cartographic ⊕ perspectives

cartographic perspectives

in this issue

messages

MESSAGE FROM NACIS XII PROGRAM CHAIR

The Twelfth Annual Meeting of NACIS will be held October 14 - 17 in St. Paul, Minnesota. As always the NACIS Conference will provide an open and professional atmosphere for the exchange of information and ideas for all who are interested in maps and cartography. This year's program promises to be quite exciting. Highlights include addresses by the dean of American cartography, Arthur H. Robinson, and John Fraser Hart, former president of the Association of American Geographers.

The latest research developments in cartography, most notably in the areas of animated mapping, cognitive cartography, cartographic education, and map librarianship will be presented. Other sessions will explore recent developments in software and hardware for cartographic production, federal mapping initiatives, and map library services and access. In addition, this year NACIS will be sponsoring a series of "hands-on" workshops on animation in cartography and thematic map design using the PC.

Several field trips are also planned to familiarize conference participants with the Twin Cities and their cartographic centers. NACIS members should have recently received (or shortly will receive) information and a registration form for the meeting. We have also published a preliminary conference schedule on pages 31 - 33 in this issue of *CP*. Do not hesitate to contact me if you have any questions or wish to receive additional information and registration material.

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MESSAGE FROM THE EDITOR

This issue marks some changes for *Cartographic Perspectives*. Although the design and overall look of the publication remain the same (at least I hope it does when it goes to press), there have been some significant changes. One of these is a change in editorship of the journal. David DiBiase, who had served as editor of *CP* since its first issue in March of 1989, completed his tenure as editor with issue No. 12 (now known as the "white issue"). I know I speak for every NACIS member in thanking Dave for making *CP* a journal of high quality in both its content and design. I personally appreciate his assistance in making the editorial transition go smoothly. Many of the contributions in this current issue were initiated, and in some cases already completed for me, by Dave and his staff at Penn State. I can only hope that we can continue to produce a publication of equal quality.

Another notable change marked by this issue is that instead of a single *Featured Article*, this issue has two *Featured Articles*. It is my hope, and that of the Editorial Board, that this precedent continues and that the cartographic community benefit from the increased scholarly contribution that *CP* can make. We wish to encourage submission of manuscripts as well as all other items of interest for publication consideration. Guidelines for papers and submissions appear at the end of this issue.

We will be publishing *CP* three times per year. We have targeted a Fall, Winter, and Spring publication schedule. This issue (Number 13, Fall 1992) has important information about NACIS XII. The meeting will be held in St. Paul, Minnesota from October 14 - 17. NACIS members should have already received (or shortly will receive) a conference schedule

program and registration forms, however, we have also included this information on pages 31 - 33 of this issue. You should note that NACIS is conducting three workshops this year: Macintosh Animation, IBM Animation, and Map Production and Design These workshops will provide an excellent opportunity to get hands-on exposure to some of the new and exciting techniques that are changing the way we conceive, store, and use maps. I urge anyone that can take advantage of these workshops to do so.

Finally, I would like to encourage each of you to let us know if you have suggestions for improving the quality and content of *CP*. Your input will be greatly appreciated and not ignored. I look forward to serving as editor and hope that the information we provide through *CP* is interesting, informative, and beneficial.

Sona Karentz Andrews

a passing

On June 7, in Chicago, Illinois, Barbara Bartz Petchenik died of cancer at the age of 52. Barbara was a member of NACIS and throughout her professional career Barbara integrated scholarly research interests in the nature of spatial knowledge and mapping participation in commercial cartography.

Barbara was a Senior Sales Representative for R.R. Donnelley Cartographic Services, Mapping Services Division since 1975. From 1970 to 1975 she was Cartographic Editor of the *Atlas of Early American History*, and from 1964 to 1970 was Cartographic Editor and Staff Consultant in Research and Design for *World Book Encyclopedia*. She

featured articles

The potential of computer animation has been realized in many different disciplines. Animation is also a powerful visualization tool for cartography; however, it has been neglected until recently. This paper portrays the need for animation in cartography in the light of the new approaches and methods in the sciences as well as in society. It discusses two main reasons for the lack of animation in cartography: the fixation on the printed map and the absence of a comprehensive approach to cartographic animation. Finally, a variety of issues for further research are proposed.

C omputer animation has become an important visualization tool in recent years. Improvements in computer hardware and software have made the widespread use of computer animation possible. The potential of computer animation has already been realized by different disciplines, for example the film industry, architecture, fashion design and the sciences.

Computer animation also has many potential uses in cartography. It allows the creation of map sequences that can show spatial information dynamically. Animated map sequences can depict time directly as a cartographic variable, they can depict information mapped in different ways; and they can present the map objects in a particular sequence. But do we really need this sort of information display? Can animation really show more than the presentation forms we already have, or is animation only a toy for cartographers? To answer this, we need to examine the modern approaches and methods in the sciences as well as in society.

Spatial science has changed from the analysis of static states to the study of processes. Researchers are no longer interested in studying only static situations; they are more concerned with changes and forces that induce or cause different states. Maps are an important tool for spatial scientists. The static map, however, is not able to show processes directly. Of course, cartographers have developed different methods for depicting changes, but all of these methods reduce the dynamic aspects of reality to static states that can hardly show the changes that take place. Cartographic animation can do more by making the dynamic aspect of spatial changes visible to the map user. Processes become more transparent using animation for their visualization.

Spatial science has also been influenced by system theory. Scientific investigations are no longer concerned only with isolated phenomena; they examine particularly the relationships and correlations of different phenomena. Scientists need a representation form that can show all the correlations. Static maps are not the best presentation form for displaying these relationships. Often, maps are overloaded with information layers to show the many correlations. In an animated map sequence, map elements can be presented in different orders and combinations to make the spatial relationships more apparent. The map user can be directed through the presented subject, and the correlations can be brought to the user's attention.

In the late 1980s, the sciences discovered scientific visualization. It is used for data analysis to see patterns that either answer questions or that pose new and unexpected questions. Scientific visualization requires computer animation, especially interactive animation, that can show the

Cartographic Animation: Potential and Research Issues

Doris Karl

THE NEED FOR ANIMATION IN CARTOGRAPHY

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data set in many different ways. The static map does not have this flexibility in information display; it can show information only in one way, so it is not a suitable instrument.

Finally, one should look at the map users of the future — the children of today. This young generation is often called "the video generation" because it has grown up with video and computer games. These children are more accustomed to the computer than most adults; the interactivity and dynamic aspects of computer games are a matter of course for them. At some schools computers with interactive and dynamic programs are used as a didactic device to rouse the students' interest. In this respect, cartographers have to ask if the traditional static map will be a good communication medium for these future map users or whether we should look for alternative forms. Animated map sequences that can be controlled interactively are an alternative.

It seems that cartographic animation is more than a nice toy and should be viewed as a powerful visualization tool for cartography that transcends the potential of the printed map. In spite of this potential, computer animation has been neglected in cartography until recently. Two main reasons for the absence of animation in cartography will be discussed in the following two sections. The first and most important reason is the fixation on the paper map; the second, resulting from the first, is the absence of a complete and systematic approach to cartographic animation.

THE EMPHASIS ON THE TRADITIONAL PRINTED MAP-- AN OBSTACLE TO CARTO- GRAPHIC ANIMATION

The traditional printed map is regarded by cartographers as an excellent form of presentation. It is considered to be a product that has attained near perfection in a long evolutionary process. Many representational methods and techniques have been developed for topographic and thematic maps which, in general, enable the creation of good maps. Also, the map user is accustomed to the printed map and presumably he wants to have a "real" map, a paper map. Thus, one can say that the traditional printed map is a standard for both the mapmaker and the map user. New techniques and methods, such as the use of computers in cartography, are always compared with and measured against the printed map and evaluated accordingly. This is perhaps especially true in Europe as Gillessen (1986, p.53), a German cartographer, states:

> "The excellence of maps produced in Central Europe places high quality demands on alternative mapping solutions and is therewith a standard of quality for all new developments in cartography. [...] One would go so far as to say that the high standard of cartography in Central Europe has hampered the development and the willingness to accept the products of any new technology [...] in cartography."

This quote illustrates the extent of the fixation on the printed map. As a result of this thinking, other and perhaps better information displays are overlooked and the standard map is not placed in question.

If one asks why the traditional map is used as the standard, many arguments are listed in its favor:
— traditional maps are though to be more attractive than computer generated maps;
— text, line and other symbols are though to be more "alive" on a traditional map and not as artificial or synthetic in appearance;
—it attracts the eye and keeps the map user's attention.

All these arguments are based on the aesthetic impression of a map. The exterior appearance is a very important criterion in its evaluation. The importance of beauty in a map can also be found in a common definition of cartography as the art and science of map making. But, can the aesthetic value of a map continue to be one of the most important

criteria for judging the quality of a map? Maps are the carriers of information in the process of communication and should they not be evaluated in this light as well? So the question to ask is whether the traditional map is really the best presentation form.

The use of computers in cartography offers new forms of information display. However, because we are still fixated on the traditional map, we overlook this potential and use the computers predominantly to mimic manual methods.

