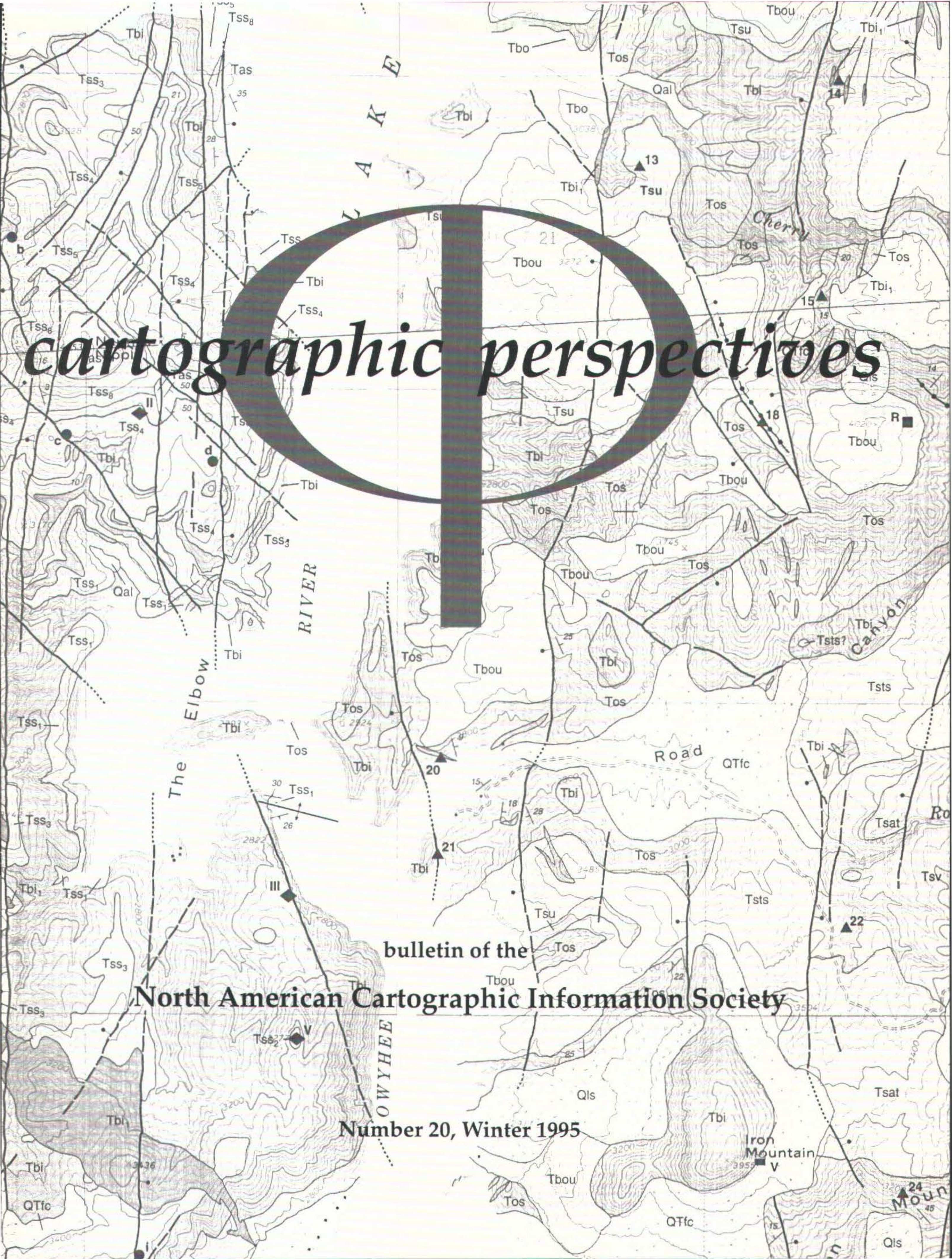

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messages

MESSAGE FROM THE PRESIDENT

Having just completed what many have reported was a most successful meeting with the Canadian Cartographic Association, we might find some useful operational ideas by examining one aspect of the structure of our most successful sister organization.

At its inception, the CCA tried to identify itself with what was considered at the time a broader definition of cartography, one that included all stages of evaluation, compilation, design, production, and uses of maps. It also tried to provide a common professional home not only for groups of cartographers that were not attracted to the then existing professional organizations but also to those who were: surveyors, topographic and government mappers, geographers, and map librarians. These "unfranchised" professionals included those with interests in historical, mathematical and thematic cartography, those in the private sector outside of Ontario, and those doing research, working with statistical data, and computers (Gutsell 1975).

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This commitment to a diversity of cartographic interests was reflected structurally in the creation of five Interest Groups labeled: Historical Cartography, Cartographic Education, Map Design and Production, Map Use, and Technology. As times have changed, the names have evolved into the present History of Cartography, Education, Map Design and Use, and Technology (Cartouche 1994, no. 13 and 19).

There have been several advantages of this structure. The Chairs of the respective Interest Groups are part of the Board of Directors and thus are at the center of the discussions which guide the workings and shape the policies of the Association. As Chairs, these people are also charged with the responsibility of making periodic reports to the membership on their interest area, as in the newsletter *Cartouche*, and in organizing a session at each annual meeting. They are also encouraged to organize in their geographic area shorter gatherings, such as a one-day workshop or evening talk, so as to provide members with opportunities to meet professionally at other times and places than at the venue of the Annual Meeting. In this way, the CCA has been able to represent cartographic interests and foster professional activities all across Canada and throughout the year often with a minimum of resources. In a way, the Interest Group Chairs are also the geographically distributed representatives of and contacts for the Association with its membership.

At the individual level, members who stand for election as Interest Group Chairs are asked to briefly describe how they might stimulate activity in some aspect of cartography or in the study or use of maps. Clearly, their statements of intent are important considerations in their election and, more important, it gives those elected some direction and purpose at the very beginning of their terms of office even though they may end up doing something quite different. Optimally, they may call attention to another way of considering some aspect of our subject and thus provide a focus area to which others may wish to contribute.

There are also some disadvantages to an interest group structure. Most revolve around the facts that (1) people don't divide easily into definite interests and (2) as fashion and technology changes, the Interest Group names may appear to no longer match the real concerns of members.

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about the cover

The cover for this issue was designed and produced by James E. Meacham of the InfoGraphics Laboratory in the Dept. of Geography at the Univ. of Oregon. A portion the *The Elbow Quad, Oregon* geology map was scanned as a 300dpi gray scale TIFF file using Ofoto software and imported into Adobe Photoshop (see pages 56-59 for a discussion of the methods used to produce the map). The image brightness was adjusted in Photoshop and its size was enlarged to 105% and cropped to final size with a bleed on three sides. The TIFF file was placed in an Aldus FreeHand file that contained the *CP* logo and text. "Paste Inside" was used to fill the image inside the *CP* logo and the "pen tool" was used to create masks to knockout the fault lines behind the cover text. The negative was created on a Linotronics L300 imagesetter with a 150 lpi screen at a 45 degree angle and a 0.125 inch bleed.

A Forward to Electronic Atlases: National and Regional Applications

A special session was organized on "Electronic Atlases: National and Regional Applications" at the 1994 ASPRS / ACSM Annual Convention in Reno, Nevada. The theme evolved from a previously successful joint seminar on "Atlas and Spatial Data in Electronic Formats of Presentation: Production, Use, Analysis, and Education" held in the spring of 1993 in Visegrád, Hungary. The 1993 seminar was sponsored by three Commissions of the International Cartographic Association (ICA): the Commission on Education and Training (CET); the Commission on National and Regional Atlases (CNRA); and the Commission on Map and Spatial Data Use (CMSDU).

The papers published in this issue of *Cartographic Perspectives* were presented at the Reno session. Dr. Bengt Rystedt from the National Land Survey of Sweden and Chairman of the CNRA moderated the atlas session. Dr. Rystedt led the presentations with his views on "Current Trends in Electronic Atlas Production." Automated atlas production techniques have been a continuing theme of the CNRA, and in his paper Dr. Rystedt emphasizes recent technological developments such as multimedia applications, a shift from workstation to PC hardware platforms, and improved user interfaces.

Professor Ferjan Ormeling from the University of Utrecht (and Co-Chair of the CET) discusses "New Forms, Concepts, and Structures for European National Atlases." Professor Ormeling reports on shifts to non-traditional forms of presentation and use. For example, he discusses the evolution of electronic atlases, recent CD-ROM media, and access of national atlases through on-line services. Readers are tempted to explore electronic atlas tools which have greater user participation.

The technical nature of these papers and the diversity of their utility to designers and producers of maps and atlases is timely.

Dr. Peter Keller from the University of Victoria introduces the transition from traditional to digital atlases and National Atlas Information Systems in his paper on "Visualizing Digital Atlas Information Products and the User Perspective." Dr. Keller observes that users want to perform more comparisons with data which previously had not been available in traditional atlases. He challenges atlas designers and producers to maximize the potential of new atlas forms and release themselves from the limitations of the traditional atlas. Dr. Keller warns of balancing conceptualization against user requirements and fiscal responsibility.

Dr. Ute Dymon from Kent State University discusses the notion of using electronic atlases for educational purposes. Her paper, "The Potential of Electronic Atlases for Geographic Education," explores the possibilities of using electronic atlases to develop higher order thinking skills.

Dr. Richard Smith and Mr. Thomas Parker from the University of Arkansas compare electronic atlas producers in terms of their mission, sales, and barriers to production in their paper "An Electronic Atlas Authoring System." They also provide guidance on creating an Atlas Authoring System based on their own experiences in this evolving technology.

Dr. Joel Morrison from the U.S. Geological Survey in his paper, "A Personalized National Atlas of the United States," conceptualizes a U.S. National Atlas Program. Dr. Morrison envisions a joint effort between government, industry, and academia. One notion is a National Atlas as a subset within the National Spatial Data Infrastructure (NSDI). Electronic atlas media suggests standards, maintenance, and network requirements. Dr. Morrison offers a sample of functional capabilities that enhance user interaction and applications.

Fast changing work environments beg for guidance on matters that ease transition and embrace the application and power of evolving technologies.

The technical nature of these papers and the diversity of their utility to designers and producers of maps and atlases is timely. Fast changing work environments beg for guidance on matters that ease transition and embrace the application and power of evolving technologies. The ICA Commission on National and Regional Atlases is pleased to have the opportunity to publish these resourceful articles in ***Cartographic Perspectives*** and we thank the Editorial Board of the North American Cartographic Information Society for their support in disseminating the CNRA's atlas perspectives.

Timothy Trainor
U.S. Representative to the ICA Commission on National and Regional Atlases

EDITOR'S NOTE

We are pleased to be able to present these papers from the 1994 ASPRS/ ACSM Annual Conference special session on "Electronic Atlases: National and Regional Applications." The idea to publish this collection of articles in ***Cartographic Perspectives*** was proposed by Professor Ute Dymon of Kent State University. The editorial staff of ***Cartographic Perspectives*** is very appreciative of Professor Dymon's assistance in initiating this idea, soliciting the papers, and making certain that the authors met deadlines.

A number of papers on electronic and multimedia atlases have been presented at national and international geographic and cartographic conferences over the past few years. The result has been an increase in the research, interest, and development of such products. For many of us, our cartographic experiences and expertise lie in printed maps. Digital publishing of cartographic products requires that we take a fresh look at how we design and communicate geographic information and how we package these new map products.

It is important that our professional journals provide a forum for these ideas. In our last issue of ***Cartographic Perspectives*** (issue #19) we published five articles that related to the use of multimedia in cartography. The six articles in this current issue are organized around the specific theme of atlases. They represents just some of the ideas and concepts the cartographic community should address as we begin to make advances in digital atlas production. We hope this issue provides useful information and ideas that, in turn, promote further research and activity in this area.

Sona Karentz Andrews
*Editor, **Cartographic Perspectives***

❑

Current Trends in Electronic Atlas Production

Electronic atlases have the potential to add a new dimension to the use of atlas information. An electronic version can contain data and software to produce maps not possible in book form. They can serve as a preliminary stage to Atlas Information Systems and can also form the core of a multimedia system. The ICA commission on national atlases was formed at the 13th International Cartographic Conference in Morelia, Mexico in 1987 to serve as a forum for electronic atlas conception and production. Electronic atlases have been a topic at every commission meeting ever since. The observations presented in this paper are findings from these meetings.

Bengt Rystedt

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INTRODUCTION

By "electronic atlas," we understand a new form of atlases. However, it is not intended to replace the traditional printed atlas. Rather, an electronic atlas will add a new dimension to the use of atlas information. The electronic version can contain data and software to produce maps which are not possible in book form. An electronic atlas can also be seen as a preliminary stage to Atlas Information Systems for different applications in national and regional land use planning. The atlas information can also form the core of a multimedia system, with animated time series information. For these reasons, it is important to devote special efforts to explore the idea of electronic atlases and to disseminate atlas information in digital form.

The term "electronic atlas" was created by Eva Siekierska (1983) and further promoted at AutoCarto London in 1986. The term was adopted by the ICA Commission on National and Regional Atlases (CNRA), which was formed at the 13th International Cartographic Conference in Morelia, Mexico in 1987. Electronic atlases have been a topic at every commission meeting ever since.

MAIN TECHNICAL PLATFORMS

The first prototype of an electronic atlas was developed in Canada in 1982 and based on a Graphic Work Station. Since then the *Electronic Atlas of Canada* has evolved and is now based on a SUN computer platform using SUN-View windows with capabilities to be used both for production and presentation of atlas data. One reason for choosing that platform was a requirement to connect to the National Atlas Information Systems databases that were produced with ARC/INFO (Siekierska 1993).

A more popular platform is the IBM compatible DOS machine with data on CD-ROM. This platform holds promise to reach an interactive multimedia stage. A first step on this road was taken by Jack Massey (1987), who produced a software package called SUPERMAP with facilities to distribute and map census data by using an ordinary IBM compatible DOS machine and the new CD-ROM technology. Although many countries expressed interest in SUPERMAP's capabilities, this interest did not lead to widespread use. I think that one main obstacle was the census bureaus' hesitation to distribute census data at low resolutions. Another obstacle was the lack of base maps to be used as background maps for the statistical data.

The DOS platform serves two other electronic atlas products: the well-known *Electronic Atlas of Arkansas* (Smith 1987) which initially required an EGA graphics card and only 3 MB of disk space to store the maps and

Sweden's national atlas. In Sweden, the DOS platform was considered in a feasibility study conducted in 1986 (Rystedt 1987). The main reason for choosing an ordinary DOS platform was that the target user group was high school and secondary school students. On the other hand, in the Netherlands the Macintosh platform with HYPERCARD dominates (Ormeling and Koop 1990).[1]

At the commission meeting in Visegrád, Hungary, Aranaz (1993) reported that the project team of the *National Atlas of Spain* is in the final preparation of a pilot electronic atlas project. Two versions will be tested. Version A will be a high capacity videodisc with a touch screen interface. Version B will be made available on diskettes for use on DOS machines.

There is no doubt that both DOS and Macintosh, with data on CD-ROM, are suitable platforms for electronic atlases. It seems obvious that the direction on both platforms is towards multimedia. Fancy tools are included for public and school use, while more sophisticated graphics are provided to more distinguished users.

HARDWARE AND SOFTWARE

At the ICA National and Regional Atlases Commission meeting, held in Madrid, Spain from May 18-22, 1992, eight different electronic atlases were demonstrated. Documentation of the session can be found in the proceedings from this meeting. A summary of the characteristics of the atlases follows.

At the ICA National and Regional Atlases Commission meeting, held in Madrid, Spain from May 18-22, 1992, eight different electronic atlases were demonstrated.

Atlas of Biskaia presented by Benjamin Sabiron i Herrero, Instituto Geografía Aplicada, Spain.

> **Computer:** DOS with EGA Color monitor (VGA or super VGA preferable).
>
> **Software:** SPSS+STATGRAF and STATWORK; LOTUS 1-2-3, SYMPHONY and EXCEL; DBASE III; WORDSTAR and WORDPERFECT; PAINTBRUSH etc.
>
> **Cartography**: AUTOCAD 10.0, MAPINFO 4.6, and ERDAS 7.5.
>
> **Content:** 20 different themes at resolutions of 1:100,000 and 1:200,000.

The National Atlas Information System presented by Olev Koop, Cartography Section, Faculty of Geographical Sciences, University of Utrecht, The Netherlands.

> **Computer:** Apple Macintosh IIx.
>
> **Software:** HYPERCARD from Apple Computer and ORACLE to link remote data sources.
>
> **Concept:** Object orientation and Hypermedia.
>
> **Content:** 9 MB of data from the National Physical Planning Agency.

1. Ferjan Ormeling discusses this further in "New Forms, Concepts, and Structures for European National Atlases" on pages 12-20 in this issue of ***Cartographic Perspectives***.

Transport Atlas of The Southern North Sea presented by Olev Koop, Cartography Section, Faculty of Geographical Sciences, University of Utrecht, The Netherlands.

Computer: IBM PC or compatible with EGA or Hercules graphic card.

Software: Display program on a floppy disk.

Content: A cartographic model to make the information concerning water transport in a conventional atlas more readily accessible.

Electronic Atlas of Arkansas presented by Olev Koop, Cartography Section, Faculty of Geographical Sciences, University of Utrecht, The Netherlands.

Computer: IBM PC or compatible with EGA color graphics.

Software: Special program for searching and browsing.

Content: A traditional regional atlas with some 100 static raster maps.

The Multimedia Map of City of Madrid presented by Miguel Angel Bernabé, Department of Topographical Engineering and Cartography, Polytechnic University of Madrid, Spain.

Computer: Macintosh II ci 5/80 with 13" monitor or fx 8/80 with 21" monitor.

Software: HYPERCARD and the MacroMind package, QUICK TIME and QUARKXPRESS.

Content: The growth of Madrid from the foundation of the city by the Moslems in the ninth century until today.

Of the twelve electronic atlas products listed, two out of three are based on DOS/Windows platform and one out of three is based on the Macintosh Platform.

Territorial Evolution of Canada, a Hypermedia Map presented by Eva Siekierska, Geomatics Canada, Ottawa, Canada.

Computer: Macintosh LC or higher with a 13" RGB monitor.

Software: Package produced with MacroMind DIRECTOR.

Content: Animation of the territorial evolution of Canada.

GEOSCOPE-Global Change Encyclopedia presented by Réjean Simard and Luc Michaud, Canada Center for Remote Sensing, Ottawa, Canada.

Computer: IBM PC-AT or compatible with VGA and CD-ROM reader.

Software: Developed in the project with possibilities to use the encyclopedia in different modes.

Content: Global coverage of more than fifty parameters from various remote sensing satellites and other maps. The *Digital Chart of the World* serves as background.

The National Atlas of Canada presented by Eva Siekierska, Geomatics Canada, Ottawa, Canada.

This presentation, "Philosophy Behind a Multimedia Atlas of Canada" focused on the observations that an electronic atlas is a hypertext and the content is displayed in form of text, diagrams, images, and maps. This makes it very close to multimedia. *The National Atlas of Canada* contains forty-four different themes and is a magnificent database describing the nature and culture of Canada. The presentation assumed that this database will soon be available as an interactive electronic atlas based on multimedia, hypertext, and electronic networks.

At the National and Regional Atlases Commission meeting in Visegrád, Hungary in April, 1993, two other atlases were presented . . .

At the National and Regional Atlases Commission meeting in Visegrád, Hungary in April, 1993, two other atlases were presented:

Picture Atlas of the World presented by Betty Kotcher, National Geographic Society, Washington D.C., U.S.A.

Computer: IBM PS/2, DOS and VGA, CD-ROM and audio-adapter.

Software: IBM's LINKWAY.

Content: Physical, economic, and cultural geography of the world in the form of photos, video clips, statistics, and essays on every country.

The PC-Atlas of Sweden presented by Wolter Arnberg, Department of Geography, University of Stockholm, Sweden.

Computer: PC-DOS with EGA or higher and CD-ROM.

Software: Developed in the project. DBASE with import functions from MAPINFO and ARC/INFO, and export to EXCEL.

Content: Source data in accordance with the book form.

In the November 1994 issue of the magazine *CD-ROM World*, I found the following two products:

World Atlas 5.0 reviewed by Carol S. Holzberg.

> **Computer:** PC 386 or higher, DOS and Windows, SVGA and MPC-compatible sound card.
>
> **Software:** Property of the publisher: The Software Toolworks, Novato CA, U.S.A.
>
> **Content:** Topographic, statistical, and relief maps; photos and video clips from every country.

Map'n'Go advertised by DeLorme Mapping.

> **Computer:** MS-Windows compatible.
>
> **Software:** Property of DeLorme Mapping with functions for route planning and printing of travel plan maps.
>
> **Content:** North American road database, and place names; lists of restaurants, hotels, and tourist attractions.

Of the twelve electronic atlas products listed, two out of three are based on DOS/Windows platform and one out of three is based on the Macintosh Platform. It is also noticeable that many publishers of electronic atlases choose to produce their own software, although this seems to be more common for the DOS platform.

ELECTRONIC ATLAS PRODUCTION TOOLS

It is well-known that, before the production of a traditional atlas can begin, the atlas format has to be designed. This is, of course, also valid for electronic atlas production. Once the target user group and its needs have been defined, it is necessary to take a closer look at the electronic atlas user. Bakker, et al. (1988) did so by categorizing the electronic atlas users into the following four groups: professional users, educational users, private users, and commercial users.

The objectives, ambitions, and budget are also prerequisites for atlas design and its user interface. If the goal is to create a multimedia and interactive system, the design phase should be comparable to writing a scenario for a movie or play (Monmonier 1992). For that purpose, authoring software is needed. Although my knowledge in this field is limited, I do know of a course in multimedia production techniques at the University of Utrecht that used Macintosh-based HYPERCARD, AUTHORWARE PROFESSIONAL and MacroMind DIRECTOR (Köbben 1993). The lack of authoring tools for PCs has given some developers the opportunity to write one.[2]

The objectives, ambitions, and budget are also prerequisites for atlas design and its user interface.

