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AUTO-CARTO SIX
Selected Papers

EDITED BY *David H. Douglas*

Auto-Carto Six, the Sixth International Symposium on Automated Cartography, was held in Ottawa/Hull, Canada's National Capital Region, October 16–21 1983

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FOREWORD

AUTO-CARTO SIX was an unqualified success and, since the Symposium, the organizing committee has received favourable comments from participants from all over the world. The success of the Symposium was largely due to the cooperative endeavours of the entire Canadian Cartographic Community and the major record of Auto-Carto Six is the two volume set of *Proceedings* edited by Dr. Barry Wellar. These are available from both the Canadian Institute of Surveying and the Canadian Cartographic Association.

I am particularly pleased to see this selection of papers from the *Proceedings* appear in *Cartographica*. It is a journal of international repute which is also a major forum for Canadian contributions to cartography. Auto-Carto Six was one of the most significant cartographic conferences ever held in Canada, and it is fitting that *Cartographica* be used as a medium to further disseminate some of the interesting presentations made at the Symposium.

D.R.F. TAYLOR
Carleton University
Chairman, Steering Committee for
Auto-Carto Six

trial Expansion, Indian and Northern Affairs, Surveys and Mapping Branch, Canadian Hydrographic Service, Compusave Inc., the Canadian Institute of Surveying and the Canadian Cartographic Association.

As Director of the technical program, Wellar partitioned the conference theme: *Automated Cartography: International Perspectives on Achievements and Challenges*, into five theme tracks, plus *Special Sessions*. These tracks were: *Applications, Education, Research and Development, Problem Analysis*, and *Integrated Systems*. In all, 175 papers were accepted for Auto-Carto Six, and 110 were received in the required camera-ready format and in time to be published in the conference proceedings. The *Proceedings*, edited by Wellar in two volumes and containing the papers and abstracts, were available on the opening day of the conference.

The scope and subject matter of papers presented at Auto-Carto Six as with all of the previous Auto-Carto conferences, was vast and stretched far beyond the traditional realms of cartography. Notably, there were many papers that discuss bureaucratic concerns of systems acquisition, implementation, and responses of organizations to the new capabilities, and the changes in production power. The technical subject matter, too, reached far into the realms of other disciplines including cartography's sister disciplines of geodesy, remote sensing, photogrammetry, surveying, geography, and the more peripheral relatives that use maps, such as geology, hydrography, planning, forestry and meteorology.

The purpose of this issue of *Cartographica* is to bring to the readership a selection of papers from Auto-Carto Six, representing, but limited to, the spectrum of specifically cartographic concerns. Beyond subject matter, the papers were chosen on the basis of being written in a straightforward, relatively jargon-free style. The twenty-two papers, preceded by the keynote address by Dr. F.J. Ormeling, President of the International Cartographic Association, are grouped into four themes representing major concerns of modern cartography. These are:

1 *Computer cartography's contribution to problem analysis and institutional decision-making;*
2 *Issues and problems relating to cartographic data use, exchange and transfer;*
3 *The merger of computer data and thematic mapping; and*
4 *Mathematical, algorithmic, and data-structure issues.*

The contribution of computer cartography to institutional decision-making in this decade represents the most recognized impact of computer cartography on society as a whole, and it has taken place in Canada within governments at all levels. The papers selected for this theme reflect a uniquely Canadian character in its propensity for local innovation and independence of approach. The unrestrained enthusiasm which the first four papers exude is only slightly dampened with the thoughtful remarks by Stein Bie of Norway on the impact of this technology on the technicians who must work with it. If government, business and industry are all going to be generating and using digital data for cartography and geographic information processing, there will be a parallel increase in demand for mechanisms to exchange cartographic data from one institution to another, but the problems of exchange are far from simple. In theme section two,

four papers demonstrate the scope, depth and range of the problem, at a variety of intellectual levels. The problems of exchange are all too easy to discount when others who must deal with them complain of having them, but the most serious consequence of failing to deal with this topic with rigourous scientific thinking is in opportunities lost for new and expanded uses of digital cartographic data.

Cartography is a graphic science. Computerized cartography has not changed this. It is the captivating, speedily-produced graphics that have attracted much attention to the field. The merger of the science of managing statistical data banks, a science that has long since reached maturity, with the exciting capabilities of computer cartography is fascinating. But whenever there is enormous untapped potential to be exploited there are problems. For example, after many years of exhausting tests, the celebrated U.S. Government Domestic Information Display System (DIDS) was characterized by David Cowen as 'isolated, expensive and restrictive'. Beginning with a paper on the 'next generation' of graphics with the new devices the section on thematic mapping reviews the 'state of the art' in thematic cartography.