If one looks more closely at the application of computers in cartography, one sees that they have been extensively used to shorten time and work intensive tasks. Data processing and drafting have been automated and interactive computer systems now facilitate the map design process. Languages like Postscript allow the direct transfer of maps between the display and the image setter. The main efforts have been directed in making computer-created maps as good as the traditional map.

The fixation on the printed map within computer cartography can be further demonstrated with regard to the German ATKIS project (Authorized Topographic Cartographic Information System) that will contain the data of the topographic maps of Germany in digital form. The purpose of ATKIS is to make possible the digital production of topographic maps that can be updated quickly and easily, and the creation of special purpose maps of single topics. The maps that are generated from ATKIS are the traditional paper maps. New forms of information display are not a goal of ATKIS. Harbeck (1989, p.98), one of the designers of ATKIS, states in this context:

> "Without doubt at the end of the digital topographic information system there is the cartographic output — the map. Whether this product is on the computer display or a printed map depends on the user. But surely it can be stated that the color printed map will continue to have its importance — perhaps even gain in importance as a commodity."

The fixation on the traditional map and on paper as the primary output medium is strongly present within cartography. If we do not overcome this fixation, we may ignore new forms of information display and we may not realize their potential.

As a result of the fixation on the printed map, other forms of information display have been overlooked and too little research has been done in this area. This is true for cartographic animation.

The potential of animation for cartography was initially described by Thrower (1961) and by Cornwell and Robinson (1966). Nevertheless, only a small amount of work has been done in this field. In the 1970s, when computer animation became available, individual cartographers used animation predominantly to show spatial changes over time. The efforts were focused on producing animated map sequences for special issues like the growth of a city (Tobler 1970), traffic accidents (Moellering 1976), population growth in urban regions (Rase 1974) and animation of three dimensional objects (Moellering 1980). Most of the 1980s saw no further work in cartographic animation. Not until the end of the 1980s was cartographic animation rediscovered when cartographers realized the potential of animation for the depiction and exploration of spatial and statistical relationships and patterns. Some authors again called attention to the potential of cartographic animation (Campbell and Egbert 1990), and a few new animation techniques were suggested for the analysis of spatio-temporal data (Monmonier 1989 and 1990) and the study of geoscientific processes (DiBiase et. al. 1991). In

THE ABSENCE OF A COMPREHENSIVE APPROACH IN CARTOGRAPHIC ANIMATION-- ANOTHER OBSTACLE

addition, a program for animating choropleth maps was created (MacChoro II 1989).

All these works employed the application of cartographic animation. Most of them exclusively deal with the realization of an animated map sequence for one special issue. Only the later works pick up a more common and extensive attempt at the cartographic application of animation.

These are important contributions, but they are individual solutions to individual problems. A comprehensive and systematic approach to the use of animation in cartography does not exist. Many essential issues have not been examined. Therefore, basic knowledge about design, perception and production of animated map sequences is not available. There are no principles that tell cartographers how to make and design animated maps. Without extensive knowledge of the creation of animated maps, cartographic animation cannot be applied widely and efficiently; it can be used only sporadically because too many design issues will need to be worked out for each single application. If the influence of animation in cartography is to increase, we must expand our knowledge about carto-graphic animation and develop a comprehensive and systematic approach to it. This will require intensive research in different areas.

REQUIRED RESEARCH

Future research in cartographic animation has to deal with a variety of questions. The following issues must be examined:

Definition of cartographic animation
The absence of a systematic approach to cartographic animation becomes particularly evident when we arrive at the question: What is cartographic animation? There does not seem to be a consensus. Can animation be used only for map sequences that depict changes over time, or can it also be used for map sequences without a time element that show changes in the presen-tation form or create a map in a sequential form? Can animation be used only for complex map sequences created by a special animation technique, or is a simple "slide show" also an animation? What are the characteristics of animation and how can it be defined? This should be the first question to be examined.

Cartographic applications
Most of the work in cartographic animation has been done in this area. However, the issue has not been handled in its entirety. Further work must investigate which other or new forms of animation are possible and whether they are useful. For this we have to examine different map types and their possibilities for cartographic animation. Perhaps we will find new forms of animated maps. A great deal of experimentation must be done within this issue.

Graphic design of animated maps
Animated map sequences are different from the maps we ordinarily use. They are predominantly displayed on a CRT, are not static but dynamic, and are often shown very quickly. We must examine how such maps must be designed. Some research on the design of maps on the computer display already exists and we can also look to television to find some ideas about the layout of pictures and the use of color. The next question is: Must we consider the dynamic aspect of map sequences when we symbolize single maps? For example, how do we select different densities in an animated choropleth map sequence, or what about labeling isolines in an animated map? And finally, there is the aspect of map complexity. In an animated map sequence the user

will see a single map for only a short time, so the map cannot be too complex. But how complex can the map be? These issues must be tested.

Legend design
Animated map sequences are different than static maps, therefore, the legend, the explanation of a map, should be different in an animated map. How must it be designed? Multimedia offer the possibility to combine animation with sound. Therefore, the legend can be an audio explanation. But is an audio explanation sufficient for the complete understanding of the animation, or must it be completed by a visual legend? If we need a graphical legend, we have to think about the design. Surely, it would have to be a dynamic legend; however, it also must be readable for the user.

Speed of animated sequences
We know that in computer animation 20-25 pictures per second are required for the perception of a continuous movement or change. But we do not know how fast an animated sequence created for the depiction of relationships must be, so that the user can recognize the objects and relationships of the map sequence. This is a problem especially for animation on video because the sequences cannot be controlled by the user and the speed cannot be changed.

Creation and control of an animated map sequence
Cartographic animation will become a widespread visualization tool only if the creation of animated map sequences is not too difficult. A user interface that allows the user to produce animations easily has to be designed. For this, useful cartographic animation functions such as changing the view-point or moving an object must be defined and arranged in menus. With these various animation operations, the user has the potential to compose complex animation sequences. Ideas for this have been suggested by Monmonier (1989). A second and very important point is the interactivity of an animation. If animation is to be more than just a film, it must have the possibility of interaction. Animation systems should have the minimum ability to stop and restart the sequence and to change the speed. The animation for graphical exploration of a data set must have a variety of controlling functions. We have to think about the whole range of interactions that cartographic animation requires.

Animation techniques
We also need more knowledge of the different animation techniques and for what types of animation they work best. Our experience in this area is limited because only a few cartographic animations have been realized. Gersmehl (1990) has examined this issue and describes nine animation metaphors and their use. Further work should expand this subject.

Cartographic animation requires a variety of research on design, creation, and use of animated map sequences. Because of the potential of animation for cartography, more attention to research is required in this field.

The potential of computer animation has already been realized by different disciplines. It can also be used for cartography as a powerful visualization tool that transcends the potential of the printed map. With animation, dynamic and interactive map sequences can be created that show changes over time or can be used to depict or explore spatial and statistical relationships.

CONCLUSION

New approaches and methods in spatial sciences such as the strong emphasis on examining processes and correlations and the use of scientific visualization require a more dynamic and user-oriented form of information display that is not possible with the printed map. Also, the map users of the future, the children of today, who are more accustomed to interactive computers, will probably ask for more dynamic and interactive forms of information display.

In spite of the need for computer animation in cartography, it has been neglected until recently. There are two main reasons for this. The first is the fixation on the traditional printed map that is strongly present within cartography. As a result of this thinking, other and perhaps better forms of information display such as computer animation have been overlooked. The second reason is the absence of a comprehensive approach to cartographic animation. Because of the fixation on the traditional map, too little research has been done on cartographic animation. Only some research has dealt with the application of animation in cartography, and many essential issues have not been examined. Therefore, basic knowledge about design, perception and creation of animated map sequences is not available. If the potential for animation in cartography is to be realized, we need a comprehensive and systematic approach to cartographic animation. This will require intensive research focusing on the definition, application, design, creation and control of animated map sequences as well as on animation techniques and their uses.

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El potencial de animación por computadoras ha sido descubierto en muchas disciplinas diferentes. La animación es también un instrumento de visualizacion poderoso para la cartografía; sin embargo, hasta hace poco ésta ha sido descuidada. Este artículo describe la necesidad de la animación en la cartografía a raíz de los nuevos enfoques y métodos tanto en las ciencias como en la sociedad. Se discuten dos razones principales que causan la falta de animación en la cartografía: la fijación en el mapa impreso y la ausencia de un enfoque comprensivo hacia la animación cartográfica. Finalmente, se propone una variedad de temas para mas investigación.

RESUMEN

Visualizing Uncertain Information

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When a GIS is used to drive map-based visualization, exploration of potential relationships takes precedence over presentation of facts. In these early stages of scientific analysis or policy formulation, providing a way for analysts to assess uncertainty in the data they are exploring is critical to the perspectives they form and the approaches they decide to pursue. As a basis from which to develop methods for visualizing uncertain information, this paper addresses the difference between data quality and uncertainty, the application of Bertin's graphic variables to the representation of uncertainty, conceptual models of spatial uncertainty as they relate to kinds of cartographic symbolization, and categories of user interfaces suited to presenting data and uncertainty about that data. Also touched on is the issue of how we might evaluate our attempts to depict uncertain information on maps.

When a GIS is used to compile, analyze, and display information, the chance for unacceptable or variable data quality is high due to the merging of multiple data layers.