The most important choice an electronic publisher has to make is between a DOS/WINDOWS, Macintosh, or UNIX platform. The ambition

2. Richard Smith and Thomas Parker discuss authoring tools in "An Electronic Atlas Authoring System" on pages 35-39 in this issue of ***Cartographic Perspectives***.

to make a production portable to all three platforms and their dialects is not recommended. Macintosh has nice tools, but in my opinion a DOS/ WINDOWS machine gives more flexibility, which may be needed to reach the objectives. The UNIX work station is for the very high end, professional user, who probably also uses the system for commercial production.

Once the platform has been chosen, the recommendation is to use standard tools for the cartographic presentation. At present, there is no need to do all the programming by yourself. However, the *PC-Atlas of Sweden* is a successful exception to this rule (Arnberg 1993).

CONCLUDING REMARKS

Although the electronic atlas will not replace the book form, it can complement printed atlases. With modern information technology electronic atlas production is rather easy today. There is also a great demand from the schools for electronic teaching materials. The *PC-Atlas of Sweden*, for example, sells well to high schools and secondary schools. The distribution of electronic atlases is growing at an exponential rate, and it will not take long until electronic atlases are readily available on the Internet.[3] Entrepreneurs in this field have great possibilities.

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[3]. For example, since the time that this paper was presented Geomatics Canada now provides National Atlas Information Service on the World Wide Web-server: http://www-nais.ccm.emr.ca.

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RESUMEN

Los atlas electrónicos tienen el potencial de añadir una nueva dimensión para el uso de la información de atlas. Una versión electrónica puede contener información y software para producir mapas que no serían posibles en el formato de libro. Pueden servir como paso preliminar para el Sistema de Información de Atlas y también pueden formar el núcleo para un sistema de información avanzada. La Comisión del ICA para atlas nacionales fue formada en la decimotercera Conferencia Cartográfica en Morelia, México en 1987 para servir como forum para la producción y concepción de atlas electrónicos. Las observaciones presentadas en este trabajo son resultados de estas reuniones.

SOMMAIRE

Les atlas électroniques ont le potentiel d'ajouter une nouvelle dimension à l'utilisation de l'information fournie par les atlas. Une version électronique peut contenir les données et le logiciel nécessaires à la production de cartes impossibles à réaliser sous forme livresque ; elle pourrait servir d'étape préliminaire à des systèmes d'information sur les atlas et former le noyau d'un système multimédiatique. La commission ICA (Conférence cartographique internationale) sur les atlas nationaux a été formée à Morelia (Mexique) en 1987, à l'occasion de la 13è Conférence cartographique internationale, pour servir de forum à la conception et à la production d'atlas électroniques. Le sujet des atlas électroniques a été débattu depuis lors à toutes les réunions de la commission. Les observations présentées dans le présent document relèvent de ces réunions.

New Forms, Concepts, and Structures for European National Atlases

Ferjan Ormeling

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After proposing definitions for "atlases," "national atlases," and "electronic atlases," this paper outlines the requirements for electronic national atlases produced in the 1990s. These requirements will then be compared with the actual national atlases produced in Europe between 1988 and 1994.

DEFINITIONS

The 1973 *Multilingual Dictionary of Technical Terms in Cartography* defines "atlases" as "collections of maps to be kept (bound or loose) in a volume" (ICA 1973). This definition is clearly no longer valid in the computer age, as it only addresses format and not atlas contents or objectives. A new edition of the dictionary might be ready for the ICA Barcelona conference in 1995, but in the meantime a definition adapted from the dictionary of the Netherlands Cartographic Society seems more appropriate. The proposed definition reads: "a systematic and coherent collection of geographical data, in analog or digital form, representing a particular area and one or more geographical phenomena, based on a narrative, together with tools for navigation, information retrieval, analysis and presentation" (Koop 1993). Here, the term "narrative" is crucial, for an atlas is an intentional combination of specific maps or data sets. This highlights the realization that an atlas is not objective but relies on a certain rhetoric; data set combinations and the specific resolution, themes, and default sequences selected are intentional.

. . . an atlas is an intentional combination of specific maps or data sets. . . [it] is not objective but relies on a certain rhetoric . . .

The function of the narrative is to increase the user's understanding of the information presented. With a logical sequence, it will be easier for the atlas-user to remember the information because a framework is created in which the user may store and accommodate new information (Van Elzakker 1993).

This same Dutch dictionary defines "electronic atlases" as "Information systems set up for the interactive consultation of digital geographic databases concerning a certain area or theme and containing data which are comparable in terms of the level of generalization and the resolution at which the data were collected" (Bos, et al. 1991). According to Van Elzakker (1993), electronic atlases have a characteristic capability for structuring the information flow. They differ from GISs in that they have an added narrative function that can be used for explanation. Van Elzakker therefore defines the electronic atlas as "computerized GIS-related to a certain area or theme in connection with a given purpose–with an additional narrative faculty in which maps play a dominant role." In short, according to this definition, electronic atlases are more than simply a GIS with a graphical user interface.

"National atlases," according to the *Multilingual Dictionary* (ICA 1973), are "Atlases that depict different aspects of one country." This definition seems a bit vague and meager now, but the new technologies allow us to concertize and expand it to assert that "national atlases" are "atlases containing a comprehensive combination of high-resolution geographical data sets that each completely cover the same country."

In general, one could ask if "atlases" is still a useful concept in the electronic age. The concept was first elaborated by Ortelius and Mercator in the 1570s as an optimal way of presenting and comparing geographical information, and it might be outdated by now, 400 years after Mercator's death. However, by adapting atlases' form to the present electronic potential so that they will be competitive with other electronic modes of presentation, "atlases" certainly remains a valid concept, as its major asset is its strength in comparing situations. Atlases are time machine and geography machine combined. Because of the specific processing of the data for atlases, various data sets have been made comparable: they have been processed so as to get the same resolution and the same degree of generalization. In short, their representation has been standardized. And this major feat, this modeling of geographical reality in a consistent way, which was conceived of in the 1570s, is as important as ever.

REQUIREMENTS

In a motion picture, single shots are only meaningful when they are combined with other shots and built into an edited sequence. Atlases work in the same way. It is through the sequence in which the maps are offered to the reader that the reader will gradually get a grasp of the new areas or themes. The sequence also works as the glue that combines the single "shots" into a meaningful whole. This is why it is so important that electronic atlases, that have no fixed sequence of presentation, still have the possibility of setting such sequences and repeating them at will. This calls for software functions that allow the user to develop customized presentation sequences of the maps contained in an electronic atlas, which may be based on something like the input of user objectives. After the user selects an area–the Midwest, for example–and some keywords–prairies, vegetation, precipitation, soils, wheat growing, silos, transportation, government aid–the atlas should be able to present the relevant maps sequentially and so produce a narrative that will explain the geographical patterns.

Atlases nowadays have to compete with TV-soaps and computer adventures which pose crucial questions such as "Will the hero be able to find true love," "Will he conquer evil," or "Will he solve the mystery?" (Lodge 1990). Cartographic counterparts of these crucial questions would be: "Does one control the environment in this region?" "How far is this country from an ideal situation?" "Do all inhabitants have equal access to the nation's resources?" or "Do people here have better chances at success than people elsewhere, and, if so, at what price?"

Atlases nowadays have to compete with TV-soaps and computer adventures which pose crucial questions such as "Will the hero be able to find true love," "Will he conquer evil," . . .

The potential of the digital environment remains insufficiently used when atlas information is not related to a specific objective like those enumerated above. However, information-objective connections can be made by constructing scenarios. In addition to creating a necessary structure, the purpose of such scenarios would be to provide navigation directives throughout the data sets. In fact, since a scenario generates a number of analogies the user can more easily identify with the information offered. Examples could be: "How do other people live as compared to us?" "What will we discover on our journey into those unknown areas?" or "How did our environment change over the last 100 years?"

Atlases are used to get at specific information, because they are interesting and entertaining to browse through, or because one is looking for something one cannot define. For all these kinds of atlas use, one needs directions in order to either trace out a route through the atlas, find one's

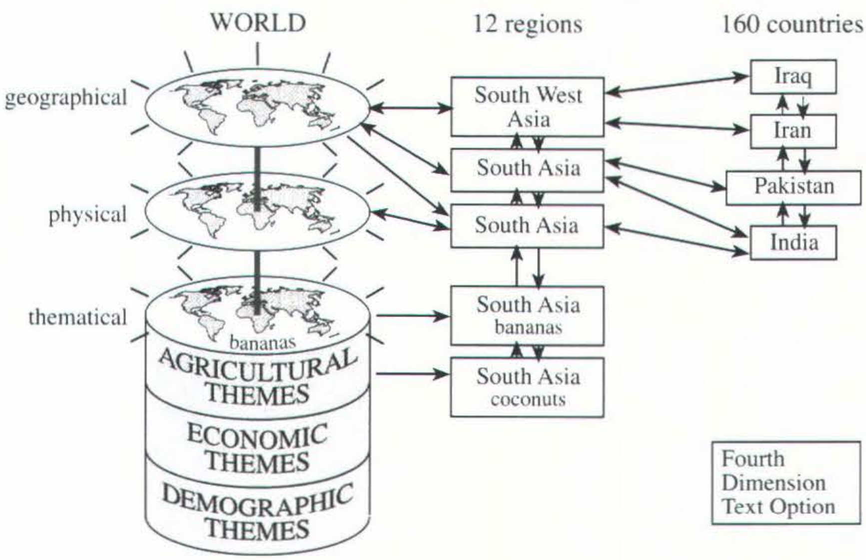


Figure 1 - Navigational aid proposed for Software Toolworks's World Atlas (Electromap), Novato, CA 1990, showing possible routes between maps with different scales and themes.

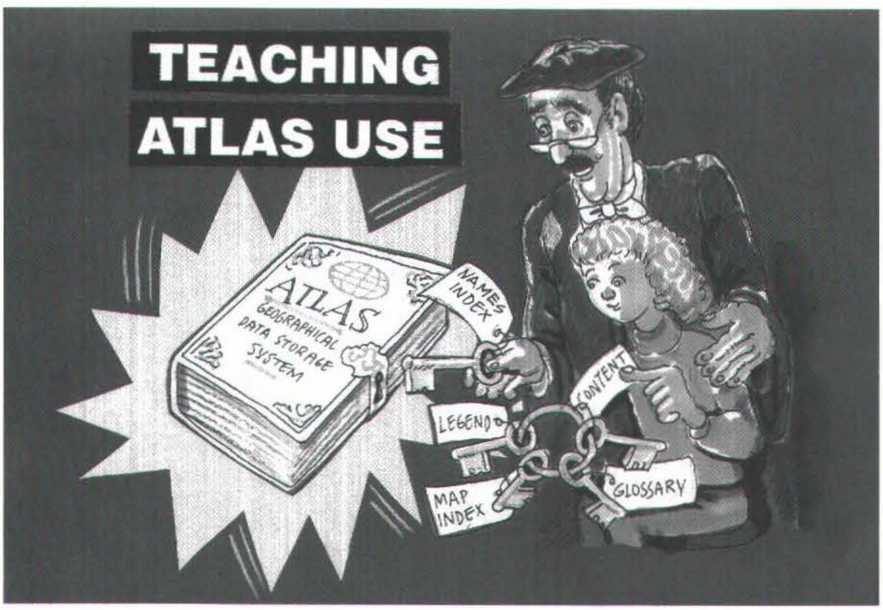


Figure 2 - Teaching atlas access (drawn by A. Lurvink).

bearing, or retrieve the atlas exit. Such directions can be presented in the form of a map. Figure 1 tries to show the available paths between regions, countries, and map themes and is an example of such a navigation map for an electronic atlas.

Teaching atlas use is mainly teaching atlas access techniques (see Figure 2) and map comparison techniques. There are vertical relationships in which situations at different times or for different topics are compared through juxtaposition or through some overlay technique. Although this type of comparison is relatively straightforward, it is more difficult to teach horizontal comparisons–that is, comparisons of similar situations that occur in different areas at the same time. Here, patterns are looked for, and here many transformations might be called for. All three forms of map comparison (see Figure 3) require a reduction of complexity; atlas use problems are primarily problems in reducing complexity in order to get the overall view needed. For example, there is a danger when the whole atlas area is not treated in the same way as happens in electronic atlases that have, for example, as much information stored for San Marino or the Vatican City as for Russia or China.

In order to analyze the structural aspects of atlases, it might be useful to look at the tools used for structuring. Here, one may discern:

- the scale tool–used to render more important areas at larger scales than less important areas
- the geographic sequence tool–used when areas that are deemed more important are presented earlier in the sequence than less important areas

- the topical sequence tool–suggests causal relationships between different geographical phenomena in the same area that are presented in a specific sequence

- the time machine–presents everything in a chronological sequence

- the windowing tool–allows for either close ups or overviews, establishes (as films do) the shots that provide the relationships between single individual shots

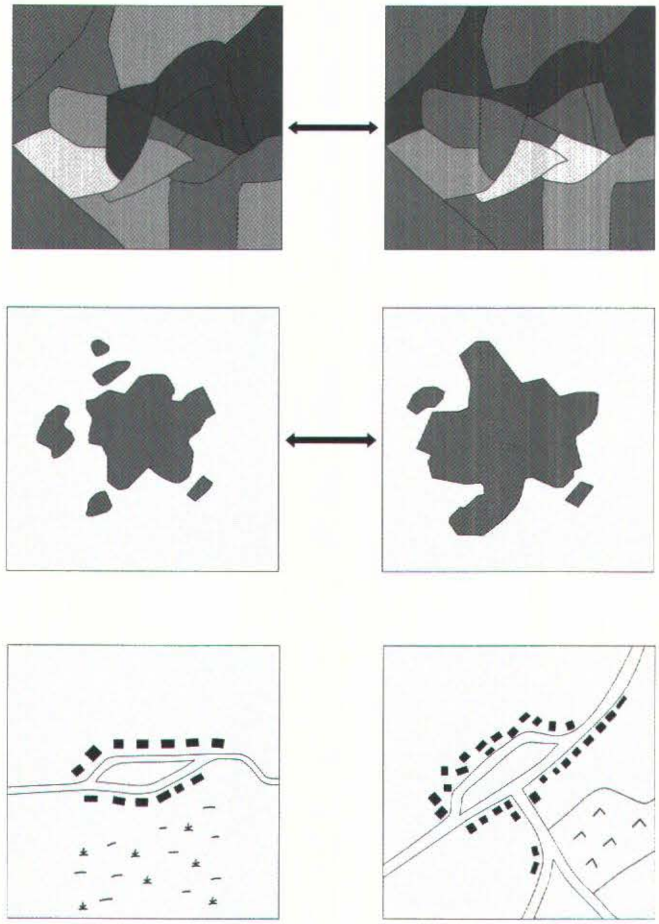
- color coding and graphical emphasis tools–used in order to establish a graphical hierarchy that translates the information hierarchy established

- the highlighting tool–increases the contrast between figure and background either temporarily (blinks) or constantly

- the layering tool–allows one to construct a specific cartographic image layer by layer, thus providing extra information (A good example is provided by the *InfoNation* electronic atlas [Electromap 1993].)

Apart from these structuring tools, reference mechanisms have been introduced into atlases. In addition to providing standard traditional reference information such as scale references, these tools alternate various views of the same area (like geographical and economical maps), provide coordinates, or provide references to places on the same longitude or latitude.

In order to access all the information stored in atlases, thematic and toponymical indexes have been developed. In electronic atlases, there are now search engines that allow one to touch an



Topical Comparison
Topic A (left)
Topic B (right)

Temporal Comparison
Year A (left)
Year B (right)

Geographical Comparison
Place A (left)
Place B (right)

Figure 3- Forms of map comparison possible in an atlas environment.

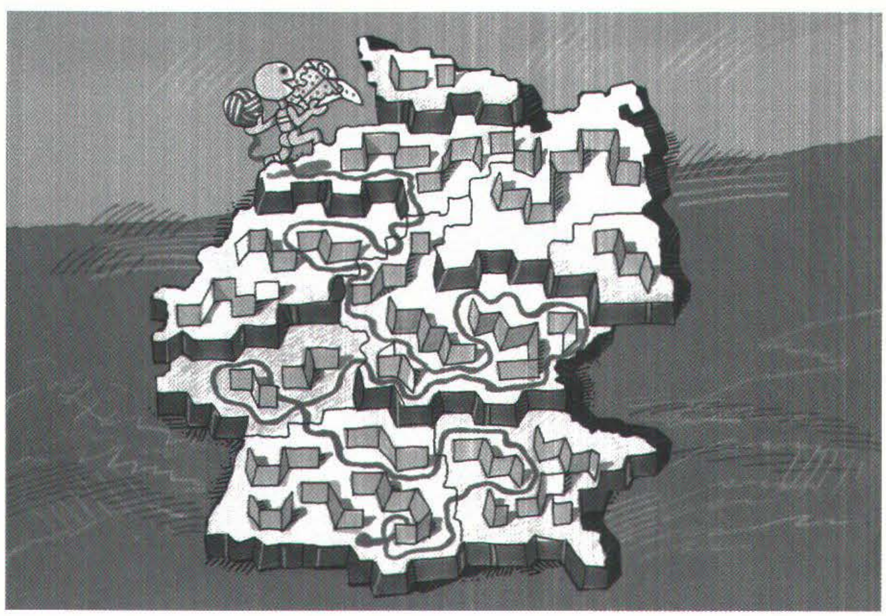


Figure 4 - Using Ariadne's thread in order to retrieve the exit in our current electronic atlases (drawn by A. Lurvink).

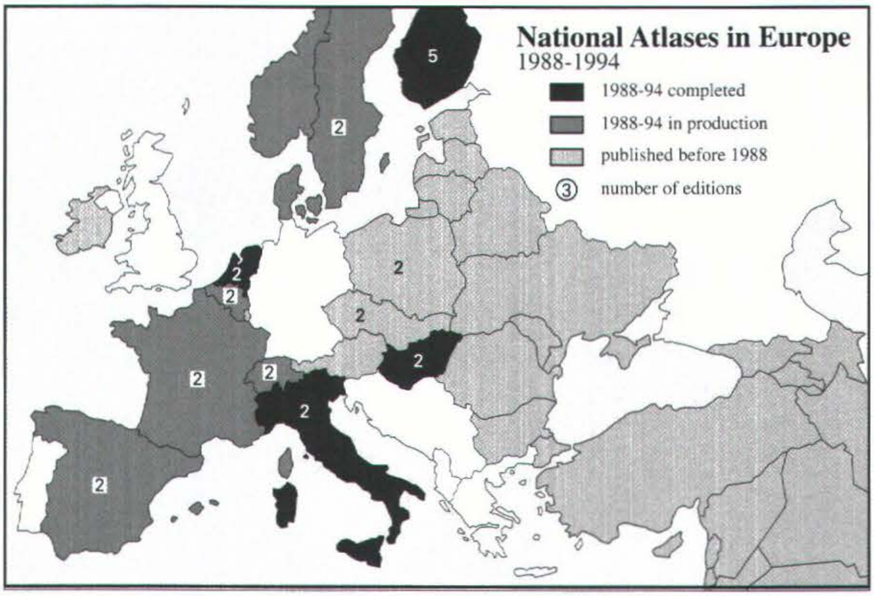


Figure 5 - Production of national atlases in Europe, 1988-1994.

object with one's cursor in order to have its name pop up, to type in a name in order to have the object highlighted, or to navigate through the atlas information in order to get at the specified item. The process for querying the atlas database and returning to one's initial position (see Figure 4, previous page) have been described at the ICA Cologne conference (Ormeling 1993).

RECENT EUROPEAN NATIONAL ATLASES

Armed with these definitions and concepts, a survey of recent European national atlases now seems possible. Figure 5 shows that, during the last six years, national atlases have been or currently are being produced for Belgium, Finland, France, Hungary, Italy, Netherlands, Norway, Spain, Sweden, and Switzerland. Some of these atlases (for Belgium, Hungary, and Italy) have been produced traditionally–in a manner similar to the *National Atlas of the United States* which was published in 1970. Some (for Finland, the Netherlands, and Switzerland) have been produced with interactive, computerized means but have been published in paper format. In other cases (for France, Spain, and Sweden), both paper and electronic editions were published. Norway's national atlas is the only example of an atlas which was intended to be published in both paper and digital form but which now is being produced as an on-line facility only.

TRADITIONAL ATLASES

Currently, even traditionally produced national atlases diverge in form and content from earlier national atlases. For example, the one produced for Hungary contains an extensive interpretative text for all maps, which describes the ways data have been processed as well as the resulting patterns. The second edition of the *National Atlas of Belgium* contains applied maps instead of the inventory maps of the first edition; it provides soil suitability maps instead of soil maps. In addition, problem-oriented map themes such as crime rates and unemployment, have been incorporated.

The objectives of national atlases have changed as well. For example, the main objective of the Hungarian atlas was to enable an evaluation of the environmental aspects of the economy in order to safeguard and improve the people's welfare. In fact, nearly all of the atlases discussed here aim at providing a basis for further research. For example, the main objective of the new Italian atlas is to visualize the radical changes that have transformed the country since the second world war into a post-industrial society. The atlas is oriented towards solving problems such as urbanization and environmental pollution. Another significant aspect can be seen in the descriptions of the map spreads, where there is a continuing reference to other maps with related themes or related patterns. By referencing maps of Europe or global maps, the atlas compares the situation of the Italians to the situations of the rest of the world's inhabitants. Finally, the Italian atlas is special in its provision of synthesis maps. One of its real strengths lies in showing temporal comparisons by using a series of consecutive maps. It also bears witness to the fact that national atlases need not be boring series of choropleth maps.

Thus, traditionally produced atlases already show important changes from traditional atlases. Most significantly, these atlases are problem oriented and people-oriented. They are not inventories of information but suggest answers to problems; they are not overviews of total production per category but statements on the welfare of the population and the environment. Moreover, these atlases are increasingly being produced for a larger, general audience rather than exclusively for restricted circles of scientists.

NEW FORMS OF NATIONAL ATLASES

The new generation of computer-assisted national atlases can be characterized by their greater accessibility and their focus on the country's inhabitants; only those aspect of the physical environment that are relevant to the people's welfare are addressed. In addition, atlases are no longer produced in heavy, unmanageable bindings but in sets of slim volumes, which can be acquired separately or in electronic form. The national atlas of the Netherlands was published in 20 volumes, the one on Sweden in 17 books, Finland's has 25, and Spain's consists of over 40 atlas volumes. The traditionally large sizes have been trimmed down, and this is the clearest indication that it is no longer necessary to impress others with a display of printed square meters. For many of these atlases, digital versions are now either being produced or examined. For example, the national atlas for Sweden is available on diskette and France's is out on CD-ROM. Currently, both a diskette and a CD-ROM version of Spain's atlas are in production. Some of the benefits of these new digital formats are increases in the potential for spatial data analysis and decreases in production costs.

NEW CONCEPTS OF ATLASES

The scenarios referred to above have not yet been applied to national atlases, although commercial products aimed at the same group of customers have introduced them, e.g. the *Canadian Geoscope Interactive Global Change Encyclopedia* (Simard 1993). This product uses the scenario of space travelers who have returned to Earth after a 40 years journey. They have to be kept in quarantine for some months but are allowed to make use of the time by viewing the Earth with the sensors available in the craft in order to check the changes since their departure. It will not take long before the advantages of scenarios will compel national atlas editors to introduce them into these works.

Another concept which is changing the national atlas is the idea that people who use the atlas have different levels of interest and expertise.

Another concept which is changing the national atlas is the idea that people who use the atlas have different levels of interest and expertise. This is seen in the provision of different modes of access which depend upon the user's expertise (like the hierarchy of different game levels in adventure games). For example, in the Swedish electronic atlas, there is a level for laymen which allows one to browse ready-made maps; there is a level for initiates which permits the user to change the parameters of the maps; and there is a level for experts which helps the users to analyze the maps, combine them, etc. (*Sveriges Nationalatlas PC Atlasen*). In the last two cases, the user is able to customize maps by selecting layers to combine. However, in most of these new, electronic national atlases it is not yet possible to rotate the maps at will and have the labels remain horizontal during rotation. Another omission up till now is the possibility to compare maps by having them next to each other on the screen (although

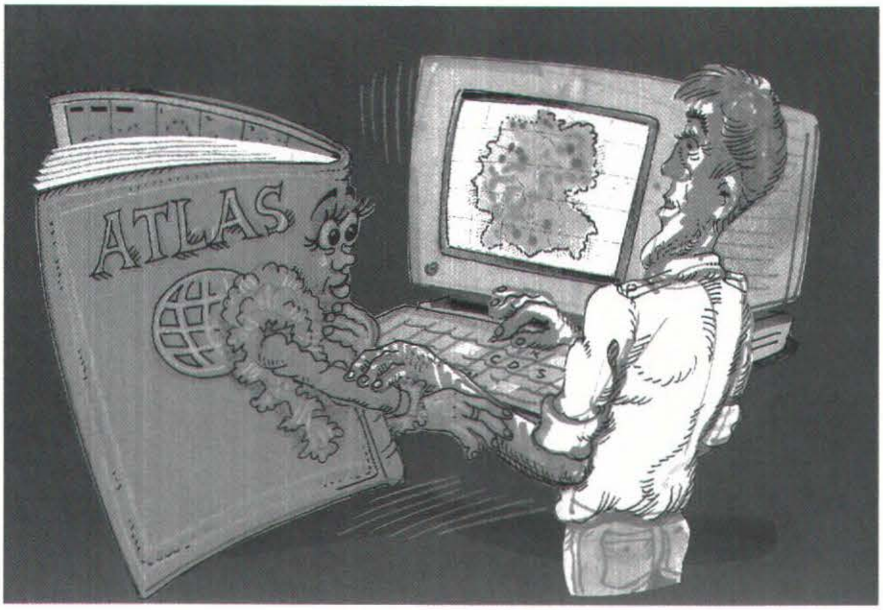


Figure 6 - The paper version of a national atlas stimulating the use of the digital version (drawn by A. Lurvink).

the Swedish national atlas comes close). Analytical means are available in the on-line *National Atlas Information System for Canada*, and the new French national atlas allows for numerical comparison of individual sets of spatial data.

Maps and explanatory texts can now be flipped, but they cannot yet be seen together on the screen. The HYPERCARD environment has taught us how to combine texts, illustrations, photographs, and maps at will; these are accepted now in atlases as well. Even animated cartographic sequences or video reels are becoming part of electronic atlases.

The Swedish national atlas finally shows the division of functions between a paper and an electronic atlas version. The paper version animates, points out the interesting images, and refers, for those that have become interested, to the diskette version which contains far more information than the paper version (see Figure 6).

NEW STRUCTURES FOR NATIONAL ATLASES

National atlases have been structured primarily by dividing maps into groups of map themes–that is, through vertical subdivision. For example, the Italian national atlas is subdivided vertically into four thematic areas, forty sections, and seventy-three individual map themes. It also has a horizontal subdivision that is characterized by temporal or dynamic aspects, resulting in time series. The environment serves as a linking element, for it is being looked at from the viewpoint of all individual themes.

The Spanish national atlas shows the landscape first as a natural environment, then as a result of physical and human factors, and finally from the point of view of environmental problems such as degradation and pollution.

. . . it is with atlases like these that society's problems can indeed be tackled.

The French national atlas allows one to aggregate thematic data to larger regions. This really is an important option for map use because it allows one to find new patterns as the scale of the enumeration areas changes. Soon, it will be possible to effectuate this with a slide bar. This interactive atlas also has options that allow the user to portray the data either relatively or absolutely through proportional symbol. In addition, the atlas has explanatory functions.

The new French national atlas, which will be released soon, will be able to show phenomena with different levels of detail and will be able to portray them by the proportional circle method or relatively by choropleths. It will show the situation within France as well as the situation of France in Europe. It will show less positive aspects of French society, such as the distribution of crime (gang warfare, rape, abuse, etc.), AIDS, and unemployment. This is a far cry from the visiting card concept national atlases once had, but it is with atlases like these that society's problems can indeed be tackled.

Finally, a list of the fields that researchers in Europe are exploring as ways to improve electronic national atlases includes options that would allow: interactive use; dialogues in which one can produce one's own maps; displays with additional graphical formats, such as photographs, diagrams, animations, etc. (multimedia); a realization of new analytical potential (such as changing the temporal or geographical resolution); creation of a separate role for digital and paper versions of the same national atlas; and the addition of adventure (or at least an explanatory structure).

Equipped with options like these, national atlases (and even atlases in general) should be able to fulfill current users (both general users' and researcher's) needs and demands.

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RESUMEN

Después de proponer definiciones para "atlas", "atlas nacionales", y "atlas electrónicos", este trabajo resalta los requisitos para atlas electrónicos nacionales producidos en los noventas. Estos requisitos pueden ser comparados con los atlas nacionales producidos en Europa entre 1988 y 1994.

SOMMAIRE

Après avoir proposé des définitions pour "atlas," "atlas nationaux" et "atlas électroniques," ce document souligne les exigences des atlas nationaux électroniques produits dans les années 90. Ces exigences seront ensuite comparées aux atlas nationaux produits en Europe entre 1988 et 1994.

Visualizing Digital Atlas Information Products and the User Perspective

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The digital revolution and associated advances in multimedia and electronic information transfer have opened hitherto unthinkable opportunities for atlas design and distribution. As a result, the status quo of the conventional atlas is being challenged by a research community eager to move towards sophisticated digital atlas products. The assumption made by the digital atlas research agenda is that atlas users share the researchers' enthusiasm for digital atlas products. It is argued that contemporary advances in digital atlas design are driven by computing innovations; that is, researchers are embracing faddish technologies to advance imaginative new atlas products with little attention given to the atlas user community's wants and needs. It is proposed that the design of innovative digital atlas products be paralleled and influenced by atlas consumer research. Atlas user surveys are called for to evaluate the market's reaction to conventional atlas products and to test the atlas users' willingness to use and pay for innovative digital atlas products.

THE DEFINITION DILEMMA

The advent and popularization of the digital computer and associated digital data management capabilities have not gone unnoticed in the atlas research community. A number of commercially available electronic atlas products began to surface in the latter half of the 1980s, and there appears to be a growing interest in the design and production of digital atlases in the 1990s.

The term "digital atlas" is now being used to market quite an array of products. Some digital atlas products, such as the *Electronic Atlas of Arkansas,* have the appearance and feel of a facsimile of the analog atlas, where flipping of the page has been replaced by the keypad or mouse. Other digital atlas products, for example the *Digital Atlas of Sweden,* are moving away from the traditional atlas concept. Their look and feel is more akin to that of an electronic information browser including hypertext data access and basic analytical capabilities. In addition, there are now some products marketed as digital atlases that are difficult to distinguish from sophisticated multimedia regional information systems where the map is but a small part of the overall information base. To muddle matters even more, some government agencies have decided to call their growing digital topographic basemap coverage a "digital atlas," as is the case in the province of British Columbia in Canada.

. . . there are now some products marketed as digital atlases that are difficult to distinguish from sophisticated multimedia regional information systems where the map is but a small part of the overall information base.

The emergence of all these different products under the name of "digital atlas" is confusing to both the research community and the atlas users. In response, the research community is attempting to define what a digital atlas ought to be. A problem here is that the progression from the conventional paper atlas to some form of digital atlas product is in an early stage of transition; it is foreseeable that the digital atlas concept will continue to evolve as long as we continue to be confronted with innovations and the rapid rate of change imposed on society by the computing industry. In short, the digital atlas is in an evolutionary stage; it will not stabilize for quite some time and any attempt at firming up a definition may be premature. Indeed, the digital products that might eventually end up replacing the traditional atlas may no longer be "atlases" according to established conceptions; instead, they may be some form of digital atlas information system (AIS).

TOWARDS VISUALIZING THE ATLAS OF THE FUTURE

Evolving computing technologies will continue to widen opportunities for innovation in digital atlas design. On the one hand, this is desirable since research ought to investigate as many avenues of innovation as possible (of course this assumes that research funds are available to conduct this work). On the other hand, the risk is that atlas researchers will jump on every technology bandwagon while losing sight of why they are developing digital atlas products and for whom. In other words, we may be getting so excited about playing the high technology game that we are letting computing innovations set the digital atlas research agenda, instead of the reverse.

This beckons the question of what the ideal atlas of the future should look like. What are our goals when designing digital atlas products and what are the ultimate objectives? Who is our market? In order to answer these questions, we need to re-direct some of our thinking towards visualizing atlas products of the future irrespective of computing innovations or computing constraints. In short, we need to reflect on and to re-think the concept of an atlas.

How ought the atlas of tomorrow differ from yesterday's atlas? Four areas come to mind. First, one could speculate that the future atlas will contain expanded information contents; that is, the future atlas should contain information previously thought impossible to include in an atlas. Second, one might expect that the atlas of the future should allow us to move beyond merely viewing information; that is, the user should be allowed to interact with and analyze the information contents. Third, one could argue that the layout and design of the future atlas should change. We already know that we can digitally re-package information contained in a traditional atlas using multimedia capabilities and hypertext, but there may be other desirable changes to layout and design. Finally, one might wish to re-think the method of atlas information access. Fiber optics, the information super highway, and satellite data transmission are offering opportunities to go beyond floppy diskettes or CD-ROM to access atlas information, and the atlas of the future could easily make use of these technologies. The following sections will examine the above four areas of possible change in more detail.

CHANGE IN ATLAS THEMATIC CONTENTS

In order to contemplate expanding or otherwise changing thematic contents in future atlases, it would help to determine whether or not an established tradition of atlas contents actually exists. If such a tradition is found, the next step is to evaluate whether or not the atlas user community has been satisfied with it.

A number of studies (Stephenson and Galneder 1969; Kent and Tobias 1990; Hocking et al. 1991; Keller 1993) have examined contents of traditional regional atlases. A number of conclusions can be drawn from these studies. First, it would appear that the conventional regional atlas commences with a general and physical introduction to a region. This is followed by thematic coverage of economic activity and the socio-cultural environment. There appears to have developed, therefore, a tradition of well-established atlas themes and topics; a tradition first identified by Salichtchev (see Fremlin and Sebert 1972).

Second, over time, there appears to have been a gradual switch in emphasis from topics covering "General" and "Physical" themes towards topics covering "Socio-cultural" themes. In other words, there has been a shift in emphasis away from the physical and towards the human dimensions of landscape and environment.

Third, one can conclude that there has been a trend to move away from strict depictions of spatial distributions and relationships towards the "telling of a story." This trend has manifested itself in two ways: (1) atlases contain increasing amounts of non-map information items (notably text, figures, photographs, and tables), (as opposed to simply depicting primary spatial information gathered in the field), and (2) in terms of information presented, preference has been increasingly given to data that has been "knowledge engineered" and "expert interpreted." This trend appears to parallel a move in the news media where there exists a shift away from a strict reporting of facts to the broadcasting of experts' interpretations of the facts from different viewpoints.

From the literature, it would appear that surprisingly little market research and surprisingly few user surveys have been conducted to solicit the atlas readerships' reactions to our products. We appear to have been content to produce atlases that please ourselves, the experts.

Is the atlas-user community satisfied with the above noted traditions of atlas contents and the observed trends through time? Does the atlas user community want change? We have not given this line of questioning a high priority in the past; indeed, it could be argued that, so far, we have not cared to address the atlas users' wishes at all. From the literature, it would appear that surprisingly little market research and surprisingly few user surveys have been conducted to solicit the atlas readerships' reactions to our products. We appear to have been content to produce atlases that please ourselves, the experts. Thus, the honest answer to the above questions about user satisfaction with respect to traditional atlases is: we don't really know.

Pilot user surveys conducted by the University of Victoria's Spatial Science Laboratories (Hocking 1991; Hocking and Keller 1992a/b; Keller et al., under review) found that atlas users are generally satisfied with the traditional themes and topics, they do not crave highly specific topics, and they lack enthusiasm for maps showing information based on complex calculations and excessive expert interpretations. However, this study's sample may be too small and the surveys too local to draw general conclusions.

Given the above observations, are we in a position to speculate what the expanded information contents of the future digital atlas should look like? We can assume with some certainty that atlas editors will not suddenly get involved in primary data collection. Future atlas initiatives, therefore, will continue to be constrained by what data are gathered and made available at reasonable cost by somebody else. As a result, we need to accept that we do not know what sort of additional information the atlas user community wants.

Overall, it would appear that we are at present poorly prepared to visualize and plan for the expanded information contents of the atlas of the future. It would seem reasonable, therefore, to dedicate research efforts towards two goals. First, we need to learn more about the needs and wishes of the atlas market, which is something we could achieve by conducting wider ranging user surveys and market research. Second, we should allocate time to identifying what hitherto unavailable information sources of potential relevance to an atlas may become available in the future. We should investigate whether there is a demand for these information items and, if so, how these information items can best be included in an atlas.

ADDING INTERACTIVE AND ANALYTICAL CAPABILITIES

The traditional atlas has supported no interactive capabilities and only very limited analytical ones. The main reason for this has been that images printed on paper simply do not lend themselves to easy manipulations for query and analysis. The main purpose of the traditional atlas, therefore, has been to provide information for visual analysis. The digital revolution may change all this. The geographic information systems (GIS) research community has made tremendous advances in the digital analysis, interactive query, and selective combination of spatial data and associated attribute information. There is nothing to stop the atlas of the future from including some or all of these analytical capabilities. Inclusion of all the analytical capabilities offered by contemporary GIS in a digital atlas would, of course, imply that the GIS is a form of digital atlas and visa versa.

However, given the excessive cost and lack of user-friendliness associated with most GIS systems on the market today, it is unlikely that the atlas user community will endorse a GIS as the atlas of the future for some time to come. A subset of all GIS analytical capabilities will therefore need to be selected for inclusion in a digital atlas. This raises the question of how to select which capabilities should be included. The traditional approach would be to let the atlas experts decide this question. A more appropriate approach, however, might be to consult the atlas-user community.

It would appear that, most of all, the user wants analytical capabilities to explore comparison and change.

A number of pilot user surveys conducted by the Spatial Science Laboratories at the University of Victoria (Hocking 1991; Hocking and Keller 1992a/b; Grant 1994; Keller and Grant 1994; Keller et al., under review) have found that the user has some very clear ideas about what analytical capabilities to add to digital atlases and maps. It would appear that, most of all, the user wants analytical capabilities to explore comparison and change. The so-called "Jones Syndrome" appears to be inherent in human nature; we wish to draw comparisons and to evaluate how we are performing relative to somebody or something else. Users thus wish to have available analytical capabilities to answer questions such as:

- How am I doing compared to . . . ?
- How many regions pay higher property taxes . . . ?
- How bad is air pollution in my neighborhood relative to . . . ?

We also appear to be fascinated by the temporal dimension of change–both absolute and relative. Users thus wish to have access to analytical capabilities that could answer questions such as:

- By what percentage have house prices increased in my neighborhood since last year . . . ?
- Where have house prices increased more in the same time period . . . ?
- How has air pollution in my neighborhood changed since . . . ?
- Where has the change in air pollution been better . . . ?

Beyond a doubt, there are other query and analysis capabilities of interest to the atlas user community, and the temptation exists to assume that the atlas user wants everything. If the latter will prove correct in the long term, then a digital atlas will become a digital atlas information system that closely resembles a GIS. Some day this may be possible, as long as the GIS community advances its products to become more user-friendly and intuitive. Our present experiences with GIS, however, tell us that we have not succeeded in packaging all analytical capabilities in a user-friendly and memory efficient manner. Atlas researchers, therefore, should direct research efforts towards identifying and prioritizing what GIS analytical and query capabilities the atlas user community really wants. The next step, of course, is to figure out how best to package these capabilities in an intuitive and user-friendly manner.

CHANGES IN LAY-OUT AND DESIGN

A third area where the future atlas may differ radically from the traditional atlas is in the layout of information and in the design of the user interface. Atlas products already exist on the market that have demonstrated that we can digitally re-package information contained in a traditional atlas by using multimedia capabilities and hypertext, and the first animated atlas modules are emerging out of the research laboratories.

Judging by some of the atlas products under development and on the market, it would appear that experts' visions of the design and layout of the atlas of the future vary widely. Some appear to believe that the future atlas should maintain that traditional air of authority by preserving a strong pedagogic feel. Others seem to place efforts on improving the atlas's "Fahrvergnügen" by moving towards an emphasis on atlas "Disney-fication"; the emphasis would make the digital atlas fun to use. Some are including lots of electronic "gee whiz" gimmicks while others favor the "KISS" (keep it simple silly) approach. Some are trying to offer a large set of analysis and query capabilities, while others favor adding minimal analysis or none at all. Some emphasize innovative ways of viewing information, including animation, while others are sticking to conventional map formats.

One thing that has become obvious from all these diverse research efforts is that we are serious about abandoning the traditional atlas concept in favor of something different.

One thing that has become obvious from all these diverse research efforts is that we are serious about abandoning the traditional atlas concept in favor of something different. We appear to be searching for a new atlas vision and we obviously need room for experimentation to find it. In the search for this new vision, the question should not be whether the atlas of the future should be animated and make noises or whether it should emphasize what insight and knowledge one can gain from it; rather, the question ought to be whether the atlas user community will endorse and pay for the atlas products we are developing. After all, the users' willingness to purchase and use our new products will be the ultimate yardstick of success or failure.

In the past, we have paid little attention to the needs and wishes of the atlas user community; we have not worried about the market's endorsement of our products. However, the only way to find out which of the innovative digital atlas ideas have merit is to prototype them and subject them to rigorous market scrutiny. We need to develop research methodologies to allow user groups to compare and contrast the relative merits and drawbacks of different, innovative digital atlas prototypes, and we need to conduct the necessary user surveys to find the answers.

CHANGES IN METHOD OF DATA TRANSFER AND ACCESS

How will the atlas of the future be marketed and delivered to the user? The traditional media for atlas production was paper, and the traditional market place was the book store. More recently, however, we have experimented with floppy diskettes and we are now well into endorsement of CD-ROMs. Marketing of the new digital products tends to be less through bookstores than through computer hardware vendors, software brokers, and catalogs. We are beginning to talk about side-stepping retailing altogether by exploring the possibility of allowing the consumer direct access to atlas information using the electronic super highway. Finally, there is some talk of the application of virtual reality to deliver atlas images; and futurists are warming us to the idea of experiencing a geographic region and its social environment using the idea of media like the Star Trek series' Holodeck.

It should become obvious from the above that the technologies underlying the packaging, transfer, and visualization of digital data are undergoing rapid advances. These technologies represent moving targets in the mid 1990s that are hard to keep up with.

Given the instability of these technologies, we should not worry about them when conceptualizing the atlas of the future. We should not let our creativity be constrained by the limitations of today's information technology. We should assume that future data transfer and manipulation technologies will exceed all of today's constraints. We should accept that we are close to a computing environment where the overriding technical criteria of importance will become the physical dimensions and capabilities of the receiving and display units, and that the weakest link in the information processing chain may well become our own limited capacities to handle neural information processing.