Perhaps the most interesting aspect of all of the applications of computers to cartography has been the forced development of a new 'science' within cartography which is introduced in the section on thematic mapping. Hundreds of operations done in manual cartography are only partially specified at best, and are dealt with on the basis of the intuition of trained cartographers. To coax a machine to replicate many of these functions is forcing a major rethinking of what, exactly, is being done in cartography and how it is being done. Precise definition of operations based on intuition is difficult, but the results expressed in the form of the computer 'algorithm', and in the structuring of data, represent major scientific contributions to the field on a purely intellectual basis. The application of these algorithms and data structures in widely available machinery is the major expression of progress in cartography in this past quarter century. In fact, the statement of algorithms and descriptions of data structure have been reliable forecasters of ten-year developments in the field for the past twenty-five years. It is expected that the papers in the last theme section will also fill a role of diviner for the next decade or more. They portray a number of very likely futures.

Three papers in this issue of *Cartographica* did not appear in the Auto-Carto Six *Proceedings*, and we are fortunate to have them. Others have been considerably modified, and all have had editorial revisions. Except as mentioned above, these papers appeared in the *Proceedings* of Auto-Carto Six which were edited by Barry S. Wellar. They have been incorporated in this special issue of *Cartographica* by kind permission of Dr. Wellar, and the Steering Committee of Auto-Carto Six.

DAVID H. DOUGLAS
University of Ottawa/Ottawa/Canada
July 1984

KEYNOTE ADDRESS AT THE OPENING SESSION OF AUTO-CARTO VI, OTTAWA, CANADA ON 16 OCTOBER 1983

PROFESSOR F.J. ORMELING, *President, International Cartographic Association*

Mr Chairman, Ladies and Gentlemen

MAY I THANK YOU for your kind introduction and also for your invitation to address the opening session of Autocarto VI. I am in fact honoured by your invitation. I have to confess, however, that I hesitated before venturing to accept. It is to some degree an act of folly for a person like myself, born before WWI, with no practical experience in computer-assisted cartography, to address a predominantly young audience, eager to conquer the world with the computer. I realize that my appearance requires some justification. As Autocarto VI is dealing with maps, it seems reasonable that somebody representing the cartographic world should take part in the opening ceremony. The cartographic world is embodied in the International Cartographic Association (ICA) which was initiated in the 1950s by European cartographers and founded in Bern in 1959. The Association, to which 60 countries adhere as members, brings together cartographers with different backgrounds and experience, scientific or theoretical cartographers, applied or practical cartographers or map producers, map authors, educators and publishers. Its corporate life shows a high frequency of well-attended biennial conferences and seminars. In its 24 years the ICA has established a series of working commissions which have been active in various theoretical and practical fields of interest among which can be found computer-assisted cartography. In the mid-1970s the ICA abandoned its predominantly western orientation and in recognition of our collective responsibility for the promotion of cartography in developing countries adopted the so-called Third World Policy. This resulted in the organization of a series of ICA seminars in developing countries on specific subjects as requested by the host countries.

The foundation of the Association was, as it were, the crowning of a long evolution in which cartography, outgrowing its mother disciplines geodesy and geography, developed from a craft into a sophisticated profession increasingly based upon scientific theory.

Together with cosmographers, geographers, surveyors, etc., cartographers have applied their skills to map making, i.e., to the display of spatial data for the

past 3000 years, though the name 'cartographer' only became the fashion in the middle of last century. Dr Helen Wallis has concluded that the famous mapmakers of the past such as Mercator, Ortelius or Bleau thus did not know they were cartographers!

As a group, cartographers have served as the final link of the mapping chain performing an intermediary function between the data collectors, the surveyors, the earth scientists, the statisticians, the pre-map producers, and the sensors on the one hand and the map users on the other. Generally cartographers are known as quiet back-room boys, who carry out what they are told to do, betraying a practical on-the-job orientation. They have served and disserved mankind in divergent situations. They paved the way for all conquerors and invaders from Alexander the Great up to Hitler, for all generals in the offensive or defensive, for all missionaries and pilgrims, for discoverers and seafarers. There is plenty of evidence in history that without their assistance things go definitely wrong. The French plans to build the Panama Canal 100 years ago failed due to a lack of topographic information of the isthmus. If Maréchal Grouchy had not lost his way and got his troops to his emperor in time, Napoleon might not have met his Waterloo in 1815. With good maps Moses could have easily crossed the Sinai desert in a few weeks instead of 40 years! So cartographers should be involved when it really matters!