U ncertainty is a critical issue in geographic visualization due to the tendency of most people to treat both maps and computers as somehow less fallible than the humans who make decisions based on them. When a GIS is used to compile, analyze, and display information, the chance for unacceptable or variable data quality is high due to the merging of multiple data layers. Together with these data quality issues, the flexibility of data manipulation that makes GIS so powerful can lead to considerable uncertainty in map displays produced at various stages of GIS analysis. This paper addresses a variety of conceptual issues underlying development of visualization tools that allow analysts to take this uncertainty into account in their research and policy formulation activities.

There is a strong tradition in cartography of attention to data quality. Only rudimentary steps, however, have been made thus far to deal with the complex issues of visualizing data quality for multidimensional data displays used in image analysis and GIS applications. The importance of this topic is evidenced by the decision of the National Center for Geographic Information and Analysis (NCGIA) to make visualization of data quality the first visualization initiative undertaken by the center.[1]

Kate Beard and Barbara Buttenfield (1991), presenting the NCGIA position, indicate that quality of spatial information "relates to accuracy, error, consistency, and reliability." These aspects of quality are meant to apply to more than locational verity. It is useful to begin consideration of quality issues with the framework of the Proposed Digital Cartographic Data Standard (Moellering, et. al., 1988), incorporating locational accu-

racy, attribute accuracy, logical consistency (i.e., a data structure whose topology makes sense), completeness (comprehensive data and systematic ways of dealing with missing values) and finally lineage.

The above quality categories are important, but to use a GIS effectively for either scientific inquiry or policy formulation, the scope must be broadened. In risk assessment circles, the term *uncertainty* has gained some acceptance and I suggest that we might be better off if we follow their lead (Morgan and Henrion, 1990; Rejeski and Kapuscinski, 1990). Analysts never know the precise amount of error in any particular data object — otherwise they would correct the error. They are more or less uncertain about the available characterization of particular data objects. From this perspective alone, the term uncertainty might be a better description of what the NCGIA (and many past cartographers) have been calling quality. In addition, however, uncertainty includes something of importance beyond the narrow definition of quality that the NCGIA initiative seems to be directed toward. A brief example will illustrate the difference between a focus on quality and on uncertainty and why it is the latter that should guide our efforts.

Imagine a single census block in a city. You have sent an enumerator out to take the census. In this particular case, the response rate is 90%. In data quality terms, we might say that our population and income information for this block is of less than perfect quality because of the lack of "completeness" in the data. Further, there may be "attribute inaccuracy" in the data collected due to misunderstanding of the survey questions or deliberate misinformation about items such as income or education, or "spatial inaccuracy" due to address coding errors by the census enumerator. If, in the adjacent census block we somehow achieved 100% participation in the census, everyone understood the questions and gave truthful responses, and the enumerator made no mistakes, a *data quality* assessment would label that unit's data as perfect. What we will be leaving out of this assessment is the issue of variability (over both space and time and within categories). This latter point is made quite forcefully by Langford and Unwin (1991) who argue that, for the mapping of most socio-economic phenomena, a choropleth map of aggregated data for enumeration units is "a poor choice" due to extreme within-unit variability that is the rule rather than the exception.

In addition to variability due to spatial aggregation, attribute aggregation adds additional variability, and therefore, uncertainty. All data are categorized. Even when individual measurements are retained in the database, categories will be implicitly defined by the mathematical precision of individual measurements. For example, temperatures might be measured to the nearest degree. Most data in a GIS, however, will be grouped into much broader categories (e.g., soil classifications, income brackets, whether a house has indoor plumbing or not, etc.). In all of these cases, the categorization introduces uncertainty even when the data are of high quality.

We can only be certain that a particular location — a particular data object — fits somewhere within the attribute bounds of the categories and the spatial bounds of the enumeration unit to which it is aggregated. The aggregate totals for our census blocks disguise the variability within those census blocks. Our level of uncertainty about map locations will be a function not only of the quality of values (as defined above), but of variance around the mean values we typically use to represent the unit, and of spatial variability across the unit.

In addition to spatial and attribute data quality and variability, a final uncertainty to be dealt with is temporal. The data, even if accurate and

We can only be certain that a particular location — a particular data object — fits somewhere within the attribute bounds of the categories and the spatial bounds of the enumeration unit to which it is aggregated.

	Accuracy	Precision
Location	*position* of vegetation boundaries	*state* birth rate
Attributes	*total* HIV positive cases/county	soil *order*
Time	*date* of the last glacier	mean *monthly* rainfall

Fgure 1: Examples of topics for which locational, attribute, and temporal accuracy and categorical precision contribute to uncertainty.

REPRESENTATIONAL ISSUES

homogeneous, represent a snapshot at one point in time. Our uncertainty about their veracity will increase due to uncertainty about temporal information, resolution with which that temporal information is specified, and the difference in time between data collection and data use. The temporally induced uncertainty will vary with the kind of phenomena being represented.

When we use a GIS, the important issue is the quality of the decisions we make — about a research course to follow, an urban development policy to impose, or an environmental regulation to enforce. Whether we use the term data quality or data uncertainty matters less than whether the tool we give the GIS user is adequate for deciding how much faith to put in any particular piece of information extracted from the database.

We can have highly accurate data while still having *imprecise* data. This lack of precision is at least as important an issue as a lack of accuracy. Precision here refers, not only to the specificity of data values in terms of significant digits, but in a more general sense to "the degree of refinement with which an operation is performed or a measurement taken" (*Webster's New Collegiate Dictionary*, 1974). In this sense it is an assessment of the resolution of categories by which a phenomenon is represented (i.e., categorical precision). Although, mathematically, a population density of 165.34 persons/sq. mi. would be considered precise, spatially it is not if that county is 1000 sq. mi. in size. Also, the map representation of the attribute (population density) becomes categorically imprecise when the data are aggregated into an attribute category ranging from 50-500 persons/sq. mi. Figure 1 provides examples of topics for which map uncertainty is due primarily to accuracy or categorical precision.

As has been pointed out elsewhere, the term *visualization* has a number of definitions (MacEachren and Ganter, 1990; MacEachren, et. al., 1992). Here it will be considered a human ability to develop mental images (often of relationships that have no visible form) together with the use of tools that can facilitate and augment this ability. Successful visualization tools allow our visual and cognitive processes to almost automatically focus on the patterns depicted rather than on mentally generating those patterns.

Following from the above conception of visualization, a research agenda to address visualizing uncertain information should include attention to the cognitive issues of what it means to understand attribute, spatial, and temporal uncertainty and the implications of this understanding for decision making and for symbolizing and categorizing uncertainty. At the most basic level, uncertainty can be divided into two components that might require different visualization strategies: visualizing accuracy and visualizing precision. In addition, attention should be directed toward the methodological, technical, and ergonomic issues of generating displays and creating interfaces that work. It is, of course, also essential to develop methods for assessing and measuring uncertainty before we can represent it. This latter topic, however, will not be addressed here.

Varied goals and needs - categories of interaction with data
If we continue to attack cartographic questions with our communication model visors on, we will fail to take advantage of the power that GIS and visualization tools provide. The search for the "optimal" data quality visualization tool might prove as fruitless as the search for the optimal graduated circle map. It is critical to recognize that GIS and visualization tools attached to them are used for a range of problem types that may have quite different visualization needs in general, and visualization

quality needs specifically. David DiBiase (1990) recently developed a graphic model of the range of uses to which graphics might be put in scientific research (fig. 2). I believe that his basic model is relevant, not only to science, but to applied spatial decision making with a GIS.

As we begin to consider the visualization of uncertainty, we need to be cognizant of this range of visualization goals and environments and the varying information requirements it implies. The kind of uncertainty and the tools used to visualize it are likely to vary across this range, from the use of GIS by an EPA scientist exploring the spatial distribution of a pollutant to the use of GIS driven map displays by policy makers trying to decide which industries to add to the list of those regulated for toxic waste emission.

Figure 2: *The range of functions for maps in spatial analysis (from DiBiase, 1990, reproduced by permission of Earth and Mineral Sciences).*

Graphics variables

Because few GIS users are trained in cartographic symbolization and design, it will be necessary to create expert systems that logically translate information into graphic displays. Jacques Bertin, the French cartographer/graphic theorist, has had a tremendous impact on our approach to this problem. The Robinson et. al., text (1984) that is used by 50% of introductory cartography courses in the country (Fryman, 1990) cites Bertin's basic system of graphic variables (location, size, value, texture, color, orientation, and shape) as the fundamental units we can use to build a map image. Monmonier and Johnson's (1990) recent guide to map design for environmental GIS also presents Bertin's system as an important organizing concept for well-designed maps. Weibel and Buttenfield (1988), in a paper on map design for GIS, and Muller and Zeshen (1990), in a paper on expert systems for map design, accept this system as a base to build from in designing expert systems for map symbolization.

An important representation issue for visualization of uncertainty, therefore, is how Bertin's graphic variables (with possible additions or modifications) might be logically matched with different kinds of data uncertainty. A critical distinction, of course, is that between ordered and differential graphic variables which can be logically associated with ordered/numerical and nominal/categorical differences among phenomena. Of Bertin's original graphic variables, size and value are most appropriate for depicting uncertainty in numerical information, while color (hue), shape, and perhaps orientation can be used for uncertainty in nominal information. Texture, although it has an order, might work best in a binary classification of "certain enough" and "not certain enough" that could be used for either nominal or numerical data.

Although Bertin ignored it, the graphic variable that is arguably the most logical one to use for depicting uncertainty is color saturation. Saturation, added to the list of variables by Morrison (1974), is sometimes
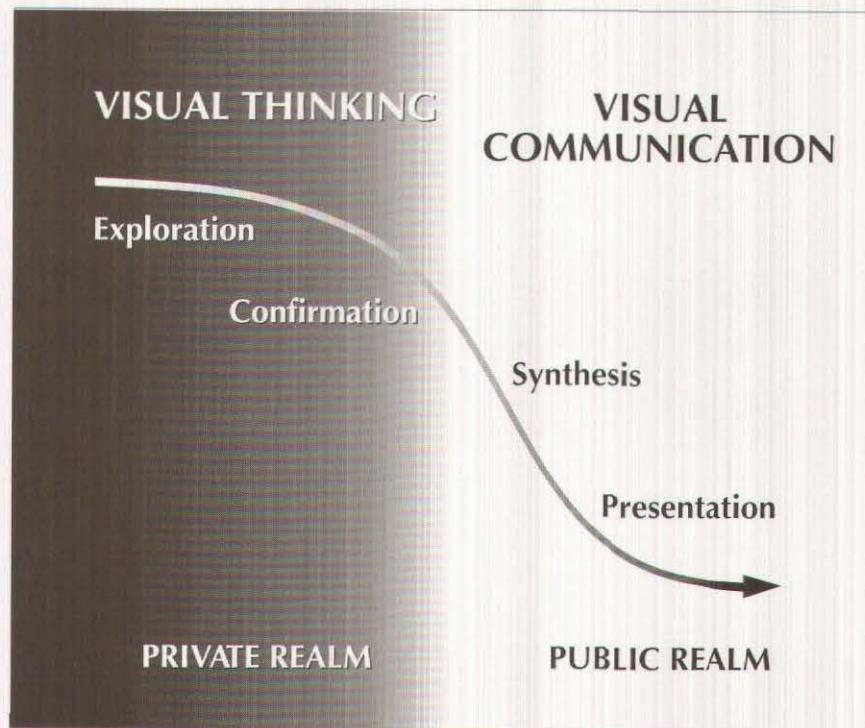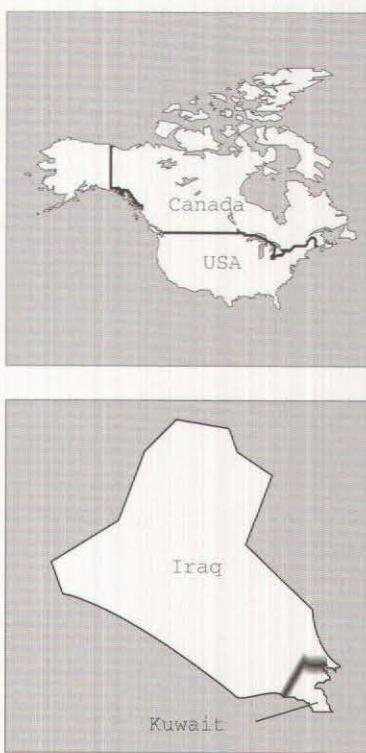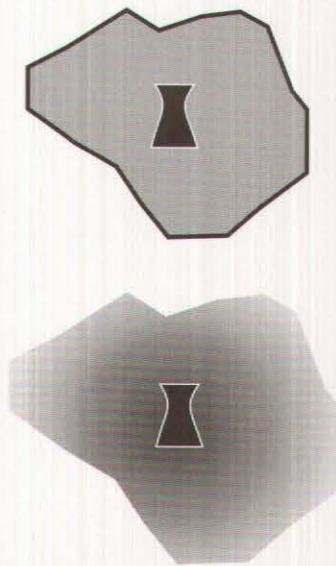
referred to as color purity. Saturation could be varied from pure hues for very certain information to unsaturated (grey) hues for uncertain information. Another variable, beyond Bertin's original seven, that seems quite promising as an uncertainty visualization tool is "focus."[2] Presenting data "out of focus" (as you would see it with an out-of-focus camera), or simply at lower spatial resolution, might be an ideal way to depict uncertainty.

Symbol focus can be manipulated in at least four ways:

Contour crispness— The most obvious way to apply focus is to vary the "crispness" or "fuzzyness" of symbol contours (edges). A certain boundary (e.g., the U.S. - Canada border) might be depicted with a sharp, narrow line, while an uncertain boundary (e.g., that between Kuwait and Iraq) might be portrayed with a broad fuzzy line that fades from the center toward the background (fig. 3). Similar "out-of-focus" symbols could be used to represent certain or uncertain location of point features, and an area may be depicted as not bounded at all, but as fading in a continuous fashion from core to periphery (fig. 4).

Fill clarity— While contour crispness intuitively suggests uncertainty in position, the crispness of elements making up interior fills for an otherwise precisely delineated area can be logically associated with attribute uncertainty. A sharp, distinct pattern, for example, might be used to indicate certainty while a less defined pattern might indicate uncertainty (fig. 5).

Fog— The transparency of the "atmosphere" that an analyst views a map through can be controlled on some computer display devices. It is possible to create what, in effect, looks like a fog passing between the analyst and the map — the thicker the fog, the more uncertain that part of the map (fig. 6).[3]

Resolution— Often maps are produced in which attribute data, geographic position, and temporal position are depicted with very different resolutions. One method of communicating uncertainty would be to adjust the resolution of geographic detail so that it corresponds to that of attributes or time (e.g., adjust resolution with which coastlines are depicted on a world map to correspond to the resolution of thematic information depicted) (fig. 7).

Linking visualization tools to models of uncertainty

Different uncertainty visualization issues will arise when dealing with different kinds of data (e.g., qualitative data on land use/land cover versus quantitative data from the census). When data are quantities aggregated to units such as counties, we should consider the spatial characteristics of the phenomena represented by these quantities as we select symbolization methods to depict the uncertainty about them. One continuum of spatial characteristics that can be identified is that from discrete (spatially fragmented) to continuous (spatially comprehensive) phenomena (Hsu, 1979). A second continuum relates to the *character* of variation in the phenomenon across space. Some phenomena (e.g., tax rates) can vary quite abruptly as political boundaries are crossed, while others (e.g., gallons of ground water pumped for irrigation per county) can exhibit a relatively smooth variation quite independent of the units to which data are aggregated. MacEachren and DiBiase (1991) recently


Figure 3: A certain (U.S. - Canada) and an uncertain (Iraq - Kuwait) border.

Figure 4: Depiction of a risk zone around a nuclear power plant as certain versus uncertain.

[2] This variable appears to have been originally suggested by David Woodward in a seminar at Wisconsin (D. DiBiase and J. Krygier, personal communication).

[3] This idea was offered by Michael Goodchild during the NCGIA Visualization of Data Quality Specialist Meeting.

proposed a series of graphic data models that represent locations in this continuity-abruptness phenomena space (fig. 8). These graphic data models correspond to a range of two dimensional symbolization methods, which include standard forms such as dot, choropleth, isopleth, and graduated symbol, along with some hybrid techniques designed to deal with the midpoints on the phenomena space axes (fig. 9).

Three research questions suggest themselves here: Is it safe to assume that the spatial characteristics of uncertainty will mimic those of the phenomena that uncertainty is being estimated for? Do specific symbolization methods actually communicate the particular spatial characteristics that we as cartographers associate them with (e.g., is a layer tinted isarithmic map depicting uncertainty in air pollution estimates interpreted as a smooth continuous surface or as discrete uncertainty regions)? What approach should be followed when a data set has multiple kinds of uncertainty associated with it and the spatial characteristics of that uncertainty vary?

User interfaces - How to merge data and uncertainty representations

Beyond the basic issue of how to represent uncertainty is the question of how and when to present the representation. This is complicated by the likelihood that GIS representations are often products of a combination of measured and model-derived multivariate data. There seem to be three choices that could be used separately or in combination:

map pairs in which a data map is depicted side-by-side with a map of uncertainty about that data (fig. 10);

sequential presentation in which a user might be warned about uncertainty with an initial map which is followed by a map of the data (fig. 11), (or interactive tools that allow toggling between the data and the uncertainty representations);

bi-variate maps in which both the data of interest and the uncertainty estimate are incorporated in the same map (fig. 12).

Most attempts thus far to graphically depict uncertainty of spatial data have used the map pair strategy (e.g., Borrough, 1986; MacEachren, 1985; MacEachren and Davidson, 1987). Cartographers have spent relatively little time investigating the impact of sequential information presentation. Possibilities of interactive mapping and GIS, as well as animation, have
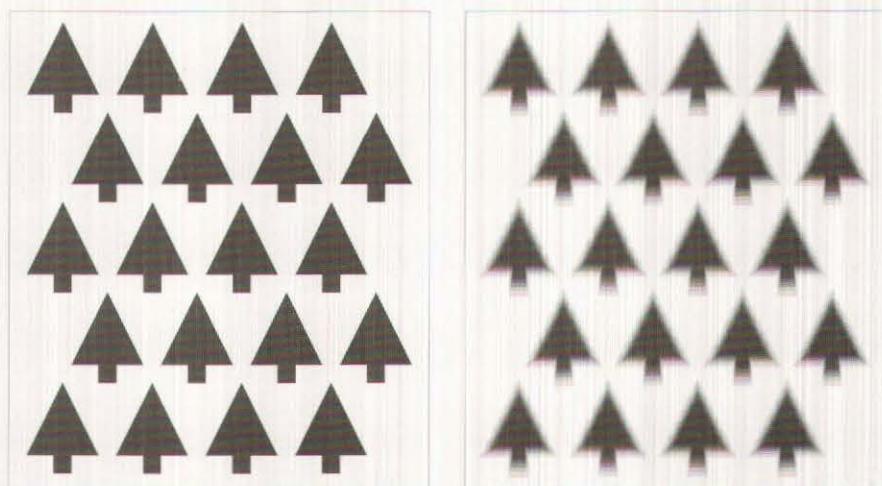
Figure 5: Certain and uncertain depiction of land cover type.
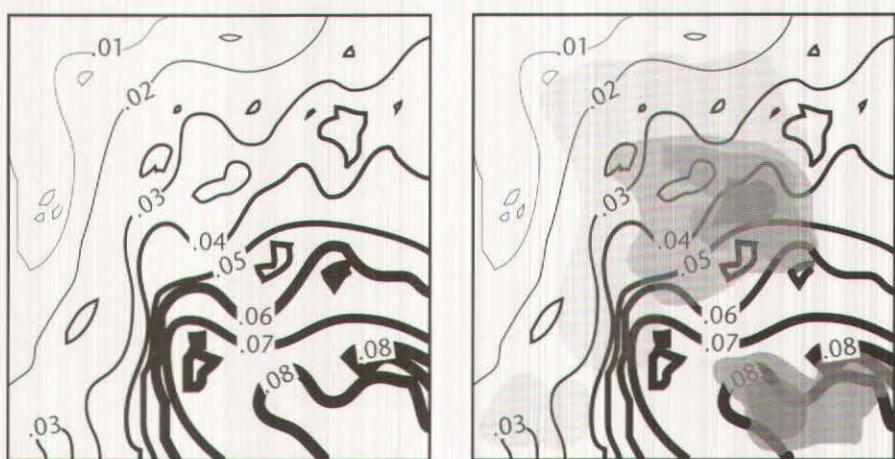
Figure 6: Map of the ecological risk due to ozone. On the left, isolines depict a composite risk index and on the right, the uncertainty in that index is overlayed as a "fog" of varying thickness corresponding to varying degrees of uncertainty.
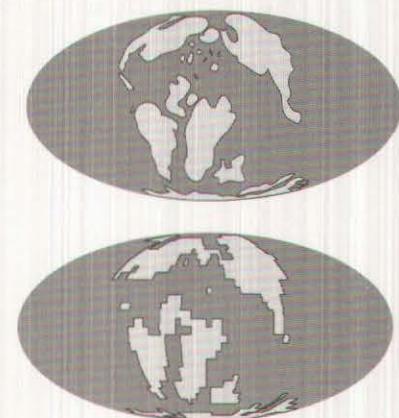
Figure 7: Degrading of coastal resolution (from top to bottom) as an indication of the uncertainty in model produced mid-cretateous ocean flows.
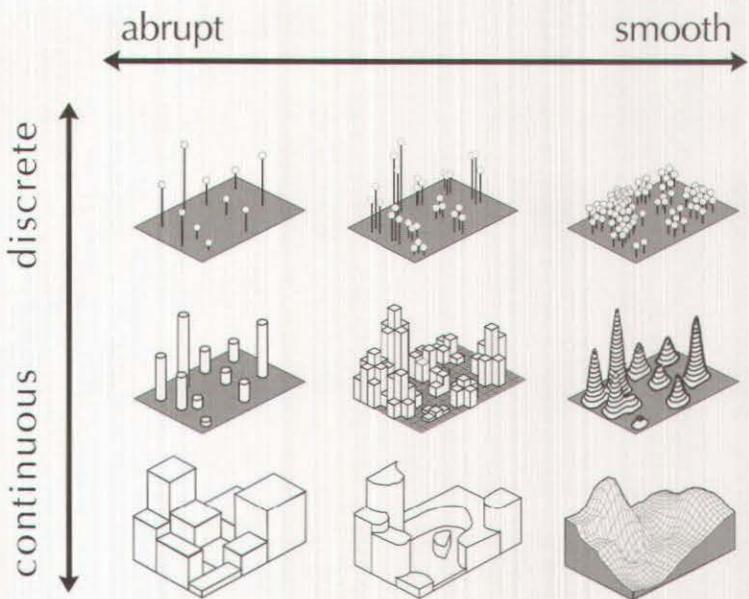
Figure 8: Data models representing points in the continuity-abruptness phenomena space.
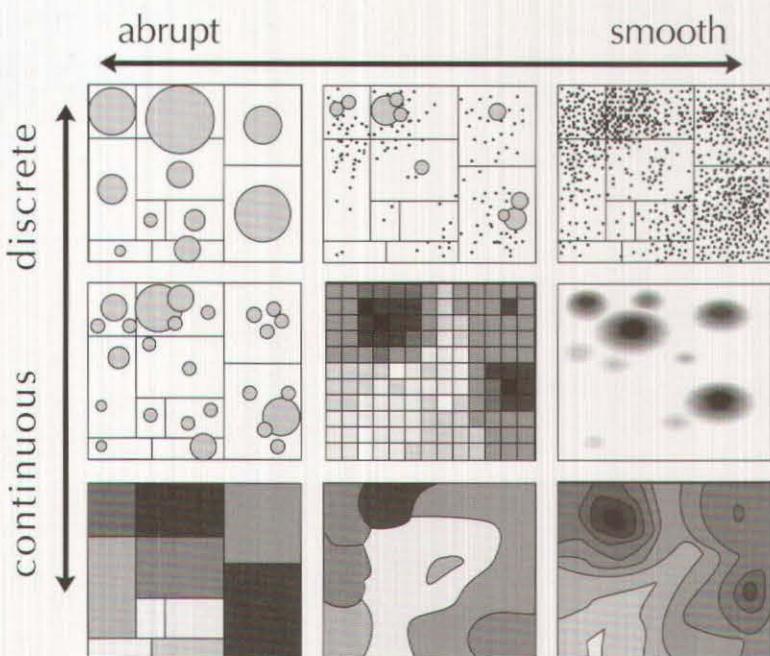

Figure 9: Possible 2D translations of the 3D data models shown in figure 8.

begun to bring attention to this issue (Taylor, 1982; Slocum, 1988). One clear avenue to explore here is the potential of hypertext to allow users to navigate through the maze of data and uncertainty representations that we might be able to provide (e.g., use of graphic scripts to guide this process (Monmonier, 1992)).

In relation to the third possibility, bivariate maps, the U.S. Census Bureau's bi-variate choropleth maps from the 1970 census are perhaps the best known attempt to relate two variables on one map. Experimentation with those maps by several researchers indicates that untrained readers have considerable trouble reading bi-variate maps (e.g., Olson, 1981). There are, however, a number of bi-variate mapping possibilities that have not yet been investigated and previous attempts to use bivariate maps dealt with two different variables rather than with a single variable related to its uncertainty. Color saturation (or intensity), for example, might be used as a graphic variable for depicting uncertainty on maps in which different hues are used to represent the data values of interest (e.g., on a land cover map). For printed maps in black and white, a combination of texture and value may be effective (see fig. 12). The variable of focus might be used in similar ways.

In a dynamic visualization environment, it would be possible to combine sequencing and bi-variate techniques and allow a fade from a data map, through a data/uncertainty map, back to the data map. For qualitative areal data (e.g., soils) Fisher (1991) has suggested an animated technique to communicate the certainty (or uncertainty) of soil classifications for particular locations. In his visualization system, duration with which pixels are displayed in a particular color is matched to the probability of that pixel being in a particular soil

classification. Certain sections of the map remain static and uncertain sections exhibit continual blinking between (or among) the potential soils for that place.

Evaluation of the utility or affect of providing uncertainty information
It is relatively easy to think up techniques by which uncertainty might be represented. Before we try to put these techniques into practice (particularly in a public policy context), we should evaluate their potential impact. The representation of uncertainty about information in a GIS provides a unique opportunity to determine whether our efforts at map symbolization and design research over the past 40 years have provided the tools required to develop a representation system. If past perceptual and cognitive research along with the conceptual models of symbol-referent relationships based on semiotics are really

Figure 10: A raster map depicting a composite health risk index due to air and water pollutants (on left) and a depiction of uncertainty of those index values.
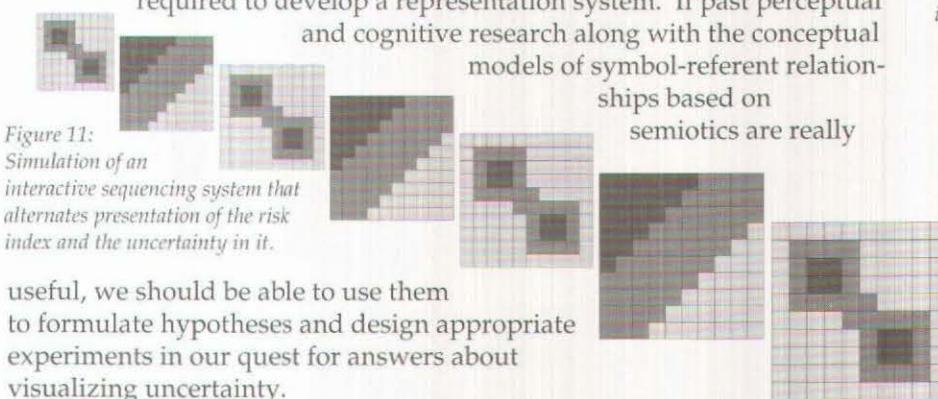
Figure 11: Simulation of an interactive sequencing system that alternates presentation of the risk index and the uncertainty in it.

useful, we should be able to use them to formulate hypotheses and design appropriate experiments in our quest for answers about visualizing uncertainty.

This possibility may tempt some of us to go back to our roots in the communication model approach to cartography. Communication of data quality or uncertainty seems to be the ideal case for which the communication model was developed. Uncertainty can be treated as a precisely defined piece of information that we want a GIS user to obtain. I am afraid, however, that if we follow this narrow information theory approach we will hit the same dead ends that we did a decade or so ago.

This time around we need to be aware of the range of human-user interactions with graphics that occur from initial data exploration to presentation. For exploratory applications, where there is no predetermined message to communicate, we cannot judge uncertainty depictions using communication effectiveness standards. We can only evaluate these depictions in terms of how they alter decision making, pattern recognition, hypothesis generation, or policy decisions. We also must be aware of the fact that our (possibly) precise uncertainty information is conditioned by the social-cultural context in which decisions about what to represent are made (e.g., a variety of estimates exist about the reliability of the U.S. Census Bureau's enumeration of homeless persons), and by the limited ability of cartographers to determine the relative importance of various kinds of quality or uncertainty information in a particular context.

In addition to the question of visualizing uncertainty, there is also a question of quality of visualizations to consider. One way to evaluate visualization of uncertainty tools, therefore, is to calibrate those tools in terms of their tendency toward type I and type II visualization errors (MacEachren and Ganter, 1990). Does providing uncertainty information (or providing it in a particular way) lead to a failure to notice patterns and relationships (type II), or to a tendency to see patterns that do not exist (type I)? Maps are re-presentations and as such are always one choice among many about how to re-present. There is always uncertainty in the choice of representation method, therefore, representing the uncertainty in our representations is an uncertain endeavor at best.
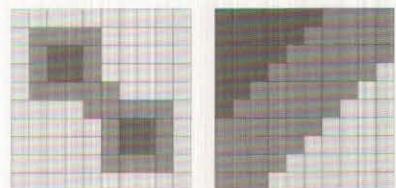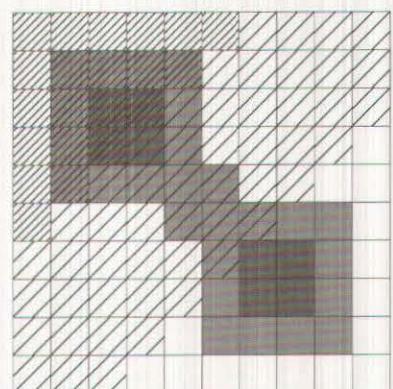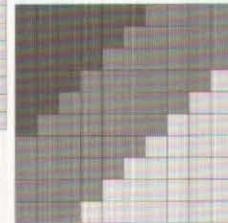

Figure 12: Risk and uncertainty merged into a bivariate map with increasing risk represented by decreasing value (darker shades) and increasing uncertainty represented by increasingly coarse textures.

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Cuando se usan mapas como instrumentos de visualización, la exploración de relaciones potenciales precede a la presentación de datos. En estas primeras etapas de análisis científico o formulación de normas, el proveer un modo para que los analistas estimen la inexactitud en los datos que están explorando es crítico para las perspectivas que formen y los enfoques que decidan seguir. Este artículo sirve de base para desarrollar métodos para la visualización de información inexacta. El artículo habla de la diferencia entre la calidad de los datos y la inexactitud, la aplicación de las variables gráficas de Bertin para la representación de la inexactitud, los modelos conceptuales de inexactitud espacial en cuanto a su relación con clases de simbolización cartográfica, y las categorías de interacción del usuario adecuadas para la presentación de datos e inexactitud de los mismos. También tratado es el tema de como podríamos evaluar nuestros intentos de describir la información inexacta en los mapas.

RESUMEN

reviews

BOOK REVIEW

Geological Maps: An Introduction
Alex Maltman. New York:Van
Nostrand Reinhold, 1990. 224 pp,
maps, diags., and biblio. $49.95
cloth (ISBN: 0-442-30307-6).

Reviewed by Norman Meek
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California State University
San Bernardino.

Geologic mappers are perhaps the
preeminent applied users of maps.
The three-dimensional nature of
most geologic phenomena means
that geologists must be able to
read and manipulate a two-
dimensional map in many ways
unimagined by most geographers.
Perhaps the most difficult course
for undergraduate geologists to
master is the geological field camp
where geological maps are made.
Thus, the complexity of the
techniques assures a need for
illustrated books showing the
fundamentals of geologic map-
ping.

This book is a welcome addition
to the sparse literature of this field.
It is composed of fifteen concise
chapters, each on a specific aspect
of geologic maps: for example,
cross-sections, portraying strike
and dip, unconformities, and folds.
The chapters are liberally illus-
trated with block diagrams and
easy-to-read figures summarizing
various topics, and eight full-color
geologic map plates are included.
There are also chapters on topics
peripheral to interpreting geologic
maps, such as on old and new
techniques of producing geologic
maps, as well as on the heritage of
geologic mapmaking in Britain,
where geologic mapping essen-
tially originated.

The book is mainly limited to a
discussion of geologic maps
produced in Britain and its former
colonies, especially the United

States, Canada, Australia and New
Zealand. Discussion of geologic
mapping in other regions is mainly
limited to a few examples from
France. Despite this limited
geographic coverage, there are
substantial international differ-
ences between geologic maps in
the English speaking regions; the
able comparison of maps pro-
duced by different mapping
traditions is a laudable aspect of
this book.

Each chapter includes a brief
introduction, a discussion of the
topic, a chapter summary and an
annotated bibliography. Accom-
panying each chapter are several
map exercises demonstrating the
principles introduced in it. Many
questions are posed about each
map, but it is left to the reader to
complete them because no exercise
solutions are included. Because
the 24 map exercises are based on
8.5" x 11" black and white maps,
they can be easily reproduced for
repeated personal trials or class-
room use.

It is apparent from the anno-
tated bibliography that several
books about geologic mapping
have been published since I
completed my geological field
camp in 1981, when this kind of
reference book was unavailable.
Although this book would have
been an extremely useful reference
book at field camp, I might not
have graduated if my instructors
could have assigned some of the
complex exercises that it includes.
There is no question that anyone
who is able to complete all of the
exercises will have a thorough
knowledge of geologic maps and
the various interpretative tech-
niques that can be employed.

There are some minor problems
with this text, but none that
discourage me from recommend-
ing it. Although I found a few
typographical errors in the text
and exercises, the typical Ameri-
can reader will find a surprisingly
great difference between British

and American spelling of geologi-
cal terminology, which could be
confusing to the novice. In this age
of computer-typeset texts, a
publisher could justify two print-
ings of a scientific text when the
terminology is this divergent, with
each text using the lexicon of the
appropriate audience. In addition,
although this book is readily
understandable to a geologist with
a working knowledge of the
geologic time scale and basic
geologic principles, some of the
text could be much more difficult
for the typical American geology
undergraduate to use without such
background knowledge. More
importantly, a few of the black and
white exercises are simply too
complex to use conventional
pattern symbols to differentiate the
areas. For example, because I am
familiar with the geology of the
Baraboo, Wisconsin area, I am
convinced that I could not deter-
mine the geological history of the
region to the extent requested in
the exercise, given the cartographic
complexity of the map included.
Thus, I am concerned that some of
the other exercise maps might be
similarly flawed. Finally, I would
recommend that the next edition
include a geologic time scale and a
chapter/pamphlet of accompany-
ing exercise solutions.

Despite these criticisms, this
book is an excellent reference text
for field geologists. The diagrams
explaining each topic are very well
drawn, and easily understandable
without reference to the text.
Although the book will be most
useful as a reference or field camp
text, for me the highlight of this
book was the entertaining stories
about some famous geologic
mappers. Like many Welshmen,
Professor Maltman is an excellent
story teller. He has done as good a
job writing captivating stories
about some famous geologists as
he has in clarifying the exceedingly
complex techniques of geologic
mapping.

BOOK REVIEW

Geographical Information Systems: Principles and Applications.
D.J. Maguire, M.F. Goodchild, and D.W. Rhind (eds). Essex, England: Longman Scientific & Technical, 1991. Vol. 1, Principles, 649 pp. Vol. 2, Applications, 447 pp. $295 Hardcover . (ISBN 0-582-05661-6) (Copublished in the United States with John Wiley & Sons, Inc., New York, (ISBN 0-470-21789-8).

*Reviewed by E. Lynn Usery,
Department of Geography,
University of Wisconsin,
Madison*

Geographic Information Systems (GIS) have developed to a stage where production of a large reference compendium is not only feasible, as the editors state in their preface to this work, but necessary. This two-volume set is a milestone in the continuing development of GIS in three respects: first, it presents a comprehensive view of GIS as an emerging technology; second, it provides a reference work for researchers and practicing GIS professionals; and third, it attempts to develop the basis of GIS as a discipline. The stated aim of the book is to assemble a team of international experts to write a major reference work on GIS. Although there is a significant North American and European (particularly the United Kingdom) bias, the editors have accomplished this aim. With only a few flaws in the presentation, the work is a monumental achievement and will probably serve as the major GIS reference for some years to come.

The book is well organized into four sections: 1) an introductory overview with eight chapters examining the definitions, history, settings, and critique of GIS; 2) principles of GIS consisting of 26 chapters arranged into subsections concerning the nature of spatial data, digital representation, functional, display, and operational issues; 3) applications of GIS with 22 chapters in four subsections concerning national and international programs, socio-economic, environmental, and management applications; and 4) an epilogue which briefly summarizes the main ideas and presents projections for the future. The editors tie the work together by providing an introductory article for each of the first three sections and by authoring the epilogue. The book contains a table of contents, preface, and list of contributors with affiliation and research interests repeated in each of the two volumes. While each article contains its own reference list, each volume contains a consolidated bibliography of some 60 pages, a six-page list of acronym definitions, an author index which includes page numbers where citations occur, and an extensive subject index. The repetition of the bibliography and indices allows each volume to be used independently but at the cost of the extra pages.

The book is a good, comprehensive work meeting the need in the GIS area for such a reference volume. It is similar in some respects to the *Manual of Photogrammetry* and the *Manual of Remote Sensing* published by the American Society for Photogrammetry and Remote Sensing, but unlike those manuals this book does not present a rigid, factual account of GIS. For example, one cannot use this book to learn how to program a quadtree data structure or how to use relational algebra to extract relevant geographical data attributes, as would be expected in a manual. The articles are more of a research approach, some with speculation and futurism. The book does provide an excellent overview of the general principles and applications of GIS, which is the intent. It is aimed at advanced undergraduates, postgraduates, professionals, and research workers and succeeds at presenting the appropriate information to this target audience.

At the same time, GIS is an area where criticism has been scarce. This book is no different and the editors lament the fact that in the applications part of the work, no examples of GIS failures are included. The one chapter which does level criticism focuses on ideas of cartography's demise, the booster atmosphere surrounding GIS, and the declarations of success before implementation or experimentation. That GIS leads to improved spatial analysis is usually not questioned, but this aspect is the weakest of the system and true spatial analysis is incorporated in few if any GIS. Several chapters in this work echo this criticism as well as the limitations of GIS to handle three-dimensional and temporal data. Also, the chapter criticizes GIS researchers and practitioners who are quick to adopt new paradigms (currently object-orientation has captured the GIS collective imagination) and hail them as the solution to representation of geographic data before any implementation or experimentation has been performed.

The section on principles of GIS forms the core of this work and the editors' introduction identifies a small number of organizing principles which have emerged in GIS: raster versus vector, query versus product, and spatial analysis versus spatial information. The principles are organized by identifying key scientific questions of GIS which include the nature of spatial data, digital representation, functional, display, and operational issues.

The applications section is a good sampling of the possible types of GIS applications. Its limitation is that the breadth of the current and potential applications

cannot be effectively represented in a single volume.

In the epilogue the editors reflect on the ideas presented throughout the book and make some statements about the current status of GIS with a prognosis for the future. It examines the outstanding issues in the research agenda, projections to the year 2000, and how GIS fits in the bigger societal future. Briefly examining its history, the editors think GIS is converging upon a set of generic issues through the use of technology. These issues include data capture, data modelling, accuracy, data volume, spatial analysis, user interfaces, cost/benefit analysis, and impacts on organizations. An argument is made for geographic information science instead of the technology of GIS. While GIS was once seen only as access to maps, it is now viewed as access to the world represented by maps. Drawing a parallel to statistical packages, GIS is said to be at the stage of those packages in 1970. Statistics emerged as a discipline, will GIS do the same or will it follow the path of remote sensing and remain an interdisciplinary tool for all spatial scientists?

While GIS has many of the trappings of a discipline, including journals, trade press, conferences, textbooks, college classes and curricula, is there a fundamental set of problems for GIS to examine? Two views of GIS are put forward, one in which GIS follows the path of the quantitative revolution in geography in the 1960s. Today few geographers, particularly human geographers, are concerned with quantification. This view portrays GIS as the Edsel of electronic data processing. The second view projects continued convergence of ideas, disciplines, technologies, and a need for the various application areas to remain affiliated. The editors prefer the second view and

expound upon it in projections for GIS to the year 2000.

In summary, the book is a major step in developing a comprehensive view of GIS. While one may not agree with the statements in the introduction or the epilogue (and there is contradiction among the contributors), the editors are to be commended for the production of such a reference work. Flaws, such as inclusion of the subsection titles only in the table of contents and not in the subsections themselves, some cited references which do not appear in the reference list or in the consolidated bibliography, and a few isolated grammatical errors, are minor. One major problem is the color plates. Most are too small to be effective (with as many as eight per page), particularly in the applications section, and in some cases the graphics are completely illegible. This problem notwithstanding, the book is an excellent presentation of the framework of GIS principles and provides a reasonable survey of the major GIS application areas with a few detailed examples. The editors elicit major themes in their introductions and tie the 56 chapters together well. This work is likely to become required reference material for GIS students and practitioners; it certainly belongs on the bookshelf of every GIS researcher.

cartographic perspectives on the news

Landsat commercialization will reach a major milestone on September 30, 1992, when taxpayer-subsidized operation of the program ends. Landsat is the United States Civil remote sensing satellite system operated by the Earth Observation Satellite Company (EOSAT). EOSAT announced it would assume opera-

tion costs for Landsat on October 1, saving the taxpayer $19 million in Fiscal Year 1993. Landsat 6 will be completed and delivered to the government in October and NOAA has scheduled its launch for January 23, 1993.

The first Landsat was launched in 1972; since that time, an archive of over 2.7 million images have been created. These images are extremely valuable and useful for mapping, research, and monitoring the Earth's natural resources. The Landsat Thematic Mapper (TM) sensor collects data from a broad region of the electromagnetic spectrum that includes visible bands, near-infrared, shortwave-infrared, and thermal wavelengths. With Landsat's TM 30 x 30 meter resolution and large area coverage (100 x 100 miles), the sensor provides detailed information at relatively low cost per unit area, compared to aerial photography or other commercial satellite data. In addition, Landsat has repeat coverage every 16 days.

TM data is well suited for many environmental applications and is used to inventory and monitor world resources, wildlife habitats, marine environments and minerals. Carla Adams, at EOSAT, has compiled a brief description of case studies of environmental monitoring using Thematic Mapper data. Examples include the use of Landsat TM data to input information into a geographic information system by the Suwannee River Water Management District to help the regulatory and planning staff assess where land cover is changing and to locate areas where land use could harm surface water. Shoreline changes in the Aral Sea are being analyzed by comparing the 1977 MMS mosaic and 1987 mosaic. The United States National CoastWatch Program intends to use TM data to develop a comprehensive nationally standardized GIS to assess changes

in land cover and habitat in the coastal regions of the United States.

Because TM data provides current land cover information, it can be used to map urban cover, update urban-rural boundaries, and identify the urban fringe zone for planning. Further examples of TM data use for oil spill tracking, water quality assessment, air pollution, and global warming demonstrate the vast amount of analytical and mapping uses of Landsat imagery and data. Landsat 6 will provide even further value of this data to the mapping community with the introduction of a 15 meter panchromatic band.

EOSAT is interested in making Landsat data grants available to researchers. They have made an agreement with NASA to dedicate up to 25% of productive capacity to the collection of research data selected by NASA, which will then pay 50% of the list price for this data set and will distribute the data to researchers for noncommercial use. EOSAT will use all revenues from these NASA purchases to make grants to researchers.

recent publications

GEOGRAPHIC INFORMATION SYSTEMS

A publication entitled *Geographic Information Systems (GIS) and Mapping— Standardization and Applications* (Special Technical Publication (STP) 1126) is available from the American Society for Testing and Materials. It contains twenty-six papers from a 1990 Symposium sponsored by the United States Geological Survey and the American Society for Testing and Materials (ASTM)

Section D18.01.03 on Remote Sensing and D18.01.05 on Mapping and GIS. The purpose of the symposium was to bring together engineers and scientists to provide a forum for exchanging experiences and findings related to GIS; learn from a variety of applications; promote technology transfer; and provide educational resources for GIS, maps, and remote sensing. Persons desiring a copy of the publication should contact the ASTM Marketing and Sales Office, 1916 Race Street, Philadelphia, Pennsylvania 19103 (215) 299-5536.

A number of current publications are available from the American Society for Photogrammetry and Remote Sensing (ASPRS). These include: *Geographic Information Systems: A Guide to the Technology* by John Antenucci, Kay Brown, Peter Croswell, Michael Kevany, and Hugh Archer; *Introductory Readings in Geographic Information Systems*, edited by Donna Peuquet and Duane Marble; *The Integration of Remote Sensing and Geographic Information Systems* (Proceedings of a special NCGIA session held at the 1991 ASPRS-ACSM Annual Meeting). To obtain a price list and more information, contact: ASPRS, P.O. Box 1269, Evans City, PA 16033; (412) 772-0070, fax (412) 772-5281.

The Extension Service of the University of Minnesota has released a 12 page publication titled *Introduction to Data Analysis Using Geographic Information Systems*. The publication provides basic information about the analytical capabilities of geographic information systems and describes some of the computer programs used by a GIS for map analysis. The cost of the publications is $2. To order, request item

NR-FO-5740 and send a check or money order payable to the University of Minnesota to: Distribution Center, 3 Coffey Hall, University of Minnesota, 1420 Eckles Ave., St. Paul, MN 55108-6064. The Telephone number for the Distribution Center is (612) 625-8173. Their Federal Tax ID number is 41-6007513.

DIGITAL DATA AND ELECTRONIC ATLASES

Strategic Mapping has announced the release of *StreetBase Plus* files. The files are derived from Dynamap 2000, an enhanced set of TIGER files originally developed by Geographic Data Technology. StreetBase Plus provides a higher address match rate when compared to StreetBase or standard TIGER files. StreetBase Plus files contain over 10 million valid address ranges, zip code information for all street types and unique street segments. In addition to the requirements for running Atlas Software, your system must be equipped with at least: 2 MB RAM and DOS 3.3 or higher. Contact: Strategic Mapping, Inc., 4030 Moorpark Ave, Suite 250, San Jose, CA 95117; (408) 985-7400, fax (408) 985-0859.

Omnigraphics has announced a new series: *The Omni Gazetteer State Series*. The series will cover all 50 states individually and will be available starting in September with the *Omni Gazetteer of New York State*. Each volume will cover a state's populated places, plus structures, facilities, locales, historical places, landmarks, and named geographic features. For more information contact: Paul Rogers, Omnigraphics, Inc., Penobscot Building, Detroit, MI 48226; (800) 234-1340, fax (313) 961-1383.

Applied Optical Media Corporation has two CD-ROM atlases available for sale. *American Vista*, an atlas of the United States, has a visual interface that provides access to a rich multimedia environment with more than 600 Megabytes of maps, information, pictures, and sound. High resolution maps, topographical maps, resource and industry maps from Hammond Inc, and searchable data from the 1990 U.S. Census. Retail price $79.95. *World Vista*, an international atlas, includes maps and data of the new republics of the old Soviet Union. It also has access to a rich multimedia environment with more than 600 Megabytes of maps, information, pictures, and sound. It includes high resolution maps and data from Rand McNally. Retail Price: $79.95. System Requirements for both products are MPC: MPC or 386sx PC with CD-ROM drive and sound and meeting MPC specifications with 2 MB of RAM; at least 640x480, 256 color display capabilities (512K VRAM) and Windows 3.1 (Windows 3.0 only if Multimedia Extensions 1.0 is properly installed). For the Macintosh: Color Macintosh with 2 MB RAM running System 7.0. For more information contact: Applied Optical Media Corporation, 1450 Boot Road, Building 400, Westchester, PA 19380; (215) 429-3701, fax (215) 429-3810.

MAPPING

MicroImages Press recently announced the publication of *A Guide to Map and Image Processing* by Dr. Merri P. Skrdla. This 292-page, soft cover edition is a technical reference on the selection and use of a second generation desktop or laptop microcomputer system for integrated GIS, image processing CAD, spatial databases, AM/FM, and desktop mapping. The retail price is $20. Contact:

MicroImages, Inc., 201 North 8th Street, Suite 15, Lincoln, Nebraska, 68508-1347; (402) 477-9554.

MAPPING SOFTWARE

GEOVISION, Inc. has released *StatMapIII.* StatMapIII for Windows is a statistical mapping program that provides the capability to match demographic data values to geographic coordinate files in order to create thematic maps for analysis and presentation. StatMapIII allows direct access to U.S. Census Bureau TIGER base map and 1990 Census databases. The minimum system requirements are MS-DOS 3.31 or later, Microsoft Windows 3.0 or later, PC using an 80286 or better, 2MB memory, Floppy disk drive, Hard disk (40 MB minimum), EGA or VGA graphics adapter and monitor, Microsoft Mouse or compatible device. Contact GEOVISION, Inc., 5680-B Peachtree Parkway, Norcross, Georgia 30092; (404) 448-8224, fax (404) 447-4525.

MAP USE

The National Council for Geographic Education has published *The Language of Maps*, as the first monograph in their *Pathway in Geography Series*. The publication, authored by Professor Phil Gersmehl of the University of Minnesota, is a supplementary manual that introduces students to the language(s) used to express ideas about spatial relationships. The volume is recommended for use in introductory courses in geography and map reading. Topics covered include: basic spatial concepts, various types of maps and analytical tools used by the map reader, spatial ideas of distance, direction, area, and volume, scales and grids, and drainage, settlement and forest

pattens, etc. To order, send $15 plus $2 for shipping and handling payable to the National Council for Geographic Education to: National Council for Geographic Education, 16A Leonard Hall, Indiana University of Pennsylvania, Indiana, Pennsylvania 15705-1087; (412) 357-6290.

The Third Edition of *Map Use, Reading - Analysis - Interpretation* written by Phillip C. Muehrcke and edited by Juliana O. Muehrcke, is now available. The new edition has over 500 illustrations, 10 new chapters, exercises added to each chapter, text updates from beginning to end, and more information about the impact of electronic technology. To order send a check or money order for $32 to: JP Publications, P.O. Box 44173, Madison, Wisconsin 53744.

MAPS

The Association of Canadian Map Libraries and Archives (ACMLA) is offering *Standard Topographical Maps of Canada, 1904-1948*, a 31-page softcover booklet that lists maps produced by surveyors working for the Canadian Government. The maps show mountain ranges, lakes, rivers, and streams for different areas of Canada. In addition, the book includes 22 map-sheet illustrations. The cost is $10. Also available are *Early Canadian Topographic Map Series: the Geological Survey of Canada, 1842-1949,* and *Sectional Maps of Western Canada, 1871-1955: An Early Canadian Topographic Map Series.* These softcover booklets list sheets of sectional maps that contain township boundaries and topographic features. Each costs $15. Contact : ACMLA, c/o MAPS, National Archives of Canada, Ottawa, Canada K1A ON3; (613) 995-1079.

received her B.S. degree in chemistry (1961), and an M.S. (1964) and Ph.D. (1969) degrees from the University of Wisconsin in cartography and educational psychology.

Barbara contributed more than 50 articles, reviews, and essays to the professional literature on topics related to map design, education, cognitive psychology and human factors, and computer-assisted vehicle navigation and the Intelligent Vehicle Highway System (IVHS). She is probably most well recognized for her co-authored book on *The Nature of Maps* (with Arthur H. Robinson).

Barbara was a member of the North American Cartographic Information Society, the American Cartographic Association, The American Congress on Surveying and Mapping, the Association of American Geographers, and the International Cartographic Association. Her service to these organizations included (among other things) Chair of the U.S. National Committee for ICA, U.S. National Committee for IGU, Editorial Board of The American Cartographer (now Cartography and Geographic Information Systems), Committee for Automobile Navigational Aids, Society of Automotive Engineers, and most recently Vice President of the International Cartographic Association. Her dedication and contributions to the cartographic community will be sorely missed.

Memorial contributions can be made to either: Executive Director, Northwestern Medical Faculty Foundation, 680 N. Lakeshore Drive, Suite 1118, Chicago, IL 60611, or the Barbara Petchenik Memorial Fund, c/o David Woodward, University of Wisconsin, Department of Geography, 550 N. Park Street, Madison, WI 53706 (the latter will be used to fund an internationally sponsored annual children's mapping competition).

announcements

J.B. Harley Research Fellowships in the History of Cartography. A fund in the memory of the late Professor Brian Harley (Professor in the Geography Department at the University of Wisconsin-Milwaukee) has been initiated to support the *J.B. Harley Research Fellowships in the History of Cartography*. The target of £40,00 will fund up to three fellowships per year, each of one month's duration. Anyone pursuing advanced research in the field will be eligible, whatever their nationality, discipline or profession. Preference will be given to interpretive studies reflecting the notable contributions made by Professor Harley. The awards will provide opportunity for intensive use of the major London Collections, notably the British Library, National Maritime Museum, Public Record Office and Royal Geographical Society, as well as others within reach of London. The Fellowships will provide welcome stimulus to the academic study of the history of cartography worldwide. It is anticipated that most of the applicants will come from outside the United Kingdom. The Trust's officers are Professor P.D.A. Harvey (Chairman), Dr. Catherine Delano Smith (Hon Treasurