOV	71
SC74	A.P.	SPEISER	62
	K.	STEINBUCH	59
SC80	F.H.	SUMNER	77, Chm 80, VChm 83
SC83	D.C.	TSICHRITZIS	80, Chm 83, VChm 86
SC74	W.M.	TURSKI	74, Chm 77, VChm 80
SC77	J.	VLIETSTRA	77, 86
	A.	WALTHER	59
	A.I.	WASSERMAN	86
SC74	A.	vanWIJNGAARDEN	59, 62
SC74	M.V.	WILKES	59, 62, 74
	J.H.	WILKINSON	71
SC74	M.	WOODGER	65
SC74	H.	YAMASHITA	59, 62
SC77	H.	ZEMANEK	62, VChm 71

IFIP CONGRESSES 1959 TO 1986

	Programme Committee Chairman		Conference or Organ.Comm. Chairman	Editor
1959	I.L. AUERBACH		H.H. AIKEN	S. dePICIOTTO
1962	N.I. BECH		A. WALTHER	Cecily POPPLEWELL
1965	B. LANGEFORS		W. BUCHHOLZ	W.A. KALENICH
1968	F. GENUYS		B.B. SWANN	AJH. MORRELL
1971	V.M. GLUSHKOV		M. OSREDKAR	C.V. FREIMAN
1974	H. FREEMAN		P. SVENONIUS	J.L. ROSENFELD
1977	W.M. TURSKI		J.H. FINCH	B. GILCHRIST
1980	F.H. SUMNER	J AUS	M. OZEKI A.W. GOLDSWORTHY	S.H. LAVINGTON
1983	D.C. TSICHRITZIS		J. CARTERON	REA. MASON
1986	D. BJÖRNER		D.J. DOLAN	H.-J. KUGLER

TECHNICAL COMMITTEE AND WORKING GROUP OFFICERS 1961 TO 1985

SC 80	J.J.	ALLAN III	Vchm	WG 5.2
SC 80	J.	ANDERSON	Secr	WG 4.1
SC 83	D.	ASPINALL	Chm	TC 10
SC 74	W.F.	ATCHISON	Chm	WG 3.1, 3.2
	S.	AUGUSTIN	Secr	WG 5.7
	A.	AVIŽIENIS	Chm	WG 10.4
	J.H.	BAIR	Chm	WG 6.3
SC 77	A.V.	BALAKRISHNAN	Chm	TC 7
	M.R.	BARBACCI	Chm	WG 10.2
	D.L.A.	BARBER	Chm	WG 6.1
	M.H.	BARTON	Secr	WG 10.3
SC 74	N.I.	BECH	Chm	TC 3
	K.	BECKMANN	Chm	TC 11
	D.	BEECH	Chm	WG 2.7
	A.	BERGER	Chm	WG 3.4
SC 83	Ö.	BJÖRKE	VChm	WG 5.3
	G.	BLAAUW	Chm	WG 10.1
SC 83	E.K.	BLUM	Secr	WG 2.2
	K.	BÖ	Chm	WG 5.2
	P.	BOLLERSLEV	Chm	WG 3.1
	Dominique	BORRIONE	VChm	WG 10.2
	H.J.	BOWLDEN	Secr	WG 2.1
	G.	BRACCHI	Chm	TC 8
	T.	BRATTVAG	Secr	TC 3
	W.	BRAUER	Chm	TC 3
	U.	BRIEFS	Chm	WG 9.1
	R.	BROTHERTON	Chm	TC 9
	K.	BRUNNSTEIN	VChm	WG 9.2
	J.	BUBENKO	Secr	WG 8.1
SC 74	R.A.	BUCKINGHAM	Chm	TC 3
	C.	CARREZ	Secr	WG 10.1
	L.R.	CARTER	Secr	WG 2.4
	V.G.	CERF	Chm	WG 6.1
SC 77	Sylvia	CHARP	Chm	WG 3.3
	Françoise	CHATELIN	Secr	WG 2.5
SC 74	D.	CHEVION	Chm	WG 3.1
	A.	COSTES	VChm	WG 10.4
	J.P.	CRESTIN	Chm	WG 5.3
	A.	CURRAN	Chm	TC 6
	J.	DANIELSSON	Secr	WG 4.4
	A.	DANTHINE	Chm	TC 6
	C.J.	DATE	Secr	WG 2.6
	D.W.	DAVIES	VChm	TC 6
	G.B.	DAVIS	VChm	TC 8
	P.A.	DEWAR	Secr	TC 10
	G.	DOUMEINGTS	VChm	WG 5.7
	J.J.	DUBY	Chm	WG 2.2
SC 79 p	J.	van EGMOND	Secr	TC 4
	B.	EINARSSON	Chm	WG 2.5
	P.	FALSTER	Chm	WG 5.7
	M.S.	FEATHER	Secr	WG 2.1
	B.	FORD	Secr	WG 2.5
SC 74	J.M.	FORSYTHE	Secr	TC 4
	L.D.	FOSDICK	VChm	WG 2.5
	L.H.	FRANSSON	Secr	TC 5
	Ms.S.	FROCK-PRUTCH	Secr	TC 2
	Joanne M.	GALLITANO	Secr	TC 2