The second justification for my appearance lies in the fact that Autocarto deals with the applications of computers in map production. Though developments in computer-assisted cartography started in the mid-1950s, the first display of a semi-automated cartographic production system to an international professional audience took place so to say on the ICA premises during its second Conference in London/Edinburgh in 1964. It was here that the prototype of the Oxford System of Automated Cartography designed by Bickmore and Boyle was demonstrated. The demonstration created a sensation among the cartographers of my generation, which may be best illustrated by the example of my personal situation. At that time I happened to be involved in atlas production in private cartography, working on a school atlas edition which had an impressive record of more than 90 years. Before my time, in 1930, my firm had decided to replace the unwieldy lithographic stones on which the atlas maps were engraved, by drawing card i.e., drawing paper mounted on zinc or aluminium. The total replacement took 9 atlas editions spread over more than 30 years. Shortly before the demonstration of the Oxford system the last map made on lithographic stone disappeared from the atlas. When confronted with the Oxford configuration a few months later I felt like a real Stone Age man awakened by the noise of an airplane and I was relieved when Bickmore's machine did not function properly and came to a stand-still during the demonstration.

The computer hit cartography in a period full of transformation. The almost explosive demand for maps during and particularly after WWII caused by the reconstruction of war damage over huge areas, the opening up and the economic development of Third World countries and the growing necessity in densely-populated areas for regional planning started a chain of developments, characterized on the one side by an avalanche of innovations in existing map production

technology, difficult in itself to accommodate, and on the other side by an increasing reflection and discussion on the essence of cartography and its theoretical basis. This manifested itself in a swelling stream of cartographic literature, in the initiation of cartographic journals, the formation of national cartographic societies and of an international umbrella organisation, the ICA. Moreover, due to an increasing involvement in peaceful tasks in serving urban and regional planning, civil administration, education, tourism, etc., a diversification of map production took place into sub-fields of narrower specialisation such as urban mapping, regional planning cartography, land use mapping, educational cartography, tourist cartography etc., each with its own map-using public and its own specific challenges. On the eve of the entry of the computer the statement could have already been made that never before in a comparable time unit in the history of cartography, had the discipline advanced more quickly, both theoretically and technically.

Cartographers of that time, mostly renegade civil engineers, surveyors and geographers, the latter category equipped with a the narrow mathematical background, were hardly prepared for the new technology. The few academic cartographers, employed in geographic departments of universities were largely absorbed in the 1960s by the study of cartographic communication, introduced by the Czechoslovakian scientist Koláčný, and by the search for a scientific theory to serve as a basis of Cartography as a separate, distinct discipline. Besides neither cartographic terminology nor its methodology were ready for the computer era. Because of the long evolution of map production the professional jargon contained in it a preponderance of local usage, in-house terms, trade names and ambiguous descriptions.

Even on a national level cartographers often did not have a consistent and accepted terminology such as found out by Dr. Meynen, who tried to coordinate the basic technical terms in cartography of the principal ICA languages. The result of his effort was the *Multilingual Dictionary of Technical Terms in Cartography,* published in 1973; a second, much-improved edition, will appear in 1984.

These were the reasons that only slowly and with only some exceptions few cartographers were involved at the outset of computer mapping and that, for the most part, university teaching and government mapping agencies, and especially private firms remained unaffected by the development during the 1960s. Meteorologists, geophysicists, geochemists, even astronomers assisted by computer scientists and engineers, i.e., individuals with no training in cartography were the main innovators in computer-assisted cartography. It is interesting to observe that a similar development took place in geography where in the 1950s mathematical methods and techniques were elaborated by economists, regional scientists and statisticians and where it took some time before the geographers moved in.

Cartographers are indebted to computer scientists and engineers for their inventiveness and originality. They presented a challenge to cartographers to make effective and efficient use of their new technology and opened up vistas of an era in which maps will play an increasingly important role than in the past. Regrettably, the computer mappers of the first hour (and later!) made the

mistake of disregarding the cartographer's long experience in design, which got them the reputation of making poorly legible maps. Indeed, the lack of sensitivity towards perceptual outcome is unforgivable as it affects that main function of a map to communicate spatial information. Map design is a vital part of the cartographic process. It is a speciality that covers various areas of knowledge. A map designer should have a good understanding of the graphic elements: clarity and legibility, visual contrast, figure-ground distinction, balance, visual hierarchy, colour, pattern and typography. Further, he should be aware of the conditions affecting the communication processes: user requirements, anticipated level of understanding, circumstances of use, technical possibilities, costs, etc. Today, we know, thanks to the computer itself which facilitates experimentation in graphic design, that a compatible blend of computer controlled technology and graphic art can be achieved, resulting in good readable maps, provided both parties understand each other's language.

In modern psychology phobic patients are cured by so-called 'behavior modification' i.e., by gradually exposing them to the feared situation. The recovery process of the cartographers suffering from computerphobia was enacted along the same lines. Gradually in the 1970s the notion broke of the great potentials of the application of computer technology to mapping and of the urgent need for cartographers to acquire new skills to equip them for the new challenges.

In the 1970s universities and other educational institutions gradually accepted the consequences of the advance of computer-assisted cartography and of the growing potential of remote sensing imagery for mapping. Though there is still great diversity in cartographic education a number of departments in Europe and America have considerably broadened their curricula. Gradually the traditional cartographer is being replaced by an expert of more modern stature. The problem thereby is that the range of subjects to be studied by the 'ideal cartographer' – from statistics to geographical analysis, from mapping fundamentals to remote sensing, from display psychology to computer sciences, operations and budget management inevitably spreads the curriculum beyond the boundaries of single departments or faculties. Another consequence is that it is impossible to maintain the traditional model of post-graduate cartographic specialisation on the basis of geography or geodesy while students at the same time have to take less relevant elements of the undergraduate mother disciplines. The introduction of new subjects in the curriculum requires an earlier start of the specialisation in under-graduate education years or, in other words, cartographic education seems to gravitate towards degree courses where cartography is regarded right from the start as a special subject equivalent to geography or geodesy and not as one of their specialisations.

The interest in the new technology does not make a stand at the shores of the Mediterranean or the Gulf of Mexico. There is plenty of evidence that various countries such as Indonesia, China, India, Mexico, etc., despite their well-trained and cheap labour, are looking towards computers to solve their arrears in mapping and inventorying natural resources. At Bakosurtanal in Indonesia a Comarc system with two work-stations is in operation.

Mexico is employing several work-stations of the Intergraph type and to mention only a few examples – in China recently a Computer Vision Interact IV system was installed for soil mapping. India, Nigeria, China and Indonesia are gaining experience in remote sensing application. Moreover, according to cartographers working in Third World countries there is already much more computer capacity available in developing countries than generally assumed. Hundreds of Third World students in geodesy, photogrammetry and/or cartography are swarming into educational institutes in Europe and America where they are exposed to the new technology. To restrain them from becoming hooked on the subject of computer-assisted cartography would only perpetuate the gulf between the industrialised countries and the Third World. It would be almost criminal not to expose them. For the present the frustration of these Third World students who, after completion of their studies, return to their sceptical homeland environment, which might be untouched by the new technology, has to be accepted. In the meantime the development of microcomputers has radically altered the costs and availability of computer technology in developing nations.

My former Institute, the ITC, Netherlands, represented here by various former students is reasonably equipped with computer hardware. Despite criticism of those who believe that sophisticated technology is not appropriate for developing countries, ITC since 1972 has offered its predominantly Third World cartography students (300 in the last 10 years) introductions to computer-assisted cartography at three different levels: technician, technologist and post-graduate; options to specialize are offered to the latter two. All cartography courses are concluded by final projects of 6 – 8 weeks duration in which students are offered experimental experience in the subject. It is indicative of their interest that in the last three years about one-third of the final projects contained components of automated cartography.

It speaks well for the International Cartographic Association in that it established a special commission on Automation in Cartography as early as 1964. It was this Commission, under a series of chairmen of US nationality, that contributed highly to the dissemination of computer processing techniques in mapping to ICA member countries. It organised a series of successful seminars in Madrid, Frankfurt, Paris, Budapest, Enschede, and published a *Glossary of terms in computer-assisted cartography,* the third edition of which, with versions in English and French, compiled by Dean Edson and Jean Denégre was printed by ACSM in 1980. Further, the commission put into practice the Third World Policy of the Association by organising seminars in, sucessively, Kenya (1978), Indonesia (1980), China (1981) with the prospect of a fourth one to be held in India, Dehra Dun in November 1983.

It will be clear that the programmes presented during these seminars vary with location. In countries with little or no experience in computer-assisted cartography, elementary introductions are offered in its terminology, its technology, its advantages and dangers measured in financial and social terms, the acquisition of data and the problems of its implementation in a traditional map production environment. In other countries where computer installations have been ac-

quired and experience has been gained in topo-mapping, remote sensing applications and marine charting the approach is different and a number of management engineering problems such as the integration and effective coordination of digital, reprographic and manual operations or the structure and implementation of cartographic data bases (problems which all organisations engaged in digital mapping have to face today), are addressed. Curiously enough, few appreciate this kind of pioneer work and, therefore, its funding remains a continuous point of concern. So far participating foreign lecturers, recruited from technically advanced countries were generously sponsored by their respective institutions while the host country offered them free accommodation. As for the Kenya seminar, we managed to generate the interest of the Swedish government which supplied funds for sending automatic equipment of Scandinavian origin and technicians for demonstration purposes in Nairobi, the first automatic plotter ever on display in black Africa. With its vast network of contacts with governmental and non-governmental bodies, the ICA, in the role of co-organiser, catalyst and fund raiser, will not hesitate to pursue these Third World seminars. It is encouraging to realise that Autocarto VI has special sessions dealing with the applicability of computer-assisted cartography to developing nations, including new and innovated use of microcomputer technology.

It is a well known fact that topographic mapping together with aeronautical and marine charting has been undergoing computerization longer than any other area in cartography. In these sectors the purpose of applying computer technology is primarily to replicate existing standard map sheets faster and cheaper, without changing their basic designs. In my opinion, more interesting applications of computer-assisted cartography are found in thematic cartography. From a designer's point of view this branch has always been considered exceptional as each thematic map requires new groundwork, a new mental plan, new generalization and symbolization and is a new challenge. The long-winded process of producing these maps, however, has formed an obstacle for its wide utilisation in the past. Moreover, their loss of elementary data accuracy, their liability to erroneous reading and to rapid obsolescence in this seething world have caused scepticism towards thematic maps by economists, regional scientists and statisticians. Planners, social scientists, politicians and others whose effectiveness often depends upon the availability of quick, up-to-date information had similar prejudices. Even geographers, twin brothers of cartographers of old, turned away from maps.

Computer-assisted cartography has contributed considerably to an improvement in the prestige of thematic maps. It not only increased the speed of their production but it also widened the horizon of thematic cartography by providing the ability to make a great range of unconventional maps on an ad-hoc basis, on local or personal demand, all of which was inconceivable in the traditional production environment. I mention a few: three-dimensional perspective views, classless choropleth maps, dynamic maps showing the time dimension, prism maps, enhanced images resulting from processing remotely sensed data etc., all, if desired, in temporary form, portrayed on CRTs or as hard copy maps. Further, the computer brought correlations of map elements within reach, the use of

which undoubtedly will be extended as more compatible cartographic and statistical data bases become available; it also allowed the selection of topographical background and facilitated last-minute changes.

Nearly all the above-mentioned sub-fields of cartography – regional planning cartography, census mapping, environmental mapping, and land-use mapping – are affected by these developments though not to the same degree. In general, there is still a great difference between the production environment in governmental mapping where computer-assisted cartography has been implemented fastest and in private cartography which has not exposed itself to the hazards of experiments in computer-assisted cartography and has been watching the innovations from a safe distance. In private cartography there is one branch that is barely touched by automation and that is my old field of educational or school cartography. In Western Europe this branch is a well-established, century-old industry, closely associated with the solid tradition of geography in the European educational system. In most European countries different types of school atlases are in use for the various age groups of students in elementary and high school systems. As atlases are required publications in high schools, student atlas sales are generally impressive. My former employer still sells some 250,000 atlas copies a year of his three atlas types. In West Germany, the leading high school atlas annually sells some 400,000 copies. Most impressive figures are known from the USSR where geography ranks high in the school curriculum. From their very nature, school atlases with their great number of maps (500 and more in one atlas is no exception), most of them thematic and predominantly socio-economic, from distinct locations from the entire world, at different scales and originating from quite diverse data collected independently and for a different purpose, do not readily lend themselves to computerization. A few firms, however, have moved into the field of computer-assisted cartography and interesting developments may be expected. One may assume that private cartography may profit from the experiences of governmental agencies and will adapt quickly.

In making an attempt to sum up the effects of computer technology from the cartographer's point of view, therby recapitulating what has been said by others, I have arrived at the following conclusions:

- In various aspects the advance of computer technology has been a blessing in disguise for cartography. It can be reasonably expected that we are on the threshold of an era in which thematic maps will play an increasingly important and wider role as research and planning tools as in the past.
- There can be no doubt that the computer has forced cartography to define its terms and procedures to a degree of precision never before necessary. Also, cartographic methodology has had to be reduced to a finite number of precisely defined steps. The necessity to consider and analyse each step logically has contributed to the theoretical basis of cartography and to the emergence of cartography as a separate discipline.
- The computer had a strange effect on the individual cartographer and he liked it. The modest backroom boy gained in self-confidence, moving to a foreground position, ready to defend the territory on which he has worked for centuries.

• The new procedures facilitate graphic design experiments and also facilitate the production of test material for perception experiments, demanding numerous map forms differing from one another.
• The technology has considerably broadened and deepened cartography education. Within the last decade well-qualified cartographers have appeared on the map production scene who are increasingly competent discussion partners for computer scientists.
• The advance of computer technology and remote sensing has had an impact on cartography's relationship to allied disciplines. The boundaries between specialists responsible for collecting, processing and graphically displaying information have become blurred while the sense of joint responsibility between geodesists, photogrammetrists, cartographers, computer scientists, image analysts, and earth scientists has increased.
• The new responsibilities have expanded the scope of cartography. Cartographers are grasping the role of being collectors and manipulators of all spatial data which can, if required, be depicted in the form of maps. Further, they are looking forward to the role of coordinator-stimulator in architecturing cartographic data bases or geographical information systems, considered an essential condition for further proliferation of the new technology.
• Computer-assisted cartography has removed many prejudices of planners, regional scientists and statisticians about maps. It has also led to a revival of interest in maps by geographers, for whom the combination of cartographic thinking assisted by remote sensing and interactive methods provide creative means for geographic analysis. The rapprochement with geographers is the more important as the cooperation of the various geographical disciplines next to the computer scientist, is required in the dialogue on information systems, particularly for the selection of environmental data elements to be stored in the data base.

The third and last reason why I gladly accepted the invitation to address this meeting is to express the ICA's concern for the fragmentation of global cartographic congress and seminar activity and the resulting dispersion of labour and costs. It is caused by the tremendous proliferation of international organizations which according to their aims and objectives are bound to hold conferences, seminars, workshops, symposia, etc. in the quest for the development of the science and technology of cartography. Governmental organizations such as the United Nations, the Pan-American Institute for Geography and History, and the African Association for Cartography follow the UN's broad interpretation of cartography from Doppler up to Cromalin proof.

Only occasionally they move into specialized fields such as illustrated by the UN Seminar on Thematic Mapping in Moscow last month. The non-governmental organizations such as the FIG, ISPRS, ICA, IAG, etc. are sectoral by nature and deal with specialized subject matter within the broad field of cartography as defined by the UN. The meetings under the heading Autocarto, its younger counterparts Eurocarto and Austracarto, the first of which will be held in conjunction with the 12th ICA Conference in Perth, Australia next year, initiated by national organizations and/or individuals belong to the same cate-

gory. The list could be easily supplemented by conferences on a national basis with international visitors.

The total selection of conferences, international and regional, is overwhelming and presents a burden to individual experts, to their institutions and governments supposed to finance their expenses and to commercial exhibitors. The scene is further complicated by the appearance of the National Computer Graphic Associations in various countries and the covering World Computer Graphics Association with their expanding foreign conference schedule focussing on the application of computer graphics to a variety of businesses and industries including cartography.

It is generally accepted that these conferences have partly overlapping elements and duplicating programme components, drain away each others participants and talented speakers and in short compete with one another. The ICA is of the opinion – and I am saying this from 25 years' experience in international conference activity – that steps should be taken to encourage governmental and non-governmental bodies to coordinate conference calendars and programmes to avoid congestion, duplication and competition and to join forces wherever possible.

Countries supporting by means of their membership the role of international professional organizations as forums for discussion should especially not launch any competitive international undertakings. The discussion going on between FIG, ICA, ISPRS to arrive at a better conference schedule, between ICA and the initiators of Eurocarto, the incorporation of Austracarto within the ICA Conference and the ICA's representation at Autocarto VI opening ceremony are indications that competitive elements are giving way to more coordination and cooperation. It is a pleasure to realise that Autocarto VI is a truly cooperative effort of the entire Canadian cartographic community with a strong international flavour and that ICA is one of the co-sponsors of this meeting. May this budding sense of cooperation and togetherness be strengthened during this conference!