SUMMARY

The digital revolution will impose considerable change on atlas cartography. Traditional paper atlases will be produced and marketed for quite some time to come. However, their merit and viability will be increasingly challenged by innovative digital atlas products. These new atlas products will change the image of the atlas as we know it today. In fact, they may well advance the concept of "an atlas" towards that of a sophisticated atlas-based, integrated information system.

Today, we can only speculate what exact shape these new atlas information products will take; the digital technology revolution and the information revolution are still too young to forecast their exact impacts. A point made in this paper is that, in the process of visualizing innovative atlas products, it is not appropriate for atlas makers and cartographers to be guided by and drift with technology trends, adopting and adapting technology. We need to visualize the next generation of atlas products by looking beyond the limitations of today's technology capabilities. Instead of following technological innovations, we should identify what technological capabilities we need and direct the computing industry to deliver on our needs.

. . . we should identify what technological capabilities we need and direct the computing industry to deliver on our needs.

A second point elaborated in this paper is that we should start seriously to consult the atlas user community when visualizing the next generation of atlas products. We should ask the atlas readership to tell us what information contents and what query and analytical capabilities we should be adding to the future atlas, and we should give the users a chance to tell us their preferred methods of information access and retrieval.

A question that this paper has failed to address is: who should conceptualize, operationalize and maintain the next generation of digital atlases?

It is anticipated that the future digital atlas information systems will be beyond the skills and capabilities of the traditional team of individuals putting together a paper atlas. The know-how, funding, administration, and technological requirements necessary to make the next generation of digital atlas information systems work will exceed the capabilities of any one individual or stakeholder group. These new atlas products will need to be conceptualized, developed, and administered by a consortium of experts from universities and research institutes, industry and government.

The biggest challenge facing any new atlas initiative in the 1990s is to secure the considerable financial support required to make it all work. The atlas research community needs to share information about how to politic and bid successfully to secure the necessary funds. One thing is for sure: having a well-defined and exciting product vision that has received endorsement from the atlas user community will lend credibility and weight to an effort to secure atlas funding.

The biggest challenge facing any new atlas initiative in the 1990s is to secure the considerable financial support required to make it all work.

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RESUMEN

La revolución digital y los avances relacionados con la transmisión de información han abierto grandes oportunidades para la distribución y el diseño de atlas. Como resultado, el atlas convencional ha sido retado por un grupo investigativo deseoso de alcanzar atlas digitales sofisticados. La hipótesis hecha por el programa para investigación de atlas digitales es que los usuarios de atlas comparten el entusiasmo de los investigadores por atlas digitales. Se discute que los avances contemporáneos en el diseño son manejados por innovaciones computarizadas; esto quiere decir que los investigadores están adoptando tecnología caprichosa para conseguir nuevos atlas imaginativos con poca atención dada a las necesidades de los usuarios de atlas. Se propone que el diseño de atlas digitales innovativos sea paralelo e influenciado por investigación de usuarios de atlas. Los estudios de usuarios de atlas hacen un llamado para evaluar la reacción en el mercado de atlas convencionales y para examinar la buena voluntad de los usuarios para usar y pagar por atlas digitales innovativos.

SOMMAIRE

La révolution numérique et le transfert de l'information multi-médiatique et électronique a mis au jour des opportunités jusqu'à présent inimaginables de conception et de distribution des atlas. Il en résulte que le status quo de l'atlas conventionnel est mis au défi par une communauté de chercheurs anxieux de passer aux atlas numériques sophistiqués. Les chercheurs ont émis l'hypothèse que les utilisateurs d'atlas partagent leur enthousiasme pour les atlas numériques. On prétend que les avances contemporaines dans la conception des atlas numériques sont entraînées par les innovations informatiques, c'est-à dire que les chercheurs embrassent les technologies à la mode pour produire de nouveaux atlas imaginatifs, sans prêter grande attention aux désirs et aux besoins des utilisateurs. On propose que la conception d'atlas numériques innovateurs se développe parallèlement avec, et subisse l'influence de la recherche auprès des utilisateurs d'atlas. Les enquêtes menées auprès des utilisateurs sont nécessaires à l'évaluation de la réaction du marché aux atlas conventionnels ainsi que pour tester la volonté des utilisateurs d'employer des atlas numériques innovateurs et d'en payer le prix.

The Potential of Electronic Atlases for Geographic Education

Available computer technology requires a rethinking of the use of cartographic aids for geographic education. Electronic atlases have the potential to provide a new, exciting medium to promote geographic instruction. They can provide an active, integrative tool to teach geographic concepts and allow processes of higher learning to take place in an innovative, dynamic format. While students are exposed to geographic concepts through electronic atlas use, they also acquire computer skills which will be essential in the twenty-first century.

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MAPS AND GEOGRAPHIC EDUCATION

Throughout the world today, the planning and allocation of resources for economic and social development demands an understanding of global systems. Geographic education is a critical component in fostering this global awareness. In developing geographic knowledge and a global perspective, the ability to make, understand, and use maps is essential (Bartz 1970; Ascov 1974; Jarest 1992; Castner 1987, 1993). To achieve a global perspective and to master geographic thinking, maps can be utilized to depict locations and to describe places; they can be used to illustrate distributions and to explain the interactions of phenomena; and they also can be used to demonstrate movements between places and to organize regions (Pattison 1964). In spite of the basic need to apply maps as tools in their study of geography, students in the United States school systems typically receive little training about map use and map reading (Newell 1986). Few American teachers study geography in their years of teacher preparation. Consequently, methods and sequences for teaching map skills are not well understood, and therefore maps are hardly ever used for problem solving in the classroom. In addition, the maps students are exposed to in the classroom are often meager in number, outdated, or simply dull. Therefore, students often perceive maps as boring or that they have little value in their lives. When taken together, all of these factors contribute to a lack of geographic awareness and lack of interest in geography as a whole (Downs, Liben, and Daggs 1988; Gersmehl and Young 1992; Dymon and Winter 1991).

Under the impetus of the recent Federal mandate Goals 2000, which requires that national standards be developed for seven basic subjects including geography, educators and geographers in the United States are seeking new ways to improve the quality of geographic education (NCGE 1989). They are aware that a fresh new approach to teaching map skills is needed to inform, inspire, motivate, and encourage students (Muir 1985). With the current infusion of computer technology into the schools, one new approach is the application of electronic atlases. They have the potential to provide new excitement in the classroom and to promote geographic education while developing map and computer skills.

The main advantage of an electronic atlases is that it permits students to choose, build, and design maps.

The main advantage of an electronic atlases is that it permits students to choose, build, and design maps. These activities support a model of geographic education that assumes that learning about places occurs on three conceptual levels: (1) concrete images, (2) abstract analysis, and (3) value evaluation (Gersmehl and Young 1992). Electronic atlases can be used as a tool to provide these learning experiences to students.

ELECTRONIC ATLASES

When analyzing existing electronic atlases, the literature points to three basic types of systems. All three systems have the potential to facilitate learning activities about places while developing map skills. The three basic systems are: (1) view-only systems, (2) creating maps on demand systems, and (3) analytical mapping based on GIS concepts systems (Siekierska and Taylor 1991).

The first electronic atlases produced were view-only systems. . . The user simply observes the maps by changing the screen of the computer, either operating a keyboard or using a mouse.

The first electronic atlases produced were view-only systems. An early example is *The Electronic Atlas of Arkansas.* This atlas was to provide timely facts and information about the state to business people, schools, and the general public. It was used like an encyclopedia since its thematic maps furnish an overview of the status of the state of Arkansas. The user simply observes the maps by changing the screen of the computer, either operating a keyboard or using a mouse. This atlas is produced in a similar format as a traditional atlas except it can be viewed on the computer (Smith 1988). One of the advantages of the system is that it allows for timely updates in a cost-effective manner. A K-12 classroom atlas built like this would be most comfortable for the rather traditional teacher or a teacher in the early stages of employing computers in the classroom. Such a view-only system might serve as an introduction to electronic atlases for the very traditional teacher who might move gradually from use of conventional, paper atlases to more innovative electronic atlases.

The next stage in the concept of a view-only system is exemplified by the *Picture Atlas of the World* prepared by the National Geographic Society. This type of atlas exposes the user or potential learner to sound, pictures, and text narratives. The concept of atlas touring, as introduced by Mark Monmonier (1990), is integrated into this atlas. In both of these view-only cases, the user or learner can participate in the decision making only by browsing through the atlas pages, skipping, returning, or moving ahead. Once launched into using computers in their classrooms, American school teachers might be reasonably comfortable with a view-only atlas as an introduction to electronic atlases in the early grades. For the higher level thinking skills and problem solving required of middle school, secondary, and university students, however, more advanced electronic atlas systems are more appropriate.

More flexible systems of learning exist with . . . an electronic atlas system which allows the creation of maps on demand.

More flexible systems of learning exist with the second type of electronic atlas system which allows the creation of maps on demand. Examples of such systems are the *Atlas of New Hampshire and Vermont* (Bayr 1992), the atlas for the Dutch National Physical Planning Agency (Koop and Ormeling 1990), and the new *Interactive Atlas of Georgia* (Institute of Community and Area Development 1994). These systems allow the user or the learner to add, remove, or change data. In addition, the classification scheme and the color code can be changed to create new maps on demand; the system also permits the user to return to the default setting. The system has the advantage that it can be updated after it has been purchased. Since these atlases are menu-operated, it is easy to follow their instructions. Especially important for public education would be the construction of a tutorial to teach school children map elements beginning with points, lines, area, and distorted shapes. An electronic atlas for the elementary classroom might be constructed around the approaches and categories of map learning outlined in the National Council for Geographic Education publication *Map and Globe Skills: K-8 Teaching Guide* (Winston 1984).

The third type of system, such as the *Electronic Atlas of Canada,* goes beyond merely creating maps on demand by providing information retrieval systems as well as analytical capabilities (Siekierska and Taylor 1991). The atlas was designed to supply data in support of decision making within the federal government of Canada. This type of system incorporates Geographic Information System (GIS) functions. Similarly, the *Digital Atlas of Sweden* provides these kinds of capabilities in a menu-operated environment. However, these atlases require some prior knowledge of the topics addressed and an understanding of the system. At this point, these systems are clearly too difficult for the novice operator to operate and to understand. An electronic atlas for teachers and students has to be more simplified without compromising the basic concepts. However, rich possibilities exist for gearing this "layers" approach to information to problems that secondary and university students can endeavor to solve.

ELECTRONIC ATLASES AS TEACHING TOOLS

The three electronic atlas systems introduced are perhaps only the beginning of a whole new generation of visually powerful cartographic displays in electronic atlas formats. Among the many possible areas of usefulness, they can provide a promising, exciting new direction for geographic education.

One strong possibility, as an example, is the role an electronic atlas might play in teaching concrete images for achieving basic knowledge and comprehension of place (Bloom 1956). Students would focus on what is at a place–its physical and human characteristics (AAG and NCGE 1984). The electronic atlas can display an area on the computer screen, identifying the specific place and setting it in its region. Added sound or explanatory text can provide additional information about the area chosen. Visualization can provide images supporting the geographic message about the physical characteristics of the lithosphere, atmosphere, hydrosphere, and biosphere there. Not only would it explain what is naturally at the place, but it would also illuminate the location's human characteristics, including the population, religions, arts, political system, economic system, languages, etc. It could also present the historical or social changes and issues that exist there. Students would be able to tour and explore the place over time and in relationship to other areas. Compared with the single page maps found in a traditional atlas, the electronic atlas can provide an interactive relationship between the students and the display. The student can use the mouse and click on an area of the map to get additional information about the place, if desired. This would not only provide more comprehensive information about a place, but it would also provide exploration into the past in order to better understand the human interactions with the environment.

Compared with the single page maps found in a traditional atlas, the electronic atlas can provide an interactive relationship between the students and the display.

At the levels of analysis and synthesis, for example, where students examine why things are the way they are at a particular place, students can use the electronic atlas to explore an area by analyzing a problem and synthesizing information provided in the system to create impressions in map or graph form. These student-created images can be expanded as students gain a better understanding of the topic or as the atlas database creates new concepts through its knowledge-base. Creative students can tap into this knowledge in order to build their own knowledge. These maps could be the mental images of students' understanding of the problem or maps created through available data sources as the result of analysis and synthesis.

Finally, at the evaluation level, students form and study opinions about how things should be at the place in question (Bloom 1956). Here, the students can take their own analyses and synthesize their information to make the mental connections between the images presented, the text provided, and the theories understood. Electronic atlases can provide a laboratory with which to make these mental connections. This is where students can form their own opinions and evaluate the possible solutions to the problem that they have to solve. Evaluation and problem solving are clearly the heart of geographic education and competency.

Electronic atlases can incorporate Siekierska's three types of learning systems without compromising the basic cognitive activities they offer. Many high school students today are familiar with numerous electronic devices, and some have access to a PC. Others, however, are computer shy and are afraid to turn on a computer. Thus, the development of an electronic atlas for high school and university students offers two advantages: a) introducing computer skills and b) introducing geographic science.

CHANGING CARTOGRAPHY, CHANGING MAPS

The literature points to the importance of map skills to promote geographic competency. It also points to the reality that students in the United States are exposed to boring, uninteresting maps and that they do not perceive maps as having much value in their lives. This adds to the overall decline in geographic knowledge and suggests that a new approach to geographic education is needed. However, rather than merely promoting map use, reading, and analysis from a traditional perspective, this paper suggests that educators should look at the capabilities that electronic atlases have to offer. Electronic atlases have the potential to provide a new map medium for geographic education. Multimedia electronic atlases should be integrated for effective geographic education. Visualizing concepts can provide better and clearer conceptualization of the geographic models than static maps perhaps ever could. With the computer revolution in full swing, cartographers and educators have an opportunity to create "holistic atlases" encompassing far more than the atlas collections of single analog maps of yore. In short, something "new under the sun," in the form of comprehensive electronic atlases could enhance education by illuminating the spatial notions which comprise geography.

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RESUMEN

La tecnología de computadoras disponible, requiere la revisión del uso de los implementos cartográficos para la educación geográfica. Los atlas electrónicos tienen el potencial de proveer un nuevo y excitante medio para promover instrucción geográfica. También pueden constituir una herramienta activa e integrativa para enseñar conceptos geográficos y permitir procesos de mayor aprendizaje dentro de un formato innovativo y dinámico. A medida que los estudiantes son expuestos a conceptos geográficos a través del uso de atlas electrónicos, también adquieren habilidad en las computadoras, las cuales serán esenciales en el siglo veintiuno.

SOMMAIRE

La technologie informatique existante exige que soit repensée l'utilisation d'outils cartographiques pour l'enseignement de la géographie. Les atlas électroniques ont le potentiel de fournir un moyen nouveau et fascinant de promouvoir l'enseignement de la géographie. Ils représentent un outil d'intégration actif de l'enseignement des concepts géographiques et permettent aux processus d'enseignement supérieur de se dérouler sous un format innovateur et dynamique. Alors que les étudiants sont exposés aux concepts géographiques grâce à l'emploi d'atlas électroniques, ils acquièrent par la même occasion les compétences informatiques qui seront essentielles au 21è siècle.

An Electronic Atlas Authoring System

This paper describes an electronic atlas authoring system that is being developed at the University of Arkansas. The system is a set of computer programs that aids in the construction of electronic atlases. The paper begins by examining the types of organizations that might be interested in using this system. It then offers a general description of the authoring system, including a discussion of the specific components which make up the system. The final section of the paper outlines how the system might be distributed.

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ATLAS PRODUCERS

There are two main types of organizations that have in the past shown an interest in producing electronic atlases. The first group–commercial companies–is probably the most visible. Commercial companies have published such widely sold software products as *Maps and Facts* and *Software Toolworks World Atlas*. The second group includes various governmental agencies, educational institutions, and advocacy groups. For convenience, we shall refer to this group as nonprofit organizations. Nonprofit organizations have published such atlases as the *Electronic Atlas of Arkansas*, the *Interactive Atlas of Georgia*, and the *Picture Atlas of the World*.

There are some fundamental differences between the marketing behavior of commercial software companies and that of nonprofit organizations. For example, commercial companies generally sell their electronic atlas products to the mass, or consumer, market. Their products can be found on the shelves of such stores as Wal Mart, Sears, and Radio Shack and software retailing chains such as Software Etc. and Egghead. You also can find their products in nationally distributed catalogs and in Original Equipment Manufacturer (OEM) bundles. An OEM bundle is a collection of computer programs that is offered free of charge or at a greatly reduced price when one purchases a personal computer or a CD-ROM drive. Additionally, commercial companies often sell their products to an international market and may sell foreign language versions of the same program.

There are some fundamental differences between the marketing behavior of commercial software companies and that of nonprofit organizations.

The electronic atlas market for nonprofit organizations has been more limited. Nonprofit organizations usually aim their products towards buyers with specialized interests rather than towards the more general mass market. Thus, an international agricultural organization might plan to sell their electronic atlas primarily to individuals and organizations that are working in some phase of the agriculture business and that would be interested in obtaining atlas-based information on agriculture. Often, their buyers are subscribers to their printed materials.

The potential market for such atlases is often limited in geographic scope. The *Atlas of Arkansas*, for example, has appealed mainly to a regional market. The new *Interactive Atlas of Georgia* will probably sell mostly to Georgians and buyers from the surrounding region.

In terms of the number of electronic atlases sold, commercial companies have been far more successful than nonprofit organizations. In fact, the vast majority of the electronic atlases that have been sold to date have been sold by commercial companies. This is not surprising since most of the important factors necessary for success in the software business favor commercial companies.

The main mission of commercial companies is to develop, market, and sell computer software. The entire company, including management, is focused on this goal. Most companies have in-house, software development expertise. Their teams of software developers are experienced and are able to respond quickly to changes in technology and market conditions. It also helps that all of the large commercial software companies have more than one product to sell.

In nonprofit organizations, it is rare to find in-house, electronic atlas development expertise, and the response to changes in technology and market conditions is typically slow.

Commercial software companies that focus on the consumer market make their money by selling a large volume of relatively low cost products. Largely due to the intense competition, most of the electronic atlases found on store shelves and in catalogs today are heavily discounted and can be purchased for under $40.

In contrast, the main mission of nonprofit organizations does not include the development, marketing, and sale of software. Management is not focused on software and often does not understand the important related issues. In nonprofit organizations, it is rare to find in-house, electronic atlas development expertise, and the response to changes in technology and market conditions is typically slow. Such organizations usually set out to sell small quantities of a single atlas product at a relatively high price. For example, the *Electronic Atlas of Arkansas* sells for $99, National Geographic's multimedia *Picture Atlas of the World* sells for about $150, and the new *Interactive Atlas of Georgia* sells for $89.

In considering all of these differences, it is important to point out that commercial companies and nonprofit organizations may have different reasons for producing electronic atlases. The goal of commercial software companies is to make a profit, and they will do almost anything to realize that objective. On the other hand, the principal goal of most nonprofit organizations is to provide better service to the group of individuals (i.e., scientists, government officials, libraries, etc.) that they may serve.

Two difficult barriers stand in the path of nonprofit organizations that might wish to produce electronic atlases. The first problem is that these organizations' lack of experienced programmers inhibits their ability to create efficient, modern software. In fact, we do not know of any nonprofit organization that has a team of programmers experienced in the production of electronic atlases. The second problem is that few nonprofits have a staff of cartographers capable of producing digital maps for electronic atlases. Thus, nonprofit organizations are unable to create high quality digital maps. And it can be very expensive for them to have this work done outside the organization.

The goal of our project is to develop an electronic atlas authoring system that is designed primarily to meet the needs of nonprofit organizations. A main objective is make it feasible for nonprofits to produce electronic atlases by reducing their costs and development time. The system incorporates maximum flexibility in order to meet the needs of a variety of organizations. Very little programming will be required on the part of the atlas producer.

Atlases created on the system will permit users to view maps, to view text and tabular data, and to make two types of thematic maps on the fly. Initially, it will create atlases that run under Windows. Additional modules are planned for the future that include more features and the ability to run on different platforms.

ATLAS AUTHORING SYSTEM

The authoring system is comprised of two parts: a builder and a viewer. The first part of the system–the builder–has several functions. The builder brings together maps and data from a variety of sources. It cross-correlates information to validate that all map and data connections are correct. It converts vector maps from AutoCAD files and raster maps from BMP files into a more efficient format. Finally, it converts all data from the data matrices into a more efficient format. These last two conversions are made so that the atlas will be smaller and will run faster. The second part of the system–the viewer–serves as the atlas interface. It is an executable file that reads a configuration file which describes the data, maps, and indexes.

Five steps are required to create an electronic atlas. These steps are: (1) design the atlas, (2) create the map component, (3) create the data component, (4) create the map / data connections, and (5) run the builder. In the first step–atlas design–the developer organization defines the atlas. This step requires a number of decisions, including the selection of an atlas title such as "Crime Atlas of the U.S." The developer must also decide which map layers to include, which data categories to include, and how to connect maps and data. For example, the organization might decide that maps will include political boundaries and major city layers; data might include demographic, crime, and population categories; map / data connections might be the U.S., States, counties, and major cities. This means that there will be maps and corresponding data for each of these four levels.

Five steps are required to create an electronic atlas. These steps are: (1) design the atlas, (2) create the map component, (3) create the data component, (4) create the map/ data connections, and (5) run the builder.

Once the atlas has been defined, the next step is to create the map component. The organization can supply its own digital maps or use those that are provided with the system. It is planned that digital maps of U.S. States and nations of the world will be provided. User-provided maps will need to match the following specifications: vector maps must be SQL databases, and raster maps must be BMP files (BMP is the standard Windows raster format). If there are both vector and raster maps, they must have a common coordinate system.

The third step is to create the data component. The data matrices can be created using any SQL database program. Most popular database programs meet this condition. The fourth step, the creation of map / data connections, can also be accomplished using an SQL database program. The resulting file is used to verify that maps and data match and to create the atlas index. It consists of a list of places to be indexed for each map / data connection. A place ID links each place (for example, each U.S. State) to a map file and a row ID in a data matrix.

The final step is to run the atlas builder. Running the builder creates the atlas with all maps, data, and indexes. The builder prompts for: the atlas name, target directories, a list of map layers, a list of data categories, a list of map / data connections, a list of filenames of map files, a list of filenames of data matrices, and a list of filenames of map / date connections.

The resultant atlas has three main parts: an information window, a map index, and a data index. One can use the information window to examine various types of information. Information can be in the form of reference maps, thematic maps, numerical data, and textual information. Data and map screens both support scrolling. Map screens also support zooming and hot spots in the event that such capabilities are desired by the atlas developer.

The map index helps a user move from place to place in the atlas. Its primary purpose is map related, but it also works for data. For example, one could move from a map of Japan to a map of Mongolia. One also could use the map index to move from Japanese economic data to Mongolian economic data.

The data index helps atlas users move from topic to topic. For example, one could use the data index to move from Japanese economic data to Japanese health data.

The authoring system was programmed using C++. For efficiency and flexibility, programming libraries were used extensively. The most important of these used in constructing the system were *Microsoft Foundation Classes* and *Victor Image Processing Libraries*. The use of libraries gives atlases a polished, professional appearance. In this case, the look and feel is that of a conventional Windows program, with print, export, help, and other standard features. Additionally, the use of programming libraries makes the system portable to other platforms. For example, it would not be very difficult to convert the system to produce Macintosh atlases.

DISTRIBUTION

A great deal of work has been done on the system to date, and we estimate that it will be finished in early 1995. At that time, we will announce its availability through the appropriate AAG, ACSM, and ICA publications. Initially, we will make the system available through the Internet. We also hope to provide various levels of support for organizations that are using the system. We may offer telephone and on site support, and we plan to develop additional modules that will permit multimedia capabilities to be added to atlases. A price has not been established, but it will certainly cost very little compared to the $350,000 or more that it costs these days to develop a full-featured electronic atlas. Thus, the system will allow the variety of nonprofit organizations that lack expert programmers and / or funds to produce high-quality digital atlases.

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RESUMEN

Este trabajo describe un sistema electrónico de autores de atlas que está siendo desarrollado en la Universidad de Arkansas. El sistema está compuesto por un juego de programas computarizados que ayudan en la construcción de atlas electrónicos. El trabajo comienza examinando los tipos de organizaciones que pueden estar interesadas en el uso de este sistema. Después ofrece una descripción general del sistema de autores sistematizado, incluyendo una discusión de los componentes específicos del sistema. La última parte del trabajo trata sobre la distribución del sistema.

SOMMAIRE

Ce document décrit un système de génération d'atlas électroniques en cours de développement à l'Université d'Arkansas. Le système consiste en un jeu de programmes informatisés qui aident à la construction d'atlas électroniques. Le document commence par examiner les types d'institutions qui pourraient s'intéresser à ce système. Il fournit ensuite une description générale du système de génération, qui comprend une discussion des composants spécifiques constitutifs du système. La section finale du document souligne le mode de distribution que pourrait adopter le système.

A Personalized National Atlas of the United States

Joel L. Morrison

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The U.S. Geological Survey published the *National Atlas of the United States of America* in 1971. Since then times have changed, and the technological revolution in cartography today makes it mandatory to take a close look at the concept of a national atlas. This paper focuses on two concepts related to national atlases: the popular conception of a national atlas and the notion that a comprehensive national atlas would contain information on the United States that most commercial atlases would not include. Ideas are presented that describe what a future, comprehensive, digitally produced national atlas for the United States (CD-NAUS) might look like.

INTRODUCTION

The U.S. Geological Survey published the *National Atlas of the United States of America* in 1971. That edition is out of print and the U.S. Geological Survey does not plan to reprint that edition. One hundred years earlier, following the 1870 Census, Francis Walker published a *Statistical Atlas of the United States* (Walker 1874). No decennial long term follow-ups to that publication occurred. On the basis of this record, the next atlas of the United States published by a U.S. Government agency should be in the year 2070. One could question why I am talking about a national atlas now. We have 75 years yet to worry about it. However, since those earlier atlases were published, times have changed, and the technological revolution in cartography today makes a close look at the concept of a national atlas mandatory. The change in technology requires us to reexamine almost all the concepts on which cartographers have based their science for the past three centuries. I want to single out two concepts related to national atlases and then speculate on what a comprehensive, digitally produced national atlas for the United States (CD-NAUS) could be like in the future.

. . . the words "national atlas" evoke in most Americans the mental image of an expensive, large book that occupies a prominent place in the reference section of each public library, in the reading rooms of private clubs, and in the home libraries of the wealthy.

The first concept, and actually the less important, is the popular conception of a national atlas. I think that the words "national atlas" evoke in most Americans the mental image of an expensive, large book that occupies a prominent place in the reference section of each public library, in the reading rooms of private clubs, and in the home libraries of the wealthy. There is justifiable reason for this conception. Any atlas that is truly national in scope and produced by analog technology is going to be big and expensive. So, few individuals will actually have copies of their own. The United States is a large nation with a large population and has the capability to collect huge quantities of data. Because of our freedom of information laws, any comprehensive atlas of the nation will be a large undertaking. In short, no matter how one looks at it, a national atlas of the United States is a "big" thing.

The second concept is that a comprehensive national atlas would contain information on the United States that most commercial atlases would not include. Commercial atlases must make a profit, and most individuals will not purchase a book that costs several hundred dollars. Therefore, commercial firms must trade off comprehensive content against production and distribution costs in order to assure that sales will be sufficient to recover their financial investment. This means that commercial atlases must concentrate on content that has the greatest appeal to the largest number of map readers. On the other hand, a national atlas should contain information that is of interest and utility to every person in the country, but it should also contain more technical information that may or may not have general appeal to the map reading public. A national atlas should include specific information mandated by law and collected by Federal agencies. I believe that these statements hold true regarding an analog or a digitally produced national atlas. A CD-NAUS should contain data and information that might have little commercial appeal but that documents the condition of the United States at a point in time. Thus, one could expect there to be a profound conceptual difference and also a major practical difference between a commercially and a governmentally prepared national atlas.

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We cannot expect a commercial firm, in isolation, to produce a comprehensive national atlas. In addition, given today's economic situation, we should not expect a single Federal agency to produce such a comprehensive national atlas either. Hence any successful effort must be made by a consortium of organizations.

All else being equal, 2070 is as good a date to target for another national atlas as any other date. But because changing technology has altered the conditions which resulted in the above described situation using analog cartography, we in the United States now need to look seriously at the potential for a digital CD-NAUS. Let me suggest a number of ideas that, when sorted out, may make a large project like that of a CD-NAUS possible, probable, and useful.

First of all, such a project will have to be a joint effort among agencies of the Federal Government, the States, and private enterprise. Let me suggest that a small part of the National Spatial Data Infrastructure (NSDI) be reserved for the CD-NAUS. We are building in the United States a National Information Infrastructure (NII) that will eventually provide every home and office with access to spatial data. The NSDI is that subset of the NII concerned with spatial data. Let me define the CD-NAUS as a four-part facet of the NSDI, consisting of the following: (1) base data (spatially referenced points, lines, and areas that rarely or only slowly change); (2) a set of thematic data (spatially referenced points, lines, and areas that may or may not change rather rapidly); (3) a set of standards, data input and data maintenance requirements, and network requirements; and (4) a set of optional additions.

BASE DATA

In the parlance of the NSDI, base data include data that constitute the "foundation" and "framework" (Mapping Science Committee 1994). I would propose that the base data for a CD-NAUS consist of a set of areas and regions that are widely recognized legal entities, or that are stable (defined by no expected changes for 10 years), and that often serve as data collection unit areas. For example, such framework data would have to include State and county boundaries. I would enhance this framework data by adding zip code areas, telephone area codes, census subdivisions (decennial censuses), defined watersheds, congressional districts, and other legally mandated areas such as national parks, wildlife refuges, and national forest boundaries.

A second set of data layers would consist of base point features. For example, the Geographic Names Information System (GNIS) is a listing of legal geographic names that are standardized for government use (U.S. Geological Survey 1987). All of the names in the file are georeferenced, and the changes per year are minimal. Another set of point data that changes relatively infrequently is elevation above sea level. A digital elevation model (DEM) for the entire United States would be part of the foundation data for the CD-NAUS.

Certain linear data sets, like the basic highway network (interstates, State highways, and so on) and the hydrography of the Nation, would be considered linear framework data. One, of course, could consider boundaries themselves. The most famous and perhaps elusive boundary is the coastline.

The exact needs for base reference data in a CD-NAUS must be debated. I would expect the base data, especially the framework and foundation layers, to be available on CD-ROMs as well as on the network. It would seem that some benefit would accrue from having available both a vector line set of reference, or base maps, and complete orthophoto coverage. With widely available software and DEM's, individuals could create fly-throughs or fly-arounds of any part of the country. Software could be written to allow simulated vegetation or buildings (that is, land cover types) to be fractalized on the surfaces created and visualized. Orthophotos are an example of another foundation data layer.

THEMATIC DATA

Thematic data sets would be national in scope and collected to standards that would assure their conformance to the base data. Weather data could be produced continually. Other thematic data would include socioeconomic data collected for unit areas. The locations of McDonald's restaurants (provided to the networked CD-NAUS by McDonald's for a fee), the locations and names of casinos in Reno (provided by the Reno Chamber of Commerce as part of a data layer maintained and paid for by the U.S. Chamber of Commerce on the Internet), the latest census statistics by collection unit area (provided by the Bureau of the Census), and the location of fragile ecosystems or wetlands (provided by the Nature Conservancy or a Federal agency) are all examples of thematic data that could become part of a CD-NAUS. The requirements would be adherence to the standard specifications and maintenance of the data layers. The possibilities are almost limitless.

STANDARDS, INPUT, MAINTENANCE, AND NETWORK REQUIREMENTS

To enable a CD-NAUS to work, a common exchange standard would be required (National Institute of Standards and Technology 1992). Data quality and information about data sets (metadata) would also require standardization (Federal Geographic Data Committee 1994). A standard graphic user interface (GUI) would make the use of a CD-NAUS efficient. We need a "home page" for CD-NAUS on the Internet.

It is envisaged that the thematic data of the CD-NAUS would be distributed. Any agency–Federal, State, or local, or any private firm–could make data available on a server over the Internet for use in a CD-NAUS context. In some instances, private firms could charge for access to their thematic data, and in other cases, they could be charged for the advertising of their thematic data. However, governmental or nonprofit organizations would not charge for data access. The overall costs for data maintenance and CD-NAUS user fees would have to be decided. Such a system could be instituted now on the Internet.

OPTIONS

The fun part of this speculation concerns the options that could be made available. Most of you have probably been visualizing maps displayed on a screen that look much like the thematic maps that are part of any printed atlas. However, current technology allows us to go far beyond that stage.

First, we must consider several multimedia options. Pictures of entities in the real world would make any map legend come to life. Consider a land cover map. One could access a picture of each land cover class type. Imagine that a category defined as "needleleaf evergreen trees, growth singly or in groups or patches" could have representative photographs to accompany the areas on the map where that category spatially occurs. Maps of the habitats of endangered species could be accompanied by pictures of the species. A diagram of the soil horizon of each soil type could be available with the spatial data. Think of how pictures could make a map showing the incidence of tornadoes or earthquakes come to life for the map reader. In maps of cultural features, photographs from each city cemetery, airport, historical site, and so on could be available.

Think of how pictures could make a map showing the incidence of tornadoes or earthquakes come to life for the map reader. In maps of cultural features, photographs from each city cemetery, airport, historical site, and so on could be available.

Now add sound to the pictures and the map. A white-water river sound could accompany a picture of such a river or the mapped position of the designated scenic river. The sounds of cities (for example, Los Angeles, Miami, Washington D.C., or New York) or the sounds of airports could greatly enhance the meaning of a map. Speaking of airports or parks, it would be possible to have an enlarged inset map of the airport or park itself as a window on your screen. Imagine being able to chart your course through an airport terminal before you ever left home. Imagine being able to see your hotel in an unknown city before your plane lands. These add-on options could easily be part of a CD-NAUS. And, these add-ons could be made available on the Internet by private firms for an advertising fee; they would be accessible on the terminal at your airline seat.

Another innovation is the capability for the user to keep a journal or notes as he or she travels through the CD-NAUS. It should be a standard tool for the user to be able to make notes or comments that can be assembled and printed after a session with the CD-NAUS.

We are teased by the talk of being able to produce smells at some future time to accompany multimedia presentations. Eventually, someone will try to create the sense of touch as well. But for the first edition of a CD-NAUS, let us limit ourselves to the senses of sight and sound. Let us not limit ourselves to maps, however, but allow accompanying photographs, videos, and graphics with sounds, music, and monologue as appropriate.

CONCLUSION

Today we are technologically capable of creating a CD-NAUS. A set of CD-ROMs to introduce the user to CD-NAUS could be sold for a nominal cost; they would contain the base data and instructions on how to access the CD-NAUS thematic data sets available on the Internet. Agencies and firms could be encouraged to create national data sets to specified standards and to make these data sets accessible on the Internet. Such processes could be ongoing, with new distributions or layers being added daily. The planning for such an atlas would be done by a consortium of interested agencies and firms. Planning and agreement on specifications to meet the CD-NAUS standards would take some time. Many data sets exist already and many more are being created. A set of specifications, a user-friendly graphic interface, and exchange, quality, and metadata standards would foster the creation of a wide variety of national thematic data sets. This would allow for a personalized national atlas for each individual.

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RESUMEN

The U.S. Geological Survey de los Estados Unidos publicó el atlas nacional de los Estados Unidos de América en 1971. Desde ese entonces, el tiempo ha cambiado y la revolución tecnológica en cartografía ha obligado a prestar más atención al concepto de un atlas a nivel nacional. Este trabajo hace énfasis en dos conceptos relacionados con atlas nacionales: La concepción popular de un atlas nacional y la noción que un atlas nacional puede contener información sobre los Estados Unidos que la mayoría de atlas comerciales no contienen. Se presentan ideas que describen el futuro, la comprensión y la producción nacional de atlas digitales para los Estados Unidos. (CD-NAUS).

SOMMAIRE

La U.S. Geological Survey a publié en 1971 le *National Atlas of the United States of America.* Les temps ont changé depuis la publication de ces anciens atlas; aujourd'hui, la révolution technologique en cartographie nous force à étudier de près le concept d'un atlas national. Le présent document se focalise sur deux concepts ayant trait aux atlas nationaux: la conception populaire d'un atlas national et la notion qu'un atlas national détaillé et complet contiendrait sur les Etats-Unis des informations n'apparaissant pas dans la plupart des atlas commerciaux. Le document présente des idées qui décrivent l'apparence que pourrait prendre un futur atlas national des Etats-Unis détaillé et complet, produit numériquement.

cartography bulletin board

The Cartography Research Laboratory at Georgia State University

by Jeff McMichael
Department of Geography
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The Cartography Research Laboratory (CRL) is an integral part of the Department of Geography at Georgia State University. It was originally established in 1972 to support the professional research of the Geography faculty, instructional, University service, and community service in a descending order of priority. Although university and community service has been the staple of the Lab in the past few years, the priority of the work has remained the same.

The Lab has one full-time cartographer and one part-time graphics technician. Student assistants are employed on an as needed basis to work on funded projects.

As with most cartography labs, in the past all production work was done using manual methods. However, we have now almost completely switched to computer methods and have retired our darkroom and stat camera. Any photo work is sent to local service bureaus.

The Lab currently has three computers–two 486/33Mhz PCs and one 386/25Mhz PC–and two printers–a HP LaserJet 4M 600x600 dpi laser printer and a HP PaintJet 180x180 dpi color inkjet printer. We have access to the Instructional Cartography Lab's HP Deskjet 1200C/PS 300 dpi color printer and the University Facilities Planning Department's HP Designjet 650C 36" wide color plotter.

Other equipment in the Lab includes a CalComp 46" x 60" digitizer with stand, a Kurta 12" x 12" digitizer, and a HP Scanjet. The three computers are currently connected to the laser printer through a smart switch (Print Director Silver, 1 MB RAM). The computers are networked by Intel ethernet cards using thin ethernet cabling (10MB per second transfer rate) running Microsoft Windows for Workgroups 3.11.

The Lab has the following software:

- Micrografx DESIGNER, ver. 3.1 and 4.0a
- Golden Software MAP VIEWER, ver. 2.0, and Surfer 4 and 5
- Zsoft PHOTOFINISH, ver. 1.0
- Microsoft EXCEL, ver. 4.0
- ESRI ARCVIEW, ver. 1.0, with US and World databases
- AutoDesk AUTOCAD for Windows, release 12
- IDRISI, ver. 4
- Strategic Mapping ATLAS*GIS for Windows
- VISTAPRO (terrain modeling)
- MicroCAM, ver. 3

Past Projects:
MARTA (Metropolitan Atlanta Rapid Transportation Authority). The Lab has been making maps for MARTA since the late 1970s. In the past four years, we have revised (and produced by computer) the System Map (showing all bus and rail routes in the two-county service area) and a new Downtown/Midtown Map, based on an existing Department map of the same area.

Kennesaw Mountain Historical Association. A two-map project detailing the Civil War battle of Kennesaw Mountain, Kolb's Farm, and Cheatham Hill.

The Map Co. A private firm that sells social science materials to public schools. The project consisted of three maps: the USA, North America, and the world; Georgia; and South Carolina.

Architectural Institute of America. The Lab produced all maps for the *Guide to Atlanta Architecture.*

The Department of Geography Atlanta Maps Project. A set of maps, printed on one sheet, showing the Atlanta's downtown area and various suburban business nodes.

Current Projects:
The New Georgia Guide. A regional guide to Georgia with 40 black and white 5" x 8" maps.

Atlanta Convention and Visitor's Bureau. Two maps for Atlanta's bi-monthly visitors' guide. Other special-purpose maps as needed.

Future Projects:
GIS laboratory. The department has received a grant for a GIS laboratory. We are soliciting projects from the university that have a GIS component. With the 1996 Summer Olympics occurring in Atlanta, we anticipate more maps aimed at this event.

Most of the computer equipment in the Cartography Research Laboratory was purchased through outside funded projects–that is, without university money. I believe this trend will continue. The department is investigating other sources of funding.

The Cartography Research Laboratory provides mapping services *gratis* to various agencies (i.e. the state Board of Regents' *University Factbook*). With the addition of a GIS Lab, the department is approaching projects with a multi-disciplinary aspect. ❑

The Oregon School Atlas Project

by Bill Loy
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University of Oregon

An experimental multimedia atlas designed to help Oregon school teachers is under construction at the University of Oregon. Funded by a $100,000 legislative appropriation, the project will be completed in June, 1995–the end of the biennium. The school atlas staff includes Joe Searl and Bill Loy, directors; George Wuerthner, editor and writer; Nancy Unruh, educational consultant and researcher; Nancy Leeper, book designer; and Jim Meacham and Jane Sinclair, cartographers.

The content of the atlas was determined by having a forum of twenty-two teachers in January 1994. We told them that our goals were: (1) to design the optimal set of maps and materials to aid in teaching in Oregon, and (2) to incorporate ongoing curriculum changes while being true to our geographic heritage. They told us what they wanted.

We are organizing our materials around the National Geographic Society's "Five Themes in Geography" while addressing the issues raised by the *Federal Goals 2000: Educate America Act* and the new geography standards in *Geography for Life: National Geography Standards 1994.* We are also studying the new curricula called ARGUS (Activities and Readings in the Geography of the United States) and, to a lesser degree, GIGI (Geographic Inquiry Into Global Issues). We will use ARGUS ideas in an Oregon context.

The new *Oregon School Atlas* will come in a box not a binding. A suite of materials will be included. Equal attention is being given to primary, middle, and high school students. There will be grade-specific magazine-format atlases; teacher workbooks in loose-leaf binders holding base maps, data sheets, and teaching activities; CD-ROM disks; and a video cassette.

Our InfoGraphics lab is now preparing several dozen page-sized, black-and-white base maps that are suitable for photocopying or making into overhead transparencies. The maps include state maps and maps of other regions, which serve to compare Oregon to other regions such as the Middle East. The magazine-style atlases are to be 128 pages long, 8.5 by 11 inches in size, and produced with QUARKXPRESS on a Power Mac for full-color printing.

The CD-ROM project will focus on the physical and cultural landscapes of Oregon. It will feature aerial photographs and maps in an interactive format using the multimedia authoring software DIGITAL CHISEL. The CD-ROM is a joint project between Geography and our Fine and Applied Arts Department.

A second CD-ROM will be called *Oregon Connections* and feature comparative images of Oregon cities and their sister cities overseas. Eugene, for example, will be compared to its sister city of Kakegawa, Japan.

Our video project is aimed at primary school children. We are experimenting with creating short videos of interest locally on topics such as "The Geography of a Glass of Water." The video will trace our water supply from original intake through filtration, distribution, consumption, and disposal. Other video topics may include a loaf of bread, a letter, a piece of lumber, and the like. ❑

reviews

BOOK REVIEW

SOME Truth with Maps: A Primer on Symbolization and Design
Alan M. MacEachren. Association of American Geographers, Washington D.C., 1994, 129pp., 8.5 x 5.5 in., maps, illustrations, bibliography, paper. $10.00. (ISBN 0-89291-214-6)

Reviewed by Jeffrey C. Patton
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As the use of GIS and computer mapping software becomes more common in private and public agencies, an increasing number of individuals with little or no training in cartographic principles have become responsible for creating an ever growing number of maps. Some of the uses of these maps may be trivial or affect only a few people. However, other maps are employed for more serious endeavors such as locating hazardous materials storage facilities, tracking global circulation patterns, establishing new congressional districts, determining the distribution of federal dollars for health care, or deciding which elementary school an eight year old will attend. Such uses are of vital interest to everyone. In the preface to his book, Alan MacEachren writes: "*SOME Truth with Maps* details a process for systematically considering cartographic symbolization and design issues so that scientists and/or policy analysts will be equipped to deal with the inevitably unique mapping problems with which they are faced in the course of their activities." This is both an ambitious and important task. As he points out, it was not his intention to provide a comprehensive text on map design; instead he wanted to describe a process for cartographic symbolization, categorization, and design. This process should lead to a more effective use of maps as analytic tools and communication devices.

Chapter one, "The Roles of Maps," lays the foundation for a discussion of cartographic design by noting the ways in which maps are used in scientific research. Using the model developed by David DiBiase (1990), MacEachren shows that, in the early stages of research, maps can function as powerful analytic tools for exploring data for unsuspected patterns and for the confirmation or refutation of hypotheses. In latter stages of research, maps may function as a means of synthesizing ideas for the researchers and finally as devices for the public presentation of the results and conclusions of research. Through a series of real-world examples, MacEachren not only illustrates how maps function as "visual thinking tools" (exploration and confirmation stages) and as "visual presentation tools" (synthesis and presentation stages), but he also shows how each role requires unique design strategies.

Chapter Two, "Cartographic Language," explores the relationship among the spatial dimensionality (positional, linear, areal, and volumetric) of the features to be mapped, the level of measurement for the collected data, and the graphic variables used to portray them. A set of graphic variables–size, shape, color value, color hue, color saturation, texture, arrangement, orientation, and focus–are defined. Each variable is discussed in terms of its suitability for the display of phenomena of each type of spatial dimensionality and for the measurement level at which data will be displayed. The chapter includes a summary chart that can be used as a general guideline for determining the suitability of each of the graphic variables discussed for particular representation problems.

"Abstracting Reality," the third chapter, begins with the statement, "Maps and map symbols are all abstractions, but the degree of abstraction can vary tremendously. Map designers must know how much abstraction is appropriate to a particular application or user and what kind of abstraction to apply." Two types of abstraction are discussed–the display form and the data being represented. The former is shown to occur along a continuum ranging from "images that mimic what an observer sees from a particular vantage point" to "graphics that represent relationships that may or may not be visible." A landsat image is given as an example of the "image" end of the continuum; a map displaying categories of ground water contamination by county lies near the middle of the continuum, and a simple line graph is found at the "graphic" end. Abstraction of the data to be represented is seen primarily as a function of categorization of the data (i.e., how many classes and what are the boundaries of those classes). The discussion of statistical methods for classifying data sets that follows is quite good. The last part of this chapter is a guide to displaying categorized data using the graphic variables discussed in Chapter Two.

The fourth chapter focuses on two of the most critical issues that must be considered when using or creating maps: visualization errors that can occur when viewing a map and how to represent the uncertainty of information. MacEachren discusses two types of visualization errors: Type I, which he calls "seeing wrong," and Type II, which he labels "not seeing." MacEachren presents a vivid example of how a Type I error occurred in the depiction of temperature on a map of North America. Initially, the data (temperature readings collected at a series of weather stations) was plotted directly onto a map of the continent and then interpolated from these points into a continuous surface (i.e., isotherms). The result was a decidedly false impression of the data. The correct procedure would be to plot the points in spherical coordinates, interpolate the continuous surface, and then project the resulting 3D surface onto a 2D map. In this example of a Type I error, some areas of Central America and the Arctic varied as much as 15° C from their actual temperature and a decidedly different pattern of temperatures resulted. Examples of Type II errors resulting from improper selection of projections and from poor data classification choices are also given. The remaining part of this chapter deals with the types of uncertainty commonly encountered in GIS and mapping, including the quality, completeness, and precision of data as well as the introduction of variability due to spatial and attribute aggregation occurring with data categorization. Two graphic variables are presented as being "intuitively appealing for representing uncertainty: color saturation and focus." The advantage of these graphic variables for representing uncertainty is that "both imply a lack of clarity or mixture of possibilities"–a virtual definition of uncertainty.

The final chapter is a brief look at cartographic composition. Graphic hierarchies, color selection for multivariate maps, the impact of scale on the material presented, and information displayed in the margins are all considered. The chapter ends with a discussion of a variety of display media and some suggested solutions for problems encountered when moving from one media form to another.

Each chapter includes a brief summary and endnotes. Illustrations, a real strength of the book, are in black and white and in color. The book concludes with a bibliography and a short list of suggestions for additional reading.

In his preface, MacEachren writes: "The purpose of *SOME Truth with Maps: A Primer on Symbolization and Design* is to introduce existing and potential users of computer-mapping and GIS software to cartographic symbolization and design issues, problems, and approaches." At this he has more than succeeded. This book is very well-crafted; he easily guides the reader through some of the most fundamental issues of map use and design with carefully constructed illustrations, explanations, and real-world examples. Cartographers, GIS practitioners, policy makers, or anyone concerned with the visualization of information will find that this book fills an important gap in the literature. It is an elegant little book that adeptly outlines the questions that must be considered when using or designing maps and provides the reader with a conceptual framework that addresses and solves those questions.

Reference

DiBiase, David. 1990. Scientific visualization in the earth sciences. *Earth and Mineral Sciences* (Bulletin of the College of Earth and Mineral Sciences). The Pennsylvania State University 59(2): 13-18. ❑

BOOK REVIEW

Boundaries of Home: Mapping for Local Empowerment
Doug Aberley, editor. Gabriola Island, BC and Philadelphia, Pennsylvania: New Society Publishers, 1993. The New Catalyst Bioregional Series v. 6. 138 pp., 37 maps and diagrams.
$34.95 USA cloth (ISBN 0-86571-271-9), $9.95 USA paper (ISBN 0-86571-272-7), $11.95 Canada paper (ISBN 1-55092-207-6).

Reviewed by Margaret Pearce and Jean McKendry
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This book is a cartographic text written for the bioregionalism movement. It is the sixth book in the Bioregional Series of the Canadian magazine *The New Catalyst*. The goal of bioregionalism, as summarized by the editor, Doug Aberley, is "to wed dynamic human populations to distinct physical territories defined by continuities of land and life. The promise is that these bioregions will be inhabited in a manner that respects ecological carrying capacity, engenders social justice, uses appropriate technology creatively, and allows for a rich interconnection between regionalized cultures."

The purpose of *Boundaries of Home* is to explain how mapping is a potential tool for bioregionalists (or "reinhabitants," as they call themselves) to use in the pursuit and expression of their environmental agenda. For Aberley, cartography promotes three of the goals of bioregionalism. First, it allows a graphic visualization of the boundaries, patterns, and relationships of the bioregion, or home place. Second, the act of making a bioregional map encourages the mapmakers to more deeply experience and become more involved in their home place. Third, the unique level of information provided by bioregional maps gives reinhabitants the power they need to act on the problems that they perceive. The map is thus the vehicle "to take our aspirations for social justice beyond the realm of desire into the terrain of empowerment and practice."

Implicit in Aberley's bioregional world view is that institutions that represent the "status quo" are responsible for environmental destruction and thus must be "reformed and ultimately replaced." Professional cartography, as a part of that status quo, is symptomatic of the problems that bioregionalism seeks to confront and overthrow. "In our consumer society," Aberley writes in the introduction, "mapping has become an activity primarily reserved for those in power, used to delineate the 'property' of nation states and multinational companies. . . The result is that although we have great access to maps, we have also lost the ability ourselves to conceptualize, make and use images of place–skills which our ancestors honed over thousands of years." Beyond Aberley's intention to teach mapping skills to people without a background in cartography, he seeks to fill them with a sense of outrage at their cartographic disenfranchisement.

Aberley begins his book by presenting his philosophy and the reasons why we, as readers/ reinhabitants, should map. This introduction is followed by a discussion of aboriginal mapping and a collection of case studies. These essays are intended to spark readers' imagination and inspire them into thinking about how to map from bioregional principles. The maps used to illustrate these principles are maps of and by indigenous peoples and maps created by specific bioregional groups. The last half of the book includes a primer on how to produce a bioregional map, the issues involved, and suggestions for further reading.

In the discussion on aboriginal mapping (Section Two, "Eye memory: the inspiration of aboriginal mapping"), Aberley presents native (or, in Canadian terminology, aboriginal) mapping as encompassing exactly those qualities which he envisions for a reinhabitant cartography. "Mapping as conceptualized and executed by aboriginal peoples," he writes, "is at the heart of what reinhabitants need to discover. How did societies that were rooted in place, that were wedded irrevocably to the land, use perceptions of time and place to provide order to their actions?" He criticizes academic interpretations of native maps for having historically denigrated native maps as "primitive" or "undeveloped" mapping, as well as for discussing the maps as objects apart from their ecological and cultural context. Aberley qualifies his own intentions toward indigenous mapping by asserting "This is no romantic quest. What we seek is inspiration from the best attributes of those who remain close to the land–rootedness, spirituality, and the ability to live in complex harmony with another life."

Aberley then moves on to testimonies from bioregional mapping projects in North America and England (Section Three, "Mapping the experience of place") from people who "walk the mapping talk." Of the eight reports in this section, two are from urban bioregions. Beatrice Briggs describes mapping the Wild Onion Bioregion, Chicago, and Whitney Smith discusses mapping the Oak Ridges Bioregion, Toronto. Three are rural mapping projects: Doug Sheriff and Eleanor Wright on the Yalakom Watershed, British Columbia; Kirkpatrick Sale on the Dart Watershed in England; and Angela King on Common Ground's Parish Mapping Project, also in England. The last three reports document bioregional GIS projects: Freeman House on the Mattole Restoration Council, California; Kai Snyder on the Yuba Watershed, California; and Jonathan Doig on Friends of the Earth biodiversity projects.

The case studies reveal shared ideals and problems through different approaches to bioregional maps. Although a bioregion may have many forms, all of the case studies (with the exception of the Parish Maps Project) base their maps on watershed boundaries. Watersheds seem to carry a primary significance as visualizing and defining the boundaries of a home place. Other common threads in the map projects include a concern for financial cost and the technicalities of locating and manipulating source material.

In the fourth and fifth sections, Aberley turns the responsibility of mapping to the reader. Section Four ("New terrain: current mapping thought") includes an essay on cartographic design from Stuart Allen of Raven Maps and Images. Seth Zuckerman and David McCloskey discuss the difficulties of overlapping regions and boundaries. George Tukel provides a reminder of the importance of GIS in bioregional planning. Aberley states that the section is intended to be a grassroots interpretation of cartographic thought rather than more "obtuse dialogue between egghead scientists or isolated academics." This suspicion of professional cartography / geography as situated within the status quo is echoed in Gene Marshall's essay. In Marshall's words, "We cannot turn our mapping task to some professional geographer. Maps which are super-imposed on us from 'higher authorities' or 'scientific theorists' mean nothing to us personally unless data from such sources resonate with our personally felt sense of place." In the fifth section, Aberley presents his step-by-step guide, "How to map your bioregion: a primer for community activists." Here, he walks us through his experience mapping his bioregion in Northwest British Columbia. The mapping process begins with the compilation of a basemap to help determine bioregional boundaries. Aberley explains how to locate and use a map library and how to trace overlays of geographic information which define the character of the bioregion.

The reader is first encouraged to use this compilation for interpreting information, such as the derivation of microclimate profiles, computation of river discharge cycles, and plotting human settlement patterns. Next, the reader is guided briefly through the process of composing an "economic history" of the mapped region. This exercise consists of analyzing mapped data (such as fishing, forestry, and mining activity) for the appropriate bioregional response. Thus, Aberley stresses not only the creation of the map but the application of the map's information towards achieving bioregional goals. At the end of the primer, Aberley has provided a list of further readings and resources on a range of geographical, cartographical, and bioregional subjects.

We found the overall theme of *Boundaries of Home* to be provocative. Aberley suggests that most people don't believe they can make their own maps or wouldn't know how to go about doing it if they wanted to. Cartography is seen as a kind of controlling force in people's lives, describing one vision of space without allowing responses. Aberley seeks to reverse this situation, imagining a future world in which "reinhabitants will not only learn to put maps on paper, maps will also be sung, chanted, stitched and woven, told in stories, and danced across firelit skies." The use of maps for local empowerment that Aberley advocates deserves attention.

The difficulty we have with Aberley's book, however, lies in the extremeness of his bioregional philosophy and the inherent contradictions and inconsistencies which are pervasive throughout the text. He is not calling for a multiplicity of maps but for a specific, bioregionally appropriate kind of map. Mapping is supposed to help reinhabitants locate where the status quo has control over the environment and how that control may be undermined. Maps of reinhabitants and native people are good and have value, and those of the status quo are evil and of value only to the extent that they may be appropriated to create bioregional maps. Likewise, the "natural" environment is good and should be protected, and the artificial, built environment is harmful (the only essay which doesn't seem to adhere to this is the section on "Common Ground mapping"). Technology is good only when it is in "the right hands." Further *a priori* assumptions exist with regard to data and its interpretation (Aberley, throughout the mapping primer, tells us how we should be feeling while making our maps) and the route of action that must be taken when the maps are made (as demonstrated by an activist interpretation of the gap analysis technique).

What makes Aberley's agenda particularly frustrating to read is that he simultaneously advocates projects and philosophies which directly contradict his bioregional dogma. For example, all of the mapping projects rely on either government base maps, professional cartographers, or GIS experts for their mapping needs; in other words, the same egghead scientists against whom Aberley has warned us. When Aberley bemoans the "specialists who wield satellites," then lists an atlas of satellite imagery in his compilation of inspirational texts, we are left wondering what to think.

These types of contradictions are most prevalent when the subject is GIS. Both Snyder and Doig mention specifically that they are working with ESRI products for their GIS. This strategy seems particularly antithetical to the bioregional philosophy because it requires high-end and expensive hardware and software. The contributors do not seem to make the connection that the industrial infrastructures that they seek to replace, the "incessant development juggernaut," are the same institutions which have made GIS possible and continue to support it. Further, the maintenance of a GIS does not always encourage immersion in the bioregion: Snyder reports in the Yuba Watershed study that Arc/Info comes with a watershed boundary definition tool. If Arc/Info is defining the extent of the bioregion, who is doing the mapping in this project?

Despite these criticisms, *Boundaries of Home* fills a need for cartographic information in the bioregional movement, and in this task, it is successful. It promises to be an inspiration for some interesting mapmaking. For those of us outside bioregionalism, it remains a thought-provoking book. Obviously, this is not the first time that cartography has been brought to task for its oppressive nature, and it probably will not be the last. It is, however, one of the few instances in which the charges have come from outside the academic walls. We as cartographers should consider seriously the charges levied against us. How can we make mapmaking more accessible, less intimidating? How can we encourage people to define their own cartographic voices? How do we find our own?

At the same time, Aberley's book might have some unintended consequences. The maps which Aberley inspires may portray other versions of reality: complexities of responsibility and connection that were once believed simple, shades of gray where formerly only black and white were perceived. The lines of power and disempowerment may turn out to be as difficult to disentwine as the lines determining the bioregions, and the web that supports the status quo may lead, unsettlingly, to every bioregional doorstep. ❑

BOOK REVIEW

Visualization in Geographic Information Systems
Hilary M. Hearnshaw and David J. Unwin (eds.). Chichester: John Wiley and Sons. 1994. 243 pp. Cloth, price $89.95. (ISBN: 0-471-94435-1)

Reviewed by J. Krygier
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Visualization in Geographic Information Systems is an explicit attempt to link developments in cartography and visualization to geographical information systems (GIS). The editors define visualization as a mental process as well as a set of methods which aid the process of visual data analysis. Cartography serves as a precursor of and foundation for visualization in this context. *Visualization in Geographic Information Systems* is a somewhat unusual hybrid. It arose out of a workshop/conference held in 1992, but it is not a typical conference proceedings. Contributors, which included geographers, cartographers, and computer scientists, submitted working papers to all attendees before the conference for comments, presented the papers at the conference, and then split into working groups (which mimic the four main sections in the book) to further critique and modify the original papers. The results of these modifications (including introductory comments for each of the sections) were then re-presented at the end of the conference and modified after the conference. The result is this book, which is much more coherent than most conference proceedings and even many edited collections of papers. Considering the fact that the territory covered in the book–the relations between visualization, cartography, and GIS–is largely unexplored, the manner in which this book was conceived and executed is both creative and innovative. *Visualization in Geographic Information Systems* provides a viable point of departure for cartographers grappling with an expanding role in geographical analysis and for experts in GIS who are beginning to seriously consider the advantages of visualization as an analytical method in GIS.

Visualization in Geographic Information Systems is divided into four main sections: "Visualization in GIS," "Advances in Visualizing Spatial Data," "Visualizing Data Validity," and "Human Factors in Visualization." Each section is preceded by a jointly-authored introduction that summarizes trends and developments in the topical area and introduces the papers which follow. The first section, "Visualization in GIS," seeks to relate traditional cartographic knowledge to current issues in visualization, link general visualization issues to GIS, and review available visualization software. M. Wood's paper opens the section with a plea to recognize that the traditional paper map has long served as a mental visualization tool and that there is existing cartographic knowledge that is of value to current research on visualization methods for GIS. M. Visvalingam reviews the somewhat confusing terminology that pervades the topic of the book (visualization, ViSC, visualisation, visual representation, visual display, etc.), suggests how cartography is related to current issues in visualization and GIS, and concludes with a list of problems which are limiting the use of visualization in GIS. A. Turk introduces the idea of cognitive task analysis in optimizing GIS visualizations, reviews a number of different taxonomies that can be used to organize and guide visualization design, and suggests that research needs to focus on developing such taxonomies as guides to selecting appropriate GIS visualizations. K. Brodlie summarizes a computer-science-oriented approach to the process of visualization, which he terms "the visualization pipeline"–the flow from raw data, through data filtering and enhancement, modeling, and rendering of the visualization. J. Gallop concludes the first section of the book by classifying a variety of visualization software packages.

The second section of *Visualization in Geographic Information Systems* seeks to review advances in visualization methodologies, including issues of audience, abstraction, interactivity, and new technologies (sound, multimedia, virtual reality). I. Bishop reviews the role of visual realism in GIS visualizations, discussing benefits and some applications of realistic simulation and modeling in geography. A. Gatrell reviews available methods for transforming distributions of point (x,y) data into continuous surfaces and describes a method for performing such a transformation in the context of GIS visualization. I. Bracken critiques the dependence on zonal (choropleth) maps in cartography and suggests the georeferenced grid as a more viable method for visualizing socioeconomic data. D. Dorling critiques the traditional plan map as an "equal-land" cartogram that is not particularly appropriate for visualization in human geography and details several methods that incorporate both cartograms and complex multi-variable symbols (Chernoff faces, trees, etc.). J. Dykes describes methods for maximizing spatial association on choropleth maps and visualizing autocorrelation. A. MacEachren reviews and elaborates research on time as a cartographic variable, describing a set of dynamic variables and a series of applications that incorporate the dynamic variables. S. Openshaw, D. Waugh, and A. Cross conclude the second section of the book with a review of map animation and its application to visualization in GIS.

The third section of *Visualization in Geographical Information Systems* focuses on the visualization of data validity in the context of visualization in GIS. An introductory chapter by M. Goodchild, B. Buttenfield, and J. Wood summarizes important definitions, ongoing research, and future directions for research on the visual display of data validity. B. Buttenfield and K. Beard build on this introductory chapter by describing a conceptual framework for guiding research on the visualization of data validity. M. Goodchild, L. Chih-Chang, and Y. Leung describe the concept of "fuzzy classification" and provide methods for visualizing fuzzy maps from such classifications. J. Wood reviews methods for visualizing the accuracy of contour interpolation in digital elevation models, concluding that many useful techniques for such visualization exist in currently available GIS software. P. Fisher concludes the third section of the book with a discussion of how animation and sound can be used to represent data uncertainty.

The final section reviews psychological and philosophical issues which surround the use of visualization in GIS. C. Davies and D. Medyckyj-Scott provide a succinct review of research within and outside of the context of visualization and GIS which may assist in evaluating the human aspects of visualization, including human factors, graphic design, psychology, and ergonomics. H. Hearnshaw provides an overview of psychological literature on the physiological, perceptual, and cognitive aspects of visual displays. D. Medyckyj-Scott applies ideas from the field of human-computer interaction studies to visualization and GIS. J. Petch concludes this final section of the book with a discussion of some philosophical issues that underpin visualization as a method and a means of knowing (epistemology) in geography.

Visualization in Geographic Information Systems seems appropriate for several audiences. On one hand, it could be used in an advanced undergraduate or graduate course on visualization and GIS. The succinct chapters are, for the most part, straightforward, easy to read, and raise numerous issues for research and discussion. The cost of the book, however, may preclude it from being adopted as a course text. On the other hand, an academic audience should also find the book useful. Interesting points of contention arise between different authors and raise interesting questions. For example, while Bishop contends that the value of realism in visualization is that such realism is "the nearest we can achieve to direct experience" and that it is "more orientation free" and objective than more abstract data and ideas, Dorling asserts that such "physical" realism is at odds with "human" realities which are better represented with abstract cartograms and multi-variate symbols.

Another conflict is revealed in Goodchild, Chih-Chang, and Leung's chapter on "Fuzzy Maps." The authors argue that the cartographic processes of generalization, abstraction, exaggeration, simplification, and classification cause uncertainty. Goodchild et al. conclude that cartographers have not paid attention to representing uncertainty because of the "desire not to confuse the process of communication" and "a willingness to portray the world as simpler than it really is." This contention is contradicted by other authors in the book (such as when Fisher reviews traditional cartographic methods for representing uncertainty) but raises a serious issue: the power of maps arises out of their ability to generalize, abstract, exaggerate, simplify, and classify the "real world." Goodchild et al. imply that such cartographic manipulations are somehow deceptive and impede understanding of the complexity of the "real world." Such differences between GIS practitioners and cartographers will obviously have to be explored in more detail.

Finally, Petch's chapter on epistemological aspects of visualization provides a somewhat peculiar end to the book. Petch closes his chapter with the supposition that, as geographic ideas, theory, and laws are at best poorly developed, attempts at formalizing spatial thinking and logic in the context of visualization and GIS will be difficult if not impossible. Petch concludes that the "progress of GIS visualization . . . rests principally on developing geographical ideas." While I agree wholeheartedly, it is strange to finish a book so focused on particular techniques, technologies, computer algorithms, equations, graphic taxonomies, abstractions about data validity, and psychological methodologies with the call for a focus on geography. Petch thus raises an important issue that is left relatively unexplored in the book: namely, how does the method (visualization and GIS) relate to its substantive context?

Visualization in Geographic Information Systems serves as point of departure for cartographers who are coming to grips with new technologies in geography–such as GIS–as well as the expanding role of visual methods in geographical analysis. For the most part, the book's authors are open and fair to cartography's past and are quite willing to borrow and apply traditional cartographic methods within the context of visualization and GIS. Yet, most of the chapters suggest that visualization is not necessarily what cartographers have always done, that visualization is more focused on the process of geographical analysis rather than the process of communicating a given message, and that this difference implies many new research challenges. At the same time, the book can serve as an introduction to experts in GIS who are beginning to seriously consider the advantages of visualization as an analytical method in GIS. The value of traditional and emerging research in cartography in shaping visualization in the context of GIS is made clear, and GIS experts who have been primarily concerned with non-visual analysis will undoubtedly find something of value in the book. ❑

ATLAS REVIEW

Interactive Atlas of Georgia.
Thomas W. Hodler, Neal Lawson, Howard A. Schretter, and Jeffrey Torguson. Athens, Georgia: Institute of Community and Area Development, University of Georgia, 1994. $89.

System requirements: IBM or compatible 386 computer with VGA graphics monitor, mouse, and 10 MB available hard disk space

Review by Patrick McHaffie
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The Interactive Atlas of Georgia comes packaged in an attractive box featuring a color, two-channel Landsat MSS mosaic of the state. The package contains the three-disk atlas, a brief 28-page tutorial, a 54-page technical manual, and a handy quick reference card. Minimum system requirements for the atlas include an IBM or compatible personal computer with 10 MB available hard disk space, DOS 3.0 or later, 512K RAM, VGA color graphics, and a high density 3.5" disk drive. The atlas also supports a Microsoft or compatible mouse (or pointing device) and an HP Laserjet Series III printer. Installation instructions are well-written and easily followed from the technical manual. I tested the atlas on two separate systems: a desktop IBM-compatible 486-33 using MS-DOS 5.0 and a color notebook 486-50 using MS-DOS 6.2.

When the atlas is opened, the user is presented with a cover page containing a number of selections arranged in a "tool bar" across the top of the screen. This first level of the menu system includes several selections. These include:

- HELP - Brief and not indexed or searchable.
- CHAPTERS - Allows the user to select one of several map screens organized around nineteen thematic headings such as "agriculture," "education," or "crime."
- SCREENS - Allows the user to browse any of the map pages independent of the chapters.
- DATA - Produces a formatted county report, listing 234 statistics for any one of Georgia's 159 counties.

Both levels of the menu system are reminiscent in "look and feel" of many early DOS applications with fixed pop-up menus and a clumsy scrolling capability. Fortunately, the user need only use this menu briefly to move to the second (and final) level of the menu.

The second level of the menu system is reached either by selecting a screen from the "chapters" selection in the first menu or by going directly to a screen in the "screen" selection. When a screen (analogous to an atlas page) is open, the user can control various parameters or move to other screens using a fixed "tool bar" at the top of the screen. The "tool bar" might have been better located at the bottom or side of the screen. In its present location, the user must turn it on and off to page through the screens in order to view the titles. The functions contained in this menu include:

- HELP - Again brief and not indexed.
- WHERE - Presents a scrollable list of counties in a fixed pop-up box. Selecting a county from the list highlights that county and pops-up a small box with the statistic for that county. The user can also point to any county in the body of any map and obtain a similar result, although I didn't like the offset method of highlighting the counties on the two displays I used to evaluate the system.
- REPORTS - Produces a formatted report of counties by county order, data order, or data class and allows the user to view or save the report. Unfortunately, this function does not allow the user to select file formats for saved reports that might be usable by an external spreadsheet, database, or thematic mapping package or include FIPS codes as a field. This is particularly annoying given the absence of any internal graphics capabilities of the atlas.
- REGIONS - A useful tool that allows the creation of user-defined regions composed of two or more counties that can be saved and processed separately.
- QUERY - Allows the user to identify counties that meet a user-defined range criterion. The user can also define ranges on multiple maps to produce a report of counties that meet multiple criteria.
- CITIES - A pop-up menu allows the user to locate a city in the selected map. The user can also display a county seat or all the cities in a selected county. The utility of this function is diminished by the absence of a zoom capability.
- INFO - This function will pop-up a scrollable text box that contains additional information about the maps contained

on that screen. The user can also display or save the references used to compile the maps on the screen.

- PRINT - Allows the user to print state and region maps or reports.

- MISC - This selection contains a "county learn game" that prompts the user with a randomly selected county name and allows 10 seconds to point to the named county. This can be quite challenging with Georgia's 159 counties, and as a new arrival, I scored poorly on several tries.

- ARROW KEYS - The user can page through the screens one at a time and, since they are organized by chapter, generally find related information. This is one of the most annoying aspects of the atlas. To move directly to another screen, which may be distant from your current view, the user must either use the bookmark system (20 function keys activate "bookmarks," which are active only for the current session) or move back into the main menu to scan the lists of chapters and screens. When the user selects one of the arrow keys to "page" to the next screen, the display "blacks out" for about a second, providing a distracting visual jolt.

The atlas was intended as a replacement for *The Atlas of Georgia,* a hardbound 286 page reference work published by the University of Georgia in 1986. The designers of *The Interactive Atlas of Georgia* have produced a useful tool for introducing K-12 students to some of the concepts of cartography, geography, computers, and a suite of information describing the state and it's people. As such, it should be a practical tool for high schools and colleges. The atlas falls short of the mark, however, in attempting to provide a serious research tool for the more advanced student or the university library.

In a cartographic sense, this atlas presents its portrait of Georgia in a rather inflexible fashion, perhaps a surprising characteristic for those who might expect a more "interactive" product. In general, the planimetry of the maps appear to be fairly detailed, although in several instances, notably on the pages in the "Physical Geography" chapter, there is an obvious misregistration between physical features and political boundaries. However, this only becomes apparent if one is using the "point and click" method of pulling up county outlines, so it's not terrifically obvious unless one is wondering why a particular boundary doesn't correspond with a particular river. The color selections used on many of the maps appear to be inappropriate and the user has no control over color selection. Likewise, class range selection is fixed and inconsistent, and there is no discussion of the scheme (e.g., quantile, natural break) used in each case. In other instances, choropleth maps are used inappropriately to represent raw values not equalized for population. The final effect is to approximate the act of paging through a paper atlas without much of the "interactivity" we might expect.

In summary, *The Interactive Atlas of Georgia* can be a useful tool for K-12 teachers or students, presenting a large volume of statistical information principally aggregated at the county level in a relatively easy-to-use format. Serious users may be disappointed by the graphical user interface, the cartographic inflexibility of the system, the lack of any internal graphic system, and the limited options for hard or soft copy output. In addition, there will certainly be many Macintosh users (who haven't sprung for the Power Mac yet) that will "pine" for a chance to access the atlas and its information. The designers have done a creditable job in replacing the hardbound atlas with a PC version. Perhaps, the next edition will improve in terms of interface, output, and interactivity. ❑

SOFTWARE REVIEW

EASY IMAGE

Version tested: 2.0. From Penmatrics, Inc., 225 S.W. Madison, Corvallis OR 97333. Phone (503) 757-3076. Fax: (503) 752-2027. $595.

System requirements: The program will run on any 386 desktop running Windows 3.0 or higher, but a 486 machine is preferable. A minimum of 4MB RAM and 3MB of hard disk space are needed, along with a VGA 256-color high resolution video card and monitor. The program was evaluated on a Gateway 486-DX4 100-MHz system with 16 MB of memory and a Mach 64 video card with 2 MB VRAM.

Reviewed by Mark D. Schwartz
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EASY IMAGE is a Windows-based image analysis package designed to meet the needs of two diverse groups. For general users with elementary needs, the program provides a complete set of tools for image display and enhancement. An add-on program, the Software Developer's Kit (SDK, $695), allows customized applications to be written in the C or C++ programming languages, and then incorporated into the basic EASY IMAGE engine. The SDK was not evaluated in this review.

The program permits basic image processing to be accomplished with the "point and click" ease of a Windows environment. The main menu includes an icon bar for quick access to major functions, a color palette to control image display, a histogram window that displays a bar graph representation of image data, and an information widow that reports information related to processing status or the current cursor position. Basic commands are also accessible along the top of the display in standard Windows format. The program supports reading and writing of TIF and BMP (up to 24 bit) formats. Other file types with one byte per pixel and non-essential header information can be imported into the program by specifying the characteristics. The PCX format is directly supported. Files can also be written in Resource IMG format.

Once an image has been brought into EASY IMAGE, it can be enhanced and manipulated in a variety of ways. Multiple images can be opened and viewed simultaneously in adjoining or overlapping windows. Area size can be controlled by zooming in or out a specified amount. An image can be registered to a real world coordinate system if it is already planimetrically correct. The formula function allows image algebra operations to be performed on one or more images. Options such as a normalized band ratio and standard equations allow the user to calculate the Normalized Difference Vegetation Index (NDVI) and average, brighten, darken, and increase or decrease contrast in an image. Users can also specify their own formulas.

Other features include the ability to crop an image and to produce a full color red-green-blue (RGB) composite from three individual bands of the same area. Statistics of the pixel values, such as average and standard deviation, are available with a click of the mouse. Images can also be resized or rotated. A standard image processing technique, the ability to stretch the contrast within an image, can be applied either through histogram equalization or a linear stretch with saturation.

While this product is marketed as a basic image processor, it also includes an number of advanced features. For example, a full set of filter functions can be applied to the image. Options include low pass, high pass, edge enhancement, or user-defined. Perhaps one of the most powerful features is image rectification. Many images lack planimetric accuracy, as well as not being registered to a real-world coordinate system. The rectification function allows both of these deficiencies to be corrected. With a minimum of four control points (known locations in a real-world coordinate system), the program can warp and georegister an image to a specified coordinate system. Classification of areas within images to known cover types can be accomplished though either an unsupervised (statistical group discrimination) or supervised (training site) approach. Lastly, the false color function lets the user assign colors to ranges of pixel values, giving color to a normally gray single-band image.

In order to evaluate program operation, I decided to tackle the problem of image rectification and georegistration. This is a common difficulty associated with incorporating remote sensing data into GIS analysis or simply developing a land cover classification. The test data were 768 x 1024 byte binary images of the northern portions of the Milwaukee metropolitan area. These were originally recorded by a NS001 Thematic Mapper Simulator (TMS) sensor onboard a C-130B aircraft. The images had a nominal resolution of 7.6 m. The date and time of the image set were not available. These data were provided to me by Michael Fitzgerald of the Aircraft Data Facility at the NASA Ames Research Center, Moffett Field, CA.

I selected for analysis the three bands commonly used in creating a near infra-red false color composite: Band 2 (0.529-0.603µm), Band 3 (0.633-0.697µm), and Band 4 (0.767-0.910 µm). The first step was to import the data, and this was accomplished by simply specifying the number of columns and rows in the file (the program terms these width and height). Next, I obtained latitude-longitude coordinates from a standard U.S.G.S. topographic map corresponding to four control points that could be visually identified on the image set. Using the rectification function, I was then able to point to each of these locations and register the coordinates. The points were saved to a file, so that I could recall them and rapidly rectify all three images in sequence. My final test was to produce a false color composite from these three bands. I first used the linear stretch function (with 5% saturation on each end of the curve) to increase the contrast of all three images. The composite function then created a combined image that simulated the appearance of a near infra-red false color photograph. This product was of acceptable visual quality, and I considered the whole procedure successful.

In general, I found the program easy to use and quite versatile. I was particularly impressed with its ability to open several images in different windows at the same time. After using exclusively DOS-based image processors, this was a refreshing and quite flexible option.

Most of my concerns about the program relate to the limitations of the available functions. This may not be a completely fair criticism of an admitted basic image processor, but some of these deficiencies could be easily addressed. First, I would like the option to write files out in the same format that they were read in. Many programs work with generic byte-binary formats and it would be useful to be able to export at least this additional format. Second, I was surprised that the composite function did not seem to automatically stretch the three component images as it was creating the full color composite. I had to do that as a preliminary step. Lastly, I was a bit disappointed in the manual. It did not offer much detail or explanation as to why certain functions might be desirable. The on-line documentation in the program was essentially the same as the manual. While basic users may not miss this, I was left wondering how long it would have taken me to use the program efficiently if I hadn't already had a fairly thorough background in image processing. It would seem that more extensive documentation would make EASY IMAGE a much more accessible product to the neophyte user. Overall, these are fairly minor concerns. The program appears to be exactly what it proposes to be–a low priced (I would say moderate), basic image processing program for the DOS-Windows environment. ❑

technical notes

The cover for this issue of *Cartographic Perspectives* is of a portion of the Oregon Department of Geology and Mineral Industries' *Elbow Quad Geologic Map*. The original map is in full color and measures 26.75 inches high and 40 inches wide. This *technical notes* section describes the design considerations and execution of the full color map.

AUTOMATED LARGE-FORMAT GEOLOGIC MAP PRODUCTION

by James E. Meacham
InfoGraphics Lab,
Department of Geography
University of Oregon

INTRODUCTION

The Department of Geography at the University of Oregon and the Oregon Department of Geology and Mineral Industries (DOGAMI) entered into a cooperative agreement to conduct cartographic research and to work on the development of an automated procedure in order to produce and to publish a multi-color version of *The Elbow Quad Geologic Map*. The work included: (1) the creation of digital cartographic files and geologic symbols, (2) the delivery of check plots, and (3) the creation of color-separation PostScript plot files.

METHODS

The research and production work was conducted on two computer platforms running MicroStation CAD software, an Intergraph Unix workstation, and a 486-PC. Intergraph MicroStation was chosen as the software package because of its compatibility with the computer mapping installations at the DOGAMI office, the Oregon Department of Transportation (ODOT), and the University of Oregon InfoGraphics Lab. The DOGAMI cartographers have traditionally created registered geologic overlays and combined them with existing U.S.G.S. film-separates of base map information. One of the purposes of this coorperative agreement was to developed a procedure to automate the creation of the geologic overlays.

PROCEDURE

The procedure developed for the creation of a geologic map was based on the on-going research being conducted for the publication of the *Official Highway Map of Oregon*. The cartographic procedure includes four major steps: (1) File Organization, (2) Map Data Input and Manipulation, (3) Geologic Symbol Design and Creation, and (4) Output of Map Images.

File Organization. The File Organization step includes: (a) planning and creating design files with the appropriate naming convention, (b) setting up of an organization scheme within the design files, and (c) determining the geographic coordinate and projection specifications of the design files.

Two files were created for the map portion of the project: *elbowmap.dgn* (line work, polygons and area patterns) and *elbowtxt.dgn* (text and symbols). These two files were referenced to each other using MicroStation's reference file capabilities. The time rock chart and geologic cross sections were created in another design file (*elbowpro.dgn*).

All the graphic cells (symbols) were designed and built from primitive elements and a description of each cell was contained in a separate design file (*zdogami.dgn*). From the design file the cells were added to a cell library (*dogami.cel*). Each data level was assigned a name corresponding to its geologic unit. A modified PostScript plotting configuration file was created (*elboptrn.plt*). A level organization scheme was setup for the *elbowmap.dgn* and the *elbowtxt.dgn* files. These two files were referenced to one another.

The projection was defined in the Intergraph Projection Manager software package. The projection definition came from *The Elbow Quad* U.S.G.S. map. The projection and coordinate system was based on *The Elbow* U.S.G.S. quad projection definition of Polyconic, NAD27, and Clarke 1866 (ellipsoid). This allowed for acceptable registration of digital images to the U.S.G.S. quad base.

Map Data Input and Manipulation. The Map Data Input step consisted of capturing the line, area, and point information by digitizing the green-line mylar provided by the DOGAMI geologists. This began by setting up a design file in the correct projection with the four latitude, longitude coordinate points that corresponded to the U.S.G.S. quad corners that were identified with circles in the design file. The mylar was used as the source map for digitizing the contacts, faults, and contact-faults. Check (pen) plots were compared to the original green-line mylar. A Linotronics image was created to check the line quality of the digital image to the mylar. Unit areas were created into polygons on the proper unit level (example, level name Qls or lv=21).

Geologic Symbol Creation and Placement. The creation of the cells took place in the *zdogami.dgn* design file. The symbol design was based on the standard symbol set given to the InfoGraphics Lab by the DOGAMI cartographers. The point symbols were created to match the existing the symbol set and then added to the cell library (*dogami.cel*).

The point symbols were digitized from the mylar quad. The strike and dip symbols were rotated to the proper angle. The text sizes were selected to match the existing standards.

The text was placed using the mylar as a guide. The linear feature thickness and line style design were based on geologic mapping standards. They were then assigned a MicroStation weight (WT=) and a specific plotting thickness in the plotter configuration file. The fault line codes were also tested for spacing of dashes and dots.

The area symbols were designed after standard transfer area patterns. Extensive testing was needed to develop the random "sand and gravel" like area patterns of many of the units. One problem was the appearance of rows where the pattern cell repeated. The solution was to interactively adjust the pattern cell elements in order for them to appear random when repeated during the area pattern execution.

The line and area pattern symbols were placed in the *elbowmap.dgn* file and the point symbols and text were placed in the *elbowtxt.dgn file*. The *elbowpro.dgn* contained all three groups of elements for the profile and time-rock chart. The map files were referenced to each other for the creation of plot files.

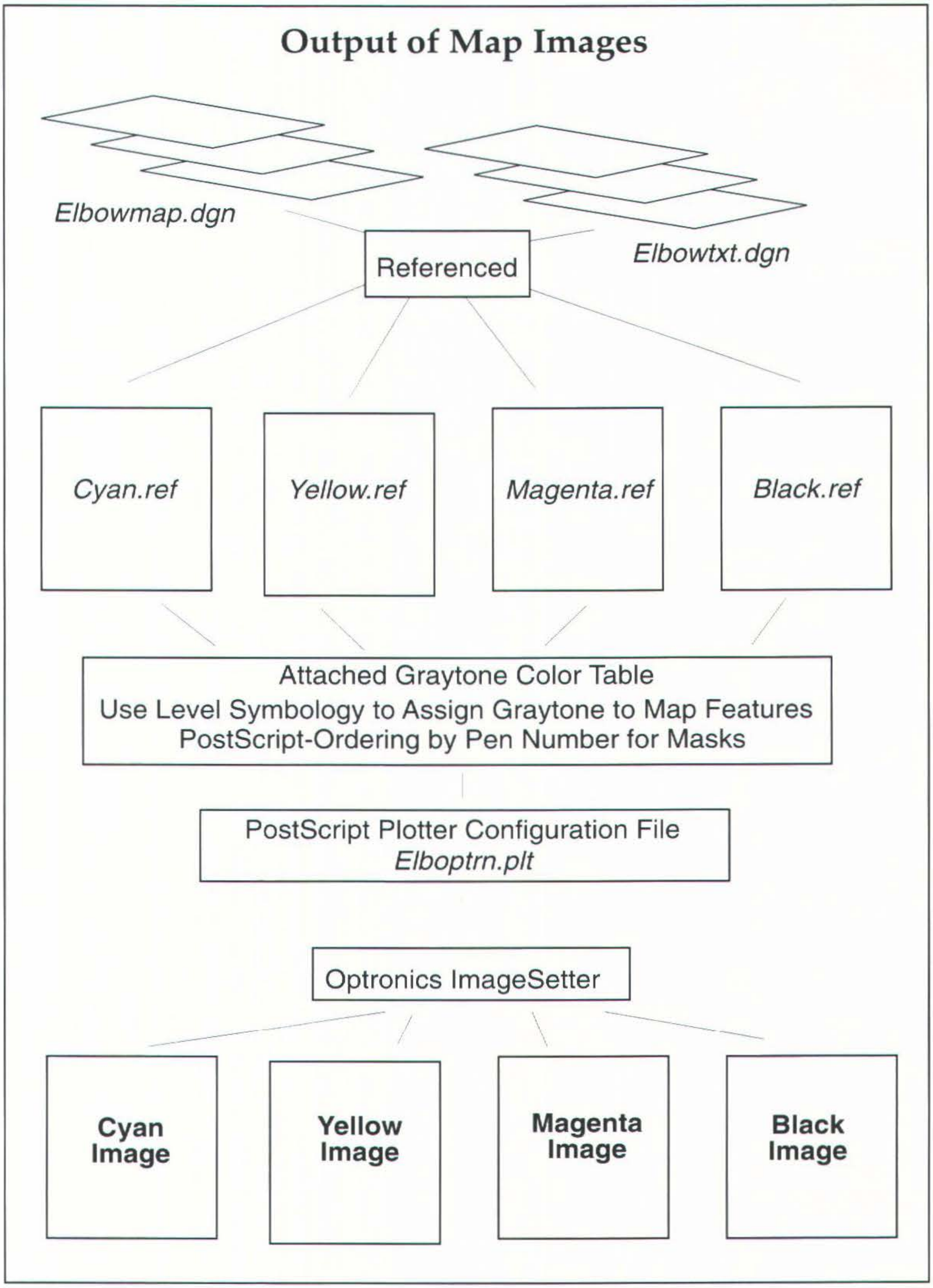
Output of Map Images. An HP Draftpro pen plotter, a laser printer, and a Linotronics image setter were used for the check plots. The final output was done on an Optronics 2000 image setter. The final map image size was 19 by 23 inches. The PostScript files were created using the *elboptrn.plt* configuration file. The method of production of color-separations with type-spreads and knockout masks was created directly from MicroStation CAD software. The procedure took advantage of level symbology, color tables, reference files, PostScript drivers, and PostScript ordering to produce high-quality large-format images with pre-angled screens. The PostScript files were created for the map area as one set and the time-rock chart and profile were created as another.

Figure 1 (page 58) shows the work flow from the design files to the final images. The map data in *elbowmap.dgn* and *elbowtxt.dgn* are referenced to color separation design files. With the use of level symbology (a MicroStation feature) and a gray tone color table, percentages of each process ink are attached to the appropriate map feature level. PostScript ordering by pen number that relate to color table number allowed for type-spreads and knockout masks. Each of these color separation files were plotted to PostScript files using the plotter configuration file *elboptrn.plt* (Figure 2, page 59). The PostScript files were sent to an Optronics 2000 image setter with screen angle instructions for the creation of the film negatives.

CONCLUSIONS

The Elbow Quad Geologic Map project was the first effort by the Oregon DOGAMI to automate their map publication process without loss of graphic quality. The procedure described here was developed in order for the Oregon DOGAMI to incorporate cartographic production advancements and enhancements into their work flow.

Figure 1: Work flow for The Elbow Quad Geologic Map.



UO InfoGraphics Lab 1994

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David Cutting and Nancy Leeper of the InfoGraphics Lab at the University of Oregon and Mark Neuhaus of the Oregon Department of Geology and Mineral Industries contributed greatly to the production of the geology map described in this article.

References

1993-94 Official Oregon State Highway Map. Salem, OR: Oregon Department of Transportation.

Meacham, James E. 1993. *The Electronic Publication of the Official Highway Map of Oregon*. Paper presented at the Association of American Geographers 89th Annual Meeting.

Geology and Mineral Resources Map of the Elbow Quadrangle, Malheur County, Oregon. 1992. GMS-62, Geological Map Series: Oregon Department of Geology and Mineral Industries. ❑

PostScript Plotter Configuration File (*elboptrn.plt*)

```
;    Optronics 2000 dpi  (postscript) Plotter Cfg File (MicroStation)
;   elboptrn.plt max 19.00 x 23.5 inches
num_pens=8                          ; required record
change_pen=weight                   ; either "color" or "weight"
size=(7.45,10.55)/num=0/off=(.55,.35)/name=A
size=(16.00,10.00)/num=0/off=(.35,.55)/name=B
size=(17.80,31.45)/num=0/off=(.21,.21)/name=C
size=(19.20,23.60)/num=0/off=(.21,.21)/name=Q
resolution(IN)=(0.0005,0.0005)      ; specifies both res and units
stroke_tolerance=4.5                ; unitless num  0 < tol <10
model=laserwriter                   ;plotter model number
autocenter
style(1) = (4,12)
style(2) = (120,60)        ; pattern 360 hatch
style(3) = (0,40,278,0)     ; approximately located fault
style(4) = (33,12,8,12)
style(5) = (0,40,40,0)      ;  concealed fault
style(6) = (75,15,15,15,15,15)
style(7) = (75,10,10,10,10,10,10,10)
weight=(5,10,15,21,30,33,43,52,62,72,81,1,1,1,1,1,1,1,1,1,1,1)
hardware_arcs = 1
font("AvantGarde-Book") = (1) /KERN=35
font("Times-Bold") = (2) /KERN=45
font("Helvetica") = (7,71,103) /KERN=40
font("Palatino-Bold") = (3) /KERN=0
font("Symbol") = (26) /KERN=10
font("Helvetica-Oblique") = (23,24,72) /KERN=20
font("Helvetica-Bold") = (73) /KERN=40
rotate = cw                         ; clockwise rotation
; border/pen=1/filename/time               ; leave this out for no border
communication=(eol1=10,eol2=0)
communication=(handshake=1,port=2,baud=19200,par=none,data=8,stop=1)
end_plot=eject
```

Figure 2: PostScript plotter configuration file (elboptrn.plt) for plotting color separations.

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cartographic perspectives Back Issues

*The first issue of **Cartographic Perspectives** was published in March 1989. Back issues (for all issues) are now available at a cost of $20 per issue ($10 for members). Please specify the issue numbers (1-19) when ordering. Makes checks or purchase orders payable to NACIS. Send your back issue requests to:*

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CALL FOR PARTICIPATION

XV Annual Meeting of the NORTH AMERICAN CARTOGRAPHIC INFORMATION SOCIETY

Wilmington, North Carolina
October 25 - 29, 1995

The NACIS Program Committee invites your participation in this meeting by:

giving a paper
organizing a session
developing a panel discussion
conducting a workshop
preparing a poster or exhibit

Poster, paper sessions, and panel discussions are now being organized on a variety of topics, including cartographic animation, multimedia presentations, and cartographic database access on the Internet. All cartographic-related topics are welcome, specific sessions or workshops are being planned for cartographic animation, multimedia presentations, and cartographic database access on the Internet and the use of Mosaic & the World Wide Web.

Persons interested in participating should develop a proposal or abstract which includes the author's name, professional address, telephone number and a description not to exceed 250 words. Student participation is encouraged. Proposals should be sent to:

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e-mail: krice@uwspmail.uwsp.edu

PROPOSALS and ABSTRACTS MUST BE RECEIVED BY JUNE 30, 1995
Participants will be notified by July 31, 1995 of the acceptance of their abstracts or proposals.

For those of you interested, Wilmington, North Carolina is an ideal location to travel with your family. There are many attractions and recreational activities available - Plan now for a sojourn to the Atlantic Coast next October!

President's Message
continued from page 2

The first point means that there is rarely a well defined group of members who are exclusively devoted to any one interest area, for example, education. This has been demonstrated on several occasions when the Association has asked its members to indicate which of the following statements most accurately described their level of interest in each of the Association's Interest Groups:

1. I am vitally interested in all aspects of this Interest Group and would want to participate actively in it.

2. I am interested in the work of this Interest Group and would, from time to time, like to take part in its activities.

3. I am only mildly interested in this Interest Group but would like to know what activities are taking place.

4. I have no interest at all in knowing about or participating in this Interest Group.

As you might expect in any organization like the CCA, and I believe NACIS as well, where members have broad interests, most had one or two favored Interest Groups, but also had a level 2 or 3 interest in the others. Rarely did they express a level 4 "disinterest." This is what makes both the Association and our Society unique–members have broad interests in things cartographic and in the work of our colleagues, whether or not we are active in the same specific area. As a result, it is difficult to isolate a very stable working core of strong interest and commitment to any one Interest Group.

As to the changes in fashion and technology, I have argued in the past that the appearances of names aren't all that important. What is important is that the Interest Group Chair take an active role in promoting something, even if it isn't very traditional or usual. This is the way new ideas and approaches get started. Given the interrelated nature of most cartographic activities, having varied Interest Groups is actually only a device to insure that different interests and alternate viewpoints are represented at our gatherings. In any given year, these Interest Groups could generate quite different program activities or reflect facets of only one approach to mapping.

In sum, the greatest potential disadvantage of Interest Groups, in my mind anyway, is that they may tend to compartmentalize the subject and thus our members. What we should be doing is finding new ways to integrate our members and to stress our commonality of purpose. By having different people present their view of a general topic area, such as education or map use, we will, over time, get a variety of perspectives which cross a number of traditional subject boundaries. In doing this, we will constantly be receiving new and often challenging perspectives on our discipline which can only foster a greater understanding of our profession and the meaning of our basic frame of reference, cartography.

Given all this, it should not be construed that I am promoting the idea that NACIS should adopt an interest group structure. The CCA Interest Groups were created at a particular time and place to meet a particular need for cartographers and those interested in maps and mapping to find their professional identities and a forum for their self-determination (McGrath 1975, 220). Our situation and needs are quite different but there are some aspects of the roles played by Interest Groups which might be of value to us.

For one, it is valuable to have people coming onto the Board with some pre-set agendas, i.e., with some sort of immediate goal or role to play. It is very easy to sit and listen while those in the know do all the talking and perhaps all the work. Given the great skills of those who have served, it is easy for one to sit back and watch in fascination for one's full term! At best, it takes a while to get a feel for the way the Society functions. In the long term, having brought people onto the Board to do particular jobs will create a corpus of people who have demonstrated their ability to organize and lead, and have had some exposure to how the Society works. Then, if the Nominating Committee asks them to stand for Vice-President, we know what to expect and they know what they are getting into!

My suggestion is that, through the instrument of the Nominating Committee and in concert with the Board, we encourage members to come forward with specific ideas that they would like to see embodied in some kind of activity at the annual meeting. At present, we elect four new Board members each year for two year terms. The Nominating Committee might consider having one or two of these nominations to stand for what we might call Focus Chairs. These nominees would include in their biographical description a short paragraph describing (1) a particular role they would like to play (or have been asked to play by the Board) or (2) an area of professional interest in which they would like to organize some kind of session, workshop, or discussion at a forthcoming annual meeting.

In a sense, we have had two Society members functioning as Focus Chairs for the Ottawa meeting. Both Patricia Chalk (who was also on the Board) and Joe Stoll were identified in the Call for Participation with particular program sessions. While they were also working behind the scenes, they made use of the Call to encourage others to come forward and join in their special programs. As you can see, both topics–"Map Projection Programs Under Inspection" and "Is There a Niche for the University Cartographic Lab?"–don't fall naturally under some usual division of cartographic knowledge but cut across a number of concerns for people who both make, use and sell cartographic information. When a few people come forward, as they did for the Ottawa meeting, we are assured a constant supply of attractive ideas surfacing at our meetings. But in their absence, it may be useful that a few Board members have elected mandates in some specific areas in which they are conversant.

As we also attempt to make ourselves more reflective of the geographic part of the Society's name, the role of Focus Chairs can also be seen in developing contacts and membership in geographic areas where our membership is thin or non-existent, e.g., west of the Mississippi River. To attract membership in these areas, we must be seen as offering activities and opportunities that are of value and interest to these people. By organizing shorter meetings or events, (and with the financial, organizational and perhaps personal assistance of the Society), the Focus Chair can bring a NACIS presence to these areas.

With your approval and encouragement, we can begin to promote this idea more formally. The Officers and the members of the Board always look forward to hearing from you. The more members who become active in our Society, the more will feel it is their organization both in terms of the opportunities for awards and for service that it offers.

Plans are now underway for NACIS XV in Wilmington, NC. It is a lovely setting for an Indian Summer meeting. We are looking forward to an engaging and diverse program; with your help this will be assured.

Henry W. Castner
NACIS President

References:

The circumstances surrounding the creation and organization of the Canadian Cartographic Association are described in two issues of the *Canadian Cartographer*: Volume 12, #2 for 1975 and Volume 13, #1 for 1976. See in particular:

Gutsell, Bernard V. 1975. Cartographic Commentary: The Canadian Cartographic Association. *Canadian Cartographer*. 12.2: 194-199.

McGrath, Gerald. 1975. Whither Cartography in Canada: From Under-to Over-Representation? *Canadian Cartographer*. 12.2: 217-221. ❑

At its 1994 Business Meeting (held in Ottawa, Ontario) the NACIS Board decided to encourage individual and corporate contributions to ***Cartographic Perspectives***. NACIS would like to acknowledge and thank the following individuals for contributions made in 1994.

Ronald Bolton
Jack Dutke
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Matthew McGranaghan
Judy Olson
Gyula Pauer
Charile Rader
Bret Rodgers
Lawrence Slaughter
Alan Stevens
Muriel Strickland

For those interested, contributions can be made at the time of your annual dues renewal or at anytime by sending your contribution to the NACIS Treasurer.
(please make checks payable to ***Cartographic Perspectives*** and indicate that this is a contribution to the journal)

cartographic events

February 12 - 15
International Symposium in Epidemiology and Environmental Health.
Tampa, Florida. Symposium coordination: World Computer Graphics Foundation, University of South Florida - SOC 107, Tampa, FL 33620-8100. (813) 974-2386; fax (813) 974-4808.

March 14 - 18
91st Annual Meeting of the Association of American Geographers.
Chicago, Illinois. Contact: Association of American Geographers, 1710 16th Street, NW, Washington, DC 2000903198. (202) 234-1450; fax (202) 234-2744; e-mail: AAG@gwuvm.gwu.edu

May 24 - 28
Canadian Cartographic Association Conference.
Calgary, Alberta. The members at Calgary are pleased to invite you to Calgary for the 1995 Annual Meetings. Plans are well under way to provide a stimulating and enjoyable conference, with workshops, technical visits and a field excursion, as well the annual general meeting and paper sessions. A preliminary program will be published in *Cartouche*. Please address all inquiries to Michael R. C. Coulson, Dept. of Geography, The Univ. of Calgary, Calgary, Alberta, T2N 1N4. (403) 220-5584; fax: (403) 282-6561. e-mail: Coulson@acs.ucalgary.ca

June 6-9
Eigth Annual Towson State University GIS Conference (TSUGIS '95).
Baltimore, Maryland. Contact: Jay Morgan, Department of Geography and Environmental Planning, Towson State University, Baltimore, MD 21204-7097. (410) 830-2964; fax (410) 830-3888.

September 3 - 9
International Cartographic Association Conference.
Barcelona, Spain. Organizing Committee: Jaume Miranda i Canals, Chairman, Institut Cartografic de Catalunya, Balmes, 209-211 – E-08006 Barcelona, Catalunya, Spain. (343) 218 87 58; fax (343) 218 89 59.

September 18 - 20
Third Thematic Conference Remote Sensing for Marine and Coastal Environments.
Seattle, Washington. Contact: ERIM, P.O. Box 134001, Ann Arbor, MI 48113-4001. (313) 994-1200, ext. 3234; fax (313) 994-5123.

North American Cartographic Information Society
1980

NACIS XV

October 25 -29, 1995

Wilmington, NC.

see call for papers
on page 61

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ACSM Bulletin. Published six times a year by the American Congress on Surveying and Mapping. Offers feature articles, regular commentaries, letters, and news on legislation, people, products, and publications. Contact: Membership Director, 5410 Grosvenor Lane, Bethesda, MD 20814; (301) 493-0200.

Baseline. Published six times a year by the Map and Geography Round Table, American Library Association. Contact: Editor Nancy J. Butkovich, Physical Sciences Library, 230 Davey Laboratory, Penn State University, University Park, PA 16802; (814) 865-3716; e-mail:njb@psulias.psu.edu

Bulletin of the Society of Cartographers. Published twice a year, the *Bulletin* features articles on techniques and ideas applicable to the Cartographic Drawing Office. Contact: John Dysart, Subscriptions Manager, Room 514, Middlesex Polytechnic, Queensway, Middlesex, EN3 4SF, England.

Cartouche. A quarterly publication offering news and announcements to members of the Canadian Cartographic Association. Contact: Canadian Cartographic Association, c/o Jim Britton, Sir Sandford Fleming College, School of Natural Resources, P.O. Box 8000, Lindsay, Ontario K9V 5E6 Canada; (705) 324-9144; e-mail: britton@trentu.ca; fax: (705) 324-9716.

Cartographica. A quarterly journal endorsed by the Canadian Cartographic Association / Association Canadienne de Cartographie that features articles, reviews, and monographs. Michael Coulson, Editor. ISSN 0317-7173. Contact: University of Toronto Press Journals Department, 5201 Dufferin Street, Downsview, Ontario, M3H 5T8 Canada; (416) 667-7781.

Cartographic Journal. Biannual Journal of the British Cartographic Society. Includes research articles, 'shorter' articles, official records of the Society, book reviews, and a list of recent cartographic literature. Contact: Hon. Secretary, Charles Beattie, 13 Sheldrake Gardens, Hordle, Lymington, Hants, SO4 10FJ, England.

Cartography. Biannual Journal of the Australian Institute of Cartographers. Each issue contains two parts: the Journal proper and the Bulletin. The Journal contains original research papers, papers describing applied cartographic projects, reviews of current cartographic literature, and abstracts from related publications. ISSN 0069-0805. Contact: John Payne, Circulation Manager, GPO Box 1292, Canberra, A.C.T. 2601, Australia.

Cartography Specialty Group Newsletter. Triannual publication of the Cartography Specialty Group of the Association of American Geographers. Features news, announcements, and comics. Contact: Ann Goulette, Editor, Intergraph Corporation, 2051 Mercator Drive, Reston, VA 22091-3414; (703) 264-7141; e-mail: ann@pluto.ne1300.ingr.com.

Cartomania. The quarterly newsletter of the Association of Map Memorabilia Collectors. Offers a unique mix of feature articles, news, puzzles, and announcements of interest to cartophiles. ISSN 0894-2595. Contact: Siegfried Feller, Publisher/Editor, 8 Amherst Road, Pelham, MA 01002; (413) 253-3115.

Geotimes. Monthly publication of the American Geological Institute. Offers news, feature articles, and regular departments including notices of new software, maps and books of interest to the geologic community. Articles frequently address mapping issues. ISSN 0016-8556. Contact: Geotimes, 4220 King Street, Alexandria, VA 22302-1507.

GIS World. Published monthly, this news magazine of Geographic Information Systems technology offers news, features, and coverage of events pertinent to GIS. Contact: John Huges, Managing Editor, GIS World, Inc., 155 East Boardwalk Drive, Suite 250, Fort Collins, CO 80525; (303) 223-4848; fax: (303) 223-5700.

Information Bulletin. Triannual publication of the Western Association of Map Libraries. Contains features, atlas and book reviews, WAML business, and news. Contact: Mary L. Larsgaard, Executive Editor, Map and Imagery Laboratory, UC-Santa Barbara, Santa Barbara, CA. 93106; (805) 893-4049; fax:(805) 893-8799, 4676, 8620; e-mail: mary@wash.uscdic.ucsb.edu.

Mapline. A quarterly newsletter published by the Hermon Dunlap Smith Center for the History of Cartography at the Newberry Library. This newsletter contains notes, announcements, recent publications, calendar, and short essays on topics of interest to the history of cartography. ISSN 0196-0881. Contact: James R. Akerman, Editor, *Mapline*, The Newberry Library, 60 West Walton Street, Chicago, IL 60610.

Perspective. This newsletter of the National Council for Geographic Education (NCGE) is published five times a year in October, December, February, April and June. News items related to NCGE activities and geographic education are featured. Contact: NCGE, Leonard 16A, Indiana University of Pennsylvania, Indiana, PA 15705; bitnet: clmccard@iup.

FEATURED PAPERS

Each issue of *Cartographic Perspectives* includes featured papers, which are refereed articles reporting original work of interest to NACIS's diverse membership. Papers ranging from theoretical to applied topics are welcome. Prospective authors are encouraged to submit manuscripts to the Editor or to the Chairperson of the NACIS Editorial Board. Papers may also be solicited by the Editor from presenters at the annual meeting and from other sources. Ideas for special issues on a single topic are also encouraged. Papers should be prepared exclusively for publication in *CP*, with no major portion previously published elsewhere. All contributions will be reviewed by the Editorial Board, whose members will advise the Editor as to whether a manuscript is appropriate for publication. Final publication decisions rest with the Editor, who reserves the right to make editorial changes to ensure clarity and consistency of style.

REVIEWS

Book reviews, map reviews, and mapping software reviews are welcome. The Editor will solicit reviews for artifacts received from publishers. Prospective reviewers are also invited to contact the Editor directly.

TECHNICAL GUIDELINES FOR SUBMISSION

Literature cited should conform to the Chicago Manual of Style, 13th ed., University of Chicago Press, Chapter 16, style "B." Examples of the correct citation form appear in the feature articles of this issue. Authors of Featured Papers should submit four printed copies of their manuscript for review directly to Dr. Michael Peterson, Chair of the *CP* Editorial Board, Department of Geography, University of Nebraska - Omaha, Omaha, Nebraska 68182. Manuscripts are reviewed by a minimum of two referees. The recommendations of the reviewers and the Chair of the *CP* Editorial Board are sent to the Editor of *CP*. The Editor will contact all authors to notify them if their paper has been accepted for publication and if revisions are necessary prior to publication. The following technical guidelines should be followed for all accepted manuscripts (these guidelines also apply to book, map, and software reviews).

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Materials should be sent to:
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e-mail: sona@csd.uwm.edu.

COLOPHON

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The North American Cartographic Information Society (NACIS) was founded in 1980 in response to the need for a multidisciplinary organization to facilitate communication in the map information community. Principal objectives of NACIS are:

§ to promote communication, coordination, and cooperation among the producers, disseminators, curators, and users of cartographic information;

§ to support and coordinate activities with other professional organizations and institutions involved with cartographic information;

§ to improve the use of cartographic materials through education and to promote graphicacy;

§ to promote and coordinate the acquisition, preservation, and automated retrieval of all types of cartographic material;

§ to influence government policy on cartographic information.

NACIS is a professional society open to specialists from private, academic, and government organizations throughout North America. The society provides an opportunity for Map Makers, Map Keepers, Map Users, Map Educators, and Map Distributors to exchange ideas, coordinate activities, and improve map materials and map use. *Cartographic Perspectives*, the organization's Bulletin, provides a mechanism to facilitate timely dissemination of cartographic information to this diverse constituency. It includes solicited feature articles, synopses of articles appearing in obscure or non-cartographic publications, software reviews, news features, reports (conferences, map exhibits, new map series, government policy, new degree programs, etc.), and listings of published maps and atlases, new computer software, and software reviews.

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