SC 80	E. GELENBE	Chm	WG 7.3
	E.D. GILLES	Chm	WG 5.5
	W.K. GILOI	Chm	WG 10.1
SC 80	R. GLOWINSKI	VChm	WG 7.2
	G. GOOS	Chm	WG 2.4
SC 74	C.C. GOTLIEB	Chm	TC 9
SC 74	I.H. GOULD	Secr	TC 1, Chm WG 1.1
	C. GRAM	VChm	WG 2.7
	P.E. GREEN	Chm	WG 7.3
SC 74	F. GREMY	Chm	TC 4
SC 80	G. GRIESSER	Chm	WG 4.4
	R.A. GUEDJ	VChm	WG 5.2
SC 74	E.L. HARDER	Chm	TC 5
	R.W. HARTENSTEIN	Secr	WG 10.2
SC 77	J. HATVANY	Chm	WG 5.3
	J. HAWGOOD	Secr	WG 8.3
SC 80	J. HEBENSTREIT	Chm	TC 3
	E.C.R. HEHNER	Secr	WG 2.3
	J. HEITE	VChm	WG 4.1
	P. HENDERSON	Secr	WG 2.3
SC 83	F.R. HERTWECK	Chm	WG 2,7
SC 83	U. HERZOG	VChm	WG 7.3
	G. HOPKINS	Chm	WG 6.4
	J.J. HORNING	VChm	WG 2.3
	T. HUSAK	Chm	WG 4.1
	D.A. JARDINE	VChm	WG 2.7
	D.E. JENSEN	Chm	WG 10.3
	S. JONASSON	Chm	WG 9.1
	V. KAESTNER	Secr	WG 4.2
SC 80	W.J. KARPLUS	Chm	WG 7.1
	P.R. KING	Chm	WG 2.1
	M. KLEIN	Secr	WG 8.1
SC 83	R. KLING	Chm	WG 9.2
SC 80	H. KOBAYASHI	Chm	WG 7.3
SC 83	D. KOCHAN	Chm	WG 5.3
	C. KUO	Chm	WG 5.6
	F.F. LAND	Chm	WG 8.2
SC 74	B. LANGEFORS	Chm	TC 8
	G. LE LANN	VChm	WG 10.3
SC 83	B. LEVRAT	VChm	TC 9
SC 83	R.E.J. LEWIS	Chm	WG 3.3
	K. LIND	Chm	WG 5.6
SC 80	J.L. LIONS	Chm	WG 7.2
	Ms.M. LOKY	Secr	WG 5.2
SC 83	F.B. LOVIS	Chm	WG 3.1, 3.5
	H.C. LUCAS Jr	Chm	WG 8.2
	M. LUCERTINI	VChm	TC 7
SC 80	J.Y.S. LUH	Chm	WG 5.1
	N.E. MALAGARDIS	Chm	WG 5.4
SC 83	F. MARGULIES	Chm	TC 9
	R.E.A. MASON	Chm	TC 2
	A. McKENZIE	Secr	WG 6.1
	J. McLEAN	Secr	WG 10.5
SC 80	D. McPHERSON	Secr	WG 5.3
	J.F. McWATERS	Secr	WG 5.3
	R. MEERSMAN	Chm	WG 2.6
	A. METAXIDES	Secr	TC 8
	L.B. METHLIE	Chm	WG 8.3
	S. MICHAELSON	Chm	WG 10.5
	Enid MUMFORD	Chm	WG 8.2
	G. MUSGRAVE	Chm	WG 5.8

	G.J.	MYERS	Secr	WG 10.3
	L.	NEMES	VChm	WG 5.3
SC 80	E.J.	NEUHOLD	Chm	WG 2.2
	M.	NEWMAN	Secr	WG 10.5
SC 80	G.M.	NIJSSEN	Chm	WG 2.6
SC 83	T.W.	OLLE	Secr	TC 8
SC 74	M.	PAUL	Chm	TC 2
SC 74	J.E.L.	PECK	Chm	TC 2
	B.I.	PENKOV	Secr	TC 3
SC 80	R.	PILOTY	Chm	TC 10
	Rosalie A.	POCKOCK	Secr	TC 2, WG 2.7
SC 74	W.L.	vanderPOEL	Chm	WG 2.1
SC 83	L.	POUZIN	Chm	TC 6
SC 83	Agnes	PREGITZER	Secr	WG 5.2
SC 83	P.G.	RAYMONT	Chm	WG 3.4
	J.K.	REID	Chm	WG 2.5
	G.L.	RIJNS	Chm	WG 10.3
	J.R.	RICE	VChm	WG 2.5
SC 83	A.	ROLSTADAS	Chm	TC 5
SC 80	J.	ROUKENS	Chm	TC 4
	H.	SACKMAN	Chm	TC 9
		SAMUELSON	Chm	WG 6.2
	B.	SCHNEIDER	VChm	TC 4
SC 80	H.J.	SCHNEIDER	Chm	WG 8.1
	J.B.	SCHNEIDER	Chm	WG 5.1
	W.	SCHNEIDER	Chm	WG 4.2
	D.	SEIBT	Secr	WG 8.1
	K.C.	SEVCIK	Secr	WG 7.3
	B.	SHACKEL	Chm	WG 6.3
	M.	SHADER		TC 3
	R.	SIZER	Chm	WG 9.2
	B.R.	SMITH	VChm	TC 5
	A.	SÖLVBERG	Chm	WG 8.1
	R.	SPRAGUE	Secr	WG 8.3
SC 74	T.B.	STEEL Jr	Chm	TC 2
	J.	STOER	Chm	TC 7
	C.	SUNSHINE	Chm	WG 6.1
	E.B.	SWANSON	VChm	WG 8.2
SC 83	E.D.	TAGG		
	C.C.	TOOTILL	Chm	TC 1
SC 74	W.M.	TURSKI	Secr	WG 2.3
SC 83	R.P.	UHLIG	Chm	WG 6.5
	W.K.	UNCAPHER	Chm	TC 6
	R.E.	UTMAN	Secr	TC 2
SC 77	G.C.	VANSTEENKISTE		
SC 83	A.A.	VERRIJN-STUART	Chm	TC 8
SC 77	J.	VLIETSTRA	Chm	TC 5
SC 83	P.	VODA	VChm	WG 2.4
	W.M.	WAITE	Chm	WG 2.4
	K.	WALK	Secr	WG 2.2
SC 83	E.A.	WARMAN	Chm	WG 5.2
	A.I.	WASSERMAN	VChm	WG 8.1
	R.J.	WELKE	VChm	WG 8.2
	B.A.	WICHMANN	Chm	WG 2.4
	G.	WIECHERS	Secr	TC 3
SC 74	A.	vanWIJNGAARDEN	Chm	TC 1
	A.R.	WILDE	Chm	TC 1
SC 77	T.J.	WILLIAMS	Chm	TC 5
SC 81	D.H.	WOLBERS	Chm	TC 3
SC 74	M.	WOODGER	Chm	WG 2.3
	D.B.	WORTMAN	Secr	WG 2.4

	W.A. WULF	Chm	WG 2.4
	J.P. YVON	Chm	WG 7.2
SC 77	H. ZEMANEK	Chm	TC 2
SC 80	Chr. ZYWIETZ	Chm	WG 4.3

IAG REPRESENTATIVES AND OFFICERS (Selection) 1968–1981

SC 74	S.D.	DUYVERMAN	Founding Chairman
	M.	van ACCOLEYEN	(B)
	E.	BIALOT	(F)
	R.G.	CHANNING	(US)
	R.C.	CHEEK	(US)
	B.H.	CROOK	(AUS)
SC 77	P.J.	DIXON	(CDN), Chairman
	K.F.	ERBACH	(D)
	H.G.	FIENT	(CH)
	L.	FONTELL	(SF)
	M.	GERMANOV	(BG)
SC 74	T.	HERBORG-NIELSEN	(DK)
	J.-F.	JACQ	(F)
	S.A.	JONKER	
SC 74	I.	KADAR	(H)
	P.	KRAMER	(N)
	S.	LESKOVAR	(YU)
	K.	LUNDIN	(S)
	R.J.	McQUAKER	(GB), Chairman
	L.	MEYER	(PY)
	J.	MONETA	(IL)
	O.C.	NORD	(DK)
	D.	RAVESTIJN	(NL)
	V.	RUPNIK	(YU)
	J.	SALONOJA	(SF)
	P.	SARDI	(I)
	E.H.	SIBLEY	(US), Chairman
	V.	SPIRIDINOV	(BG)
	P.O.	STENSETH	(N)
	P.	SVENONIUS	(S)
	A.A.M.T.	VEENHUIS	(NL)
	M.	VERHELST	(B)
	J.	VLCEK	(CS)
	Y.	YOSHIDA	(J)

SPECIAL MEMBERS OF IFIP COMMITTEES

	F. DUNCAN	Editor ALGOL Bulletin
	Karen DUNCAN	Publications Officer
SC80	E. FREDRIKSSON	North Holland Publ. Co.
SC74	F. GENUYS	Chm Congress Organization Committee
	E. HERBERT	Chm Public Information Committee
	Gloria KARLMARK	TC5 Journal Editor
	J.L. KOORY	Chm Congress Organization Committee
SC74	D. KRONEBERG	Publications Officer
	D. MEIER	Chm Congress Organization Committee
	P. NAUR	Editor ALGOL Bulletin
SC83	J.E.D. NAVEZ	Conference Officer
	K. OWEN	IFIP Author, Public Info. Comm.
	P.L. REICHERTZ	TC4, IMIA Publications
SC77	J.L. ROSENFELD	Editor IFIP Newsletter
	G. ROSSBACH	Springer Verlag
	A.J. SIMOES-MONTEIRO	Conference Officer
	Stephanie SMIT	North Holland Publ. Co.
	W.H. WIMMERS	North Holland Publ. Co.
	H. WÖSSNER	Springer Verlag

IFIP EDITORS

^{2}83 ... ^{2} = number of Editors, 83 = year of event; S = Springer

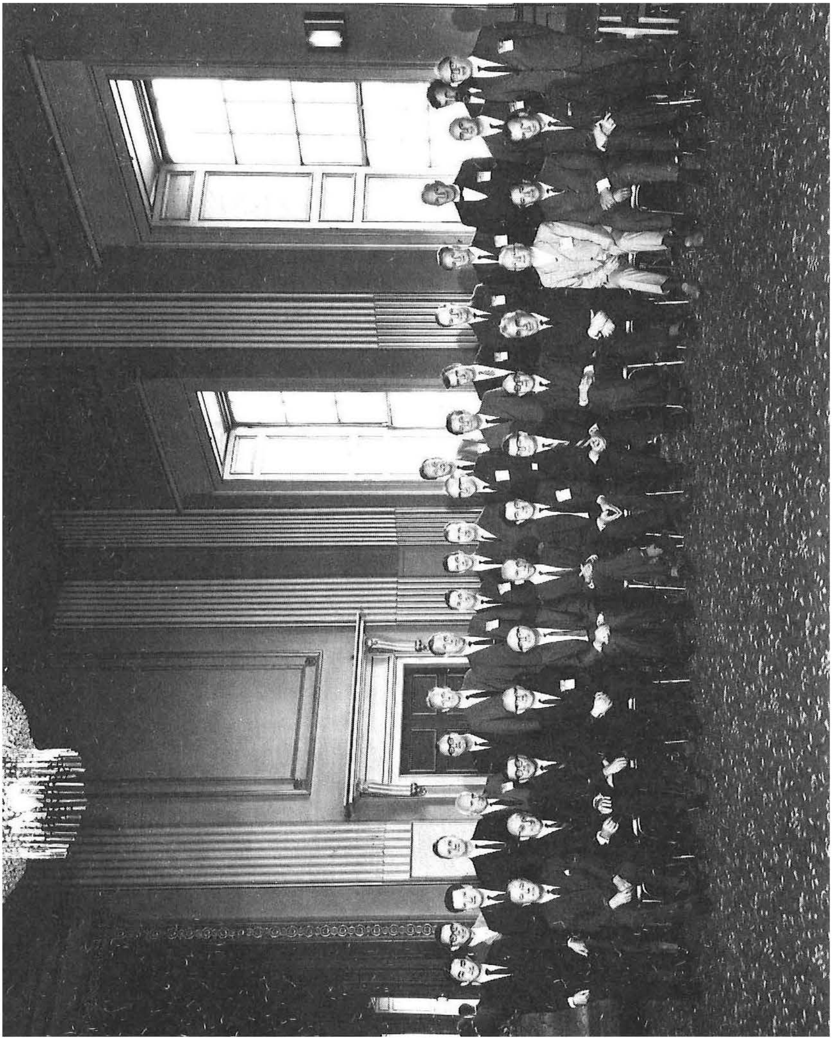
	E.J. AAS	^{2}83
SC80	J.J. ALLAN III	^{1}76
	A. ALPEROVICH	^{3}79
	F. ANCEAU	^{2}83
SC80	J. ANDERSON	^{2}70 ^{2}74
	M. ARATO	^{3}80S
	S. AUGUSTIN	^{3}85
	A.B. AUNE	^{2}80
	N.T.J. BAILEY	^{3}72
	J.W. de BAKKER	^{2}81
SC77	A.V. BALAKRISHNAN	69S ^{3}80S
	A. BALASUBRAHMANIAN	^{1}84
	N.J. BALL	^{3}83
	P. BANDA	^{3}85
	M. BARBACCI	^{2}83
	B.Z. BARTA	^{2}84
	D. BEECH	^{1}79
	H. BEILNER	^{2}76 ^{2}77
	C.G. BELL	^{2}75
	J.R. BELL	^{2}75
	L.N. BELYKH	^{2}82
	Th.M.A. BEMELMANS	^{1}83
	J.H. van BEMMEL	^{2}76 ^{3}83
SC77	J.M. BENNETT	^{2}80
	J. BERGHAMMER	^{1}65
	J. BERLEUR	^{4}85
	D. BJÖRNER	^{1}82
	P. BLAKE	^{1}79
	K. BÖ	^{2}82
	D.G. BOBROW	^{1}66
	F. BORGSTRÖM	^{3}76
	J. BORMANN	^{1}83
	E.J. BOUTHMY	^{2}79
	K.L. BOYANOV	^{1}84
	G. BRACCHI	^{2}79
	J.F. BRANDEJS	^{1}76
	M. BREUER	^{2}81
	U. BRIEFS	^{3}82 ^{2}83 ^{3}85S
	J.N.G. BRITTAN	^{1}74
	J. BROWNE	^{2}85
	J. BUBENKO Jr	^{3}85
SC74	R.A. BUCKINGHAM	^{1}77
	Claudia BUSSEL	^{1}72
	W. BUX	^{2}84
	J.N. BUXTON	^{1}67
	W.A. CARTER	^{2}82
	J. CEA	^{1}75S
	K.M. CHANDY	^{2}77
	G. CHROUST	^{2}80 ^{2}85
	C. CIBORRA	^{3}82
	R. CONTI	^{2}73S
	P. COUSOT	^{2}74 ^{1}77
	J.P. CRESTIN	^{2}85
	L. CSABA	^{3}81 ^{3}85

	E.L. DAGLESS	^{2}84
	I.N. DALLAS	^{2}83
	A. DANTHINE	^{2}79
	G. DAVID	^{2}83
	M. DIAZ	^{1}85
	F.T. de DOMBAL	^{2}76 ^{3}79
	E.G. DOUGALL	^{2}84
	G. DOUMEINGTS	^{2}82
	B.C.M. DOUQUE	^{2}75
	R.F. DRENICK	^{2}81S
	D.A. DUCE	^{5}79
	H. DUCROT	^{4}78
	Karen DUNCAN	^{2}85
SC79	J. van EGMOND	^{3}76
	T.M.R. ELLIS	^{2}82
	J.L. ENCARNACAO	^{2}81 ^{3}81
SC80	B. ENGQUIST	^{2}83
SC80	P. FALSTER	^{2}80 ^{2}84
	G. di FILIPPO	^{3}85
	J.H. FINCH	^{2}84
	W.H. FLEMING	^{2}82S
SC77	J.M. FORSYTHE	^{2}70 ^{2}74
	L.D. FOSDICK	^{1}78
	C.V. FREIMAN	©^{3}71
	Y. FUJITA	^{3}73 ^{3}73
	F.L. GALTUNG	^{3}76
SC80	E. GELENBE	^{2}76 ^{2}77
	J.S. GERÖ	^{1}83 ^{1}84
	M. GIEN	^{2}79
SC80	B. GILCHRIST	©^{1}77
	W.K. GILOI	^{2}83
	M. GOLDBERG	^{4}78
	L.G. GOROSTIZA	^{2}82S
SC74	I.H. GOULD	^{1}66 ^{1}71
	J.-L. GRANGE	^{2}79 ^{1}83
	J.F. GREENLEAF	^{3}78
SC74	F. GREMY	^{2}70 ^{2}76 ^{3}79
	J.E. GRIFFITH	©^{3}71
	M. GRIFFITHS	^{3}84
	B. GRIGELONIS	^{1}78S
	D. GRIES	^{1}78S
SC80	G. GRIESSER	^{1}76
	J.B. GRIMSON	^{2}85
	P.A. GUEDJ	^{2}76 ^{5}79
	R. GÜNDLING	^{3}85
	P.J.W. ten HAGEN	^{5}79
	D. HARRIS	^{2}85
	R. HARTENSTEIN	^{2}81
	T. HASEGAWA	^{3}85
	J. HAWGOOD	^{1}81
	J. HATVANY	^{1}73
	G.T. HERMAN	^{3}78
	P.G. HIBBARD	^{2}77
	R. HOIGNE	^{4}78
	F.R.A. HOPGOOD	^{5}79
	G. HOPKINS	^{2}82
	K. HOPPER	^{2}85
	E. HÖRBST	^{1}85
	H. HÜBNER	^{1}83
	J.D. ICHBIAH	^{2}74
	K. IRACKI	^{3}79

	H.L.W.	JACKSON	[2]79 [1]81
	A.	JACOBSSON	[3]76
	P.	JANSON	[2]80
	D.C.	JOHNSON	[2]77
	M.	JOSEPH	[2]76
	S.	KAIHARA	[2]80
	W.A.	KALENICH	©[1]65
	G.	KALLIANPUR	[1]82S
	R.E.	KALMAN	[2]80 [2]81 [1]83 [1]83
	F.	KAMOUN	[1]84
	J.	KJAER	[3]85S
	J.W.	KLIMBIE Jr	[2]74
SC83	D.	KOCHAN	[1]83 [1]86S
	K.L.	KOFFEMAN	[2]74
	F.C.	KOHLI	[2]76
	C.J.	KOOMEN	[2]85
	F.	KOZIN	[2]81S
	H.	KRAUS	[1]83
	F.L.	KRAUSE	[2]81
	S.	KRCEVINAC	[1]80S
	H.-J.	KUGLER	©[1]86 [2]85
	C.	KUO	[3]79 [3]82 [2]85 [3]85
	F.F.	LAND	[4]79
	J.C.	LATOMBE	[1]78
	R.	LAUFER	[4]85
SC80	S.H.	LAVINGTON	©[1]80
	O.	LECARME	[2]75
	W.H.P.	LESLIE	[1]69
	A.H.	LEVY	[3]76
SC83	R.E.J.	LEWIS	[2]75 [2]79 [2]81 [2]82
	F.	LILLEHAGEN	[2]82
	T.J.	LINCOLN	[4]79
SC80	K.	LIND	[3]73 [3]73
	D.A.B.	LINDBERG	[2]80
SC77	C.H.	LINDSEY	[2]77
	P.C.	LOCKEMANN	[2]76
SC83	F.B.	LOVIS	[2]83 [2]84
	H.C.	LUCAS Jr	[4]79
	L.A.	MAARSEN	[2]73
	P.	MACFARLANE	[2]79
	J.	MADEY	[1]76
	K.	MALANOWSKI	[3]79
SC80	G.I.	MARCHUK	[1]74S [1]78S [2]82
	G.	MARKS	[2]79
	J.	MARTINEZ	[2]81
SC83	R.E.A.	MASON	©[1]83
	R.B.	MAZUMDER	[2]84
	K.J.	McCALLUM	[3]79
SC80	D.	McPHERSON	[1]76
	J.F.	McWATERS	[2]85
	R.	MEERSMAN	[2]85
	L.B.	METHLIE	[2]84
	M.	METIVIER	[2]84S
SC77	S.G.	van der MEULEN	[2]77
	P.	MIDDLETON	[4]78
	N.N.	MOISSEEV	[1]68S
	E.	MONOD	[3]84
	A.J.	MORRELL	©[1]68
	T.	MOTO-OKA	[2]85
	A.	MOWSHOWITZ	[1]79
	J.	MÜHLBACHER	[2]80

	Enid MUMFORD	^{2}74
SC83	N. NAFFAH	^{1}79 ^{2}82
	F. NAKE	^{2}72
	B.C. NEHRLING	^{3}82
SC80	E.J. NEUHOLD	^{2}76 ^{1}77 ^{2}85
	A. NEWMAN	^{2}85
SC80	G.M. NIJSSEN	^{1}76 ^{1}77 ^{2}79
	J. OHANIAN	^{3}85
	A. OLERUP	^{3}84
	A. OLIVE	^{3}85
SC83	T.W. OLLE	^{3}82 ^{3}83
	J.C. PAGES	^{3}74
	E. PARDOUX	^{2}84S
SC74	J.E.L. PECK	^{1}70
	Y. PERRY	^{1}85
	S. de PICCIOTTO	©^{1}59
	M. PITKIN	^{3}76
SC74	W.L. van der POEL	^{2}73
	Cecily POPPLEWELL	©^{1}62
	A. PREKOPA	^{3}85S
	B.H. RAAB	^{2}84
	J. RABEN	^{2}79
	V. RAJARAMAN	^{1}85
SC83	J. RAVIV	^{3}78
	S. RAMANI	^{1}80
	P.C. RAVASIO	^{3}82
	J.K. REID	^{1}81
	G.L. REIJNS	^{2}84
	M. REISER	^{2}77
	J.-L. RIGAL	^{3}85S
	S. RINALDI	^{1}81
	J.J. ROCHE	^{3}76
	D.F. ROGERS	^{3}82
SC83	A. ROLSTADAS	^{2}80
	K. RÖSANDHAUG	^{3}76
	A. ROSENFELD	^{2}72
SC77	J.L. ROSENFELD	©^{1}74 ©^{3}71
	A. RUBERTI	^{2}73S ^{1}76S
	H. RUDIN	^{2}83 ^{2}83 ^{2}84
	H. SACKMAN	^{2}74 ^{1}85
	A.-L. SAGVALL HEIN	^{2}77
	P.A. SAMET	^{1}79
	K. SAMUELSON	^{1}67
	T. SATA	^{2}80
	B. SCHNEIDER	^{2}71
SC80	H.J. SCHNEIDER	^{1}79 ^{2}82
	L. SCHNEIDER	^{3}82 ^{3}84
	W. SCHNEIDER	^{2}77
	S.A. SCHUMAN	^{2}77
	A. SEMADAS	^{3}85
	O.I. SEMENKOV	^{2}82
SC77	Bl. SENDOV	^{3}72
	B. SHAKEL	^{1}84
	R.H. SHANNON	^{1}79
	B. SCHEEPMAKER	^{2}70
SC83	D. SHIRES	^{2}77
	B.D. SHRIVER	^{2}83
	R. SIZER	^{4}85
	T. SMEDSAAS	^{2}83
	H.T. SMITH	^{1}84
	H.G. SOL	^{1}82 ^{3}82 ^{3}83

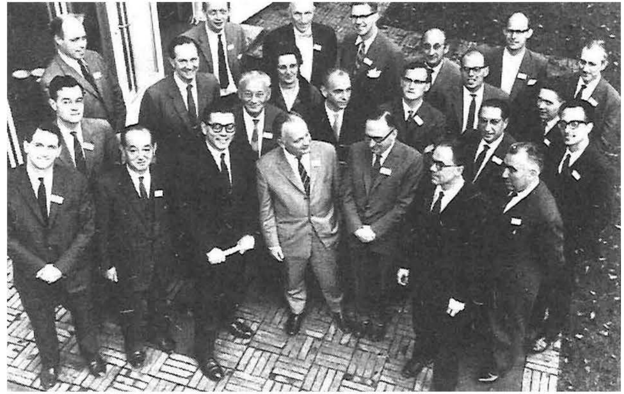
	R. SPRAGUE	[2]84
	E.B. SPRATT	[2]83
SC74	T.B. STEEL Jr	[1]64 [2]85
SC83	J. STOER	[1]77S
	B. STRAZICKI	[2]85S
	R. STROM	[3]84
	C. SUNSHINE	[1]82
	K. SUPPER	[4]79
	J. SZELEZSAN	[2]85S
	E. SZELKE	[2]85
SC83	T. SZENTIVANYI	[3]81 [3]85
SC83	E.D. TAGG	[2]79 [1]80 [2]81 [2]82 [2]83 [2]83 [2]83 [2]84 [2]84
	H. TAKAGI	[3]85
	Y. TAKAHASHI	[3]85
	K. TARNAY	[3]81 [3]85
	D. TEICHROEW	[2]83
	P. THOFT-CHRISTENSEN	[1]83S
	A.J. THUNEM	[2]85
	J.D. TINSLEY	[2]77 [2]83
	O.F.F. TORRES	[3]81
	R. TSANEV	[3]72
	H.A. TUCKER	[2]75 [5]79
	C.J. TULLY	[3]83
SC74	W.M. TURSKI	[1]72
	T. UEHARA	[2]83
SC83	R. UHLIG	[1]81 [1]85
	C. UNGER	[1]74
	V. VAK	[1]83
SC77	G.C. VANSTEENKISTE	[1]74 [1]75 [1]77 [2]82
	D. VERMES	[3]80S
SC83	A.A. VERRIJN-STUART	[3]82
	J.C. van VLIET	[2]81
SC77	J. VLIETSTRA	[2]72 [1]79 [2]80
	E. VOLTA	[1]82
	P.F. de VRIES ROBBE	[3]76
	S. WALUKIEWICZ	[3]79
SC83	E.A. WARMAN	[2]80 [3]81 [1]83
	A.I. WASSERMAN	[2]82
	A. WEST	[2]80
	C.H. WEST	[2]83
	G. WIECHERS	[2]79
	R.F. WIELINGA	[2]72
	O. WIGERTZ	[3]83
	J.L. WILLEMS	[2]76
SC77	T.J. WILLIAMS	[3]73 [3]73 [3]76 [3]76 [3]76 [3]79
	H.K. WOLF	[2]77 [2]79
	J.V. WOODS	[1]85
	S. YEMINI	[3]84
	Y. YEMINI	[3]84
	L. YNGSTRÖM	[4]85
	P.C. YOUNG	[2]82
SC77	H. ZEMANEK	[1]70 [1]86
	K. ZINN	[2]70
SC80	Chr. ZYWIETZ	[2]71



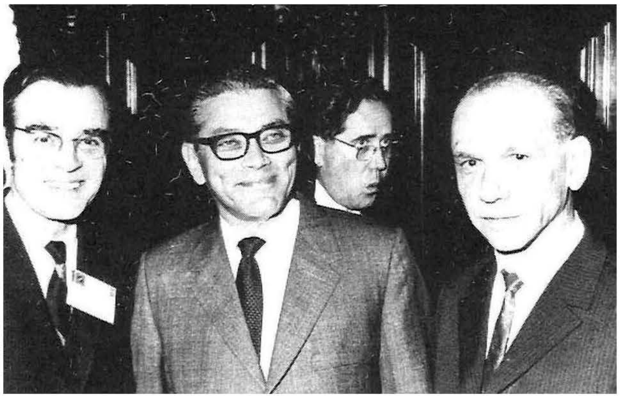
General Assembly at Congress '68 (Edinburgh)

THE PAST

Past Presidents: H. Zemanek,
R. Tanaka and P. Bobillier



IFIP Council Meeting, October 1961
in Denmark



Past Presidents: A. Speiser,
I. Auerbach and A. Dorodnicyn

Past President I. Auerbach
at 10th Anniversary.

INDEX

NAME INDEX

This index is not perfect. The editor apologizes for all omissions and errors. Names occurring only in committee lists or in quotations were not included. P means paper by, p paper on, • obituary for. Φ photograph of the person.

H. RUTISHAUSER (CH) WG2.1 (1918-1970) 166 452
SC83 G. SACERDOTI (I) GA . . . . . 17 P 201-205
H. SACKMAN (US) TC9 . . . . . 401 P 393-408 Φ 108

COUNTRIES

CODE	COUNTRY	YEAR	REPRESENTATIVES
A	AUSTRIA	1964	Zemanek, Zich
AUS	AUSTRALIA	1961	Bennett, Cohn, Bennett, Goldsworthy
B	BELGIUM	1960	Linsman, Ribbens, Navez
BG	BULGARIA	1965	Iliev, Sendov
BR	BRAZIL	1964	many
C	CUBA	1967	Alvarez-Marcer, Martinez, Oliveira
CDN	CANADA	1960	Gotlieb, Hull, Hume, Boyd, Finch
CH	SWITZERLAND	1960	Speiser, Bobillier, Bauknecht
CS	CSSR	1960	Kryze, Plander, Gvozdjak
D	GERMANY (FR)	1960	Walther, Bauer, Samelson, Piloty, Brauer
DK	DENMARK	1960	Bech, Herborg-Nielsen, Melbye
DZ	ALGERIA	1970	Mentalecheta
E	SPAIN	1960	Santesmases, Moreno-Diaz, Eced, Portaencasa, Sendin
ET	EGYPT	1977	Sarhan
F	FRANCE	1960	Carteron, Renard, Fourot
GB	UNITED KINGDOM	1960	Wilkes, Gill, Douglas, Morris
*GDR	GERMAN DEM REP	1970	Lehmann
GH	GHANA	1970-1976	Doe, Quist
GR	GREECE	1983	Trapezanoglou
H	HUNGARY	1966	Kádár, Kálmán, Kovács
I	ITALY	1961	Ghizzetti, Dadda, Sacerdoti
IL	ISRAEL	1964	Chevion, Rabin, Raviv
IND	INDIA	1973	Narasimhan, Balabrahmanian
IQ	IRAQ	1978	Aboud
IRL	IRELAND	1974	Dempsey, Marchand, Dalton
J	JAPAN	1960	Yamashita, Goto, Yamauti, Degwaw, Goto, Ando
K	KOREA	1978	Park, Lee
MA	MOROCCO	1979	Benmokhtar
MEX	MEXICO	1964-1973	Beltran
N	NORWAY	1961	Garwick, Övergaard, Keilhau, Sölvberg, Rolstadas
NL	NETHERLANDS	1960	vanWijngaarden, vanderPoel, vanderSluis, Verrijn-Stuart
NZ	NEW ZEALAND	1974	Cox, Scholar, Potter
P	PORTUGAL	1981	Simoez-Monteiro, Penedo
PL	POLAND	1960	Lukaszewicz
PRC	CHINA	1979	Guo
RA	ARGENTINA	1961-1974, 1978	Ciancaglini, Milchberg, Basso-Dastugue
RCH	CHILE	1969-1976, 1984/CLEI	Friedmann, Duran
S	SWEDEN	1960	Comet, Langefors, Sem-Sandberg, Hernaes
SF	FINLAND	1960	Laasonen, Andersin, Tuori, Kontinen, Haglund
SU	USSR	1960	Dorodnicyn
SYR	SYRIA	1981	Munajed
TN	TUNISIA	1978	Gribaa, Kamoun
US	USA	1960	Auerbach, Pasta, Harder, Tanaka, Freeman, Glaser
WAN	NIGERIA	1981	Longe, Jaiyesimi
YU	YUGOSLAVIA	1967	Tomović, Zeleznikar, Aleksić
ZA	SOUTH AFRICA	1971	Marting, Henderson, vanderVeer, LeRoux

SEARCC		1982	Iau
CLEI		1986	

				PI	PHILIPPINES	1982	SEARCC
BOL	BOLIVIA	1986	CLEI	PY	PARAGUAY	1986	CLEI
CO	COLOMBIA	1986	CLEI	RI	INDONESIA	1982	SEARCC
HK	HONGKONG	1982	SEARCC	SGP	SINGAPORE	1982	SEARCC
MAL	MALAYSIA	1982	SEARCC	T	THAILAND	1982	SEARCC
PAK	PAKISTAN	1984	SEARCC	U	URUGUAY	1986	CLEI
PE	PERU	1986	CLEI	YV	VENEZUELA	1986	CLEI

CITIES

AMS	AMSTERDAM	GA 70 + 10Y
ATH	ATHENS	
BOM	BOMBAY	C 78
BRU	BRUSSELS	C 69
BTS	BRATISLAVA	C 79
BUD	BUDAPEST	
CPH	COPENHAGEN	C 61
CPT	CAPE TOWN	C 84
DRE	DRESDEN	C 76
DUB	DUBLIN	GA 81, ©$_{10}$ 86
EDI	EDINBURGH	©$_{4}$ 68
GVA	GENEVA	
HEL	HELSINKI	C 74, C 82
JRS	JERUSALEM	GA 66
LIS	LISBON	C 86
LJU	LJUBLJANA	©$_{5}$ 71
LON	LONDON	C 66, C 77, GA 79 + EUROIFIP
MAD	MADRID	C 67
MEL	MELBOURNE	©$_{8}$ 80
MEX	MEXICO CITY	GA 67
MUC	MUNICH	©$_{2}$ 62, C 73, C 85 + 25Y
NCE	NICE	GA 65
NYC	NEW YORK CITY	©$_{3}$ 65
OSL	OSLO	GA 78
PAR	PARIS	©$_{1}$ 59, ©$_{9}$ 83
PEK	PEKING	C 83
PRG	PRAGUE	C 64, GA 69
RIO	RIO DE JANEIRO	GA 75
ROM	ROME	C 60, C 64, GA 82
SFO	SAN FRANCISCO	©$_{11}$ 89
SOF	SOFIA	GA 72, C 80
STO	STOCKHOLM	©$_{6}$ 74
TAS	TASHKENT	GA 76
TBS	TBILISI	C 68
TOR	TORONTO	GA 73, ©$_{7}$ 77
TYO	TOKYO	C 75, ©$_{8}$ 80, GA 85
VAR	VARNA	GA 84
VIE	VIENNA	C 72 + TD
AC	ATLANTIC CITY NJ	C 70
AH	ANAHEIM CA	C 81
BL	BLED NEAR LJU	C 71
DA	DARMSTADT	C 61
FA	FELDAFING NEAR MUC	C 62
GO	GOLA NEAR OSL	C 63

ABBREVIATIONS

ACM	AFIPS MS: ASS FOR COMP MACHINERY
ACS	MS(AUS): AUSTRALIAN COMP SOC
AFCET	MS(F): ASS FRANÇAISE POUR LA CYBERNETIQUE ECONOMIQUE ET TECHNIQUE
AFIPS	MS(US): AMERICAN FED OF INFORM PROC SOC
AI	ARTIFICIAL INTELLIGENCE
AICA	MS(I): ASSOCIAZIONE ITALIANA PER IL CALCOLO AUTOMATICO
AICA	OLD NAME OF IMACS: INTERNAT ASS FOR ANALOG COMP
AIEE	AMERICAN INST OF ELECTRICAL ENGINEERS
AM	AFFILIATE MEMBER
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ARPA	
ASS	ASSOCIATION
AUTOMATH 59	COMP EXHIBITION AT ICIP 59
BCS	MS(GB): BRITISH COMP SOC
BULL	BULLETIN
C	COUNCIL
CAD	COMPUTER AIDED DESIGN
CAM	COMPUTER AIDED MANUFACTURING
CAPE	COMPUTER APPLICATIONS IN PRODUCTION AND ENGINEERING (IFIP CONF)
CCITT	COMITE CONSULTATIF INTERNAT TELEGRAPH ET TELEPHONE
CIE	MS(PRC): CHINESE INSTITUTE OF ELECTRONICS
CIPS	MS(CDN): CANADIAN INFORM PROC SOC
CLEI	MS(LATINAMERICA): CENTRO LATINOAMERICANO DE ESTUDIOS EN INFORMATICA
COMP	COMPUTER, COMPUTING, COMPUTATION
CONF	CONFERENCE
CT	COMMITTEE
DANFIP	MS(DK): DANISH FEDERATION FOR INFORM PROC
DARA	OLD MS(D): DEUTSCHE ARBEITSGEMEINSCHAFT RECHENANLAGEN
ECMA	EUROPEAN COMP MANUFACTURERS ASS
ETAN	MS(YU): CT FOR ELECTRONICS AND AUTOMATION
EUR	SUBURB OF ROME
EUROIFIP	IFIP REGIONAL CONFERENCE
EUROMICRO	AM: EUROPEAN ASS FOR MICROPROCESSING AND MICROPROGRAMMING
FACE	AM: INTERNAT FEDERATION OF ASS OF COMP USERS IN ENGINEERING etc
FED	FEDERATION
FESI	MS(E): FEDERACION ESPANOLA DE SOCIEDADES DE INFORMATICA
FIACC	FIVE INTERNAT ASS COORDINATING COMMITTEE
FID	FEDERATION INTERNATIONALE DE DOCUMENTATION
FIIG	FED OF INTERNAT INSTITUTIONS OF GENEVA
GA	GENERAL ASSEMBLY
GAMM	MS(DARA): GESELLSCHAFT FUR ANGEWANDTE MATHEMATIK UND MECHANIK
GI	MS(D): GESELLSCHAFT FUR INFORMATIK
HCC	HUMAN CHOICE AND COMPUTERS (IFIP CONFERENCE)
HM	HONORARY MEMBER
IAG	IFIP ADMINISTRATIVE DATA PROC GROUP (SIG)
IAPR	AM: INTERNAT ASS FOR PATTERN RECOGNITION
IASC	AM: INTERNAT ASS FOR STATISTICAL COMPUTATION
IBI	INTERGOVERNMENTAL BUREAU FOR INFORMATICS
ICC	OLD NAME OF IBI: INTERNAT COMP CENTER
ICCC	AM: INTERNAT COUNCIL FOR COMP COMMUNICATIONS
ICID	IFIP COMMITTEE: INFORMATICS FOR DEVELOPMENT
ICIL	IFIP COMMITTEE FOR INTERNAT LIAISON
ICIP	INTERNAT CONF FOR INFORMATION PROC (1959)
ICSU	INTERNAT COUNCIL OF SCIENTIFIC UNIONS
IEEE	AFIPS MS: INST OF ELECTRICAL AND ELECTRONICS ENGINEERS
IFAC	FIACC MS: INTERNAT FED OF AUTOMATIC CONTROL
IFORS	FIACC MS: INTERNAT FED OF OPERATIONS RESEARCH SOC

IIASA	INTERNAT INST FOR APPLIED SYSTEMS ANALYSIS (LAXENBURG NEAR VIENNA)
IJCAII	AM: INTERNAT JOINT CONFERENCE ON ARTIFICIAL INTELLIGENCE Inc.
IM	INDIVIDUAL MEMBER
IMACS	FIACC MS: INTERNAT ASS FOR MATHEMATICS AND COMP IN SIMULATION
IMEKO	FIACC MS: INTERNAT MEASUREMENT CONFEDERATION
IMIA	IFIP SPECIAL INTEREST GROUP: INTERNAT MEDICAL INFORMATICS ASS
INFOPOL	IFIP CONFERENCE IN POLAND
INFORM	INFORMATION
INST	INSTITUTE
INTERACT	IFIP CONFERENCE ON HUMAN-COMPUTER INTERACTION (1984)
INTERNAT	INTERNATIONAL
IPA	MS(IL): INFORM PROC ASS OF ISRAEL
IPSJ	MS(J): INFORM PROC SOC OF JAPAN
MEDINFO	IFIP WORLD CONFERENCE ON MEDICAL INFORMATICS (since 1974)
MS	MEMBER SOCIETY (OR FEDERATION etc) of IFIP, FIACC etc
NJCC	NATIONAL JOINT COMPUTER CONFERENCE (USA)
PC	PUBLICATIONS COMMITTEE
PIC	PUBLIC INFORMATION COMMITTEE
PRES	PRESIDENT
PROC	PROCESSING
PROLOMAT	IFIP/IFAC JOINT CONFERENCE ON COMP LANGUAGES FOR NUMERICAL CONTROL
SBC	STATUTES AND BYLAWS COMMITTEE
SEARCC	MS(ASIA): SOUTH EAST ASIA REGIONAL COMPUTER CONFEDERATION
SEC	IFIP CONFERENCE ON COMPUTER SECURITY (since 1983)
SIG	SPECIAL INTEREST GROUP
SOC	SOCIETY
SPIN	CONFERENCE ON STRATEGIES AND POLICIES IN FORMATICS (IBI)
TC	TECHNICAL COMMITTEE
TD	TECHNICAL DAY (VIENNA 1972)
UN	UNITED NATIONS
UNESCO	UN EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
UNIDO	UN INDUSTRIAL DEVELOPMENT ORGANIZATION
UNISIST	
WHO	WORLD HEALTH ORGANIZATION

SUBJECT INDEX

ABBREVIATIONS INDEX

[1]HCC:	1974,1977,1985
[2]INTERACT	1984
[3]MEDINFO	1974,1977,1980,1983,1986
[4]SEC	1983
[5]WCCE	1970,1975,1981,1985
[6]PROLAMAT	1970,1973,1977,1979,1982,1985

ISBN 0 444 70003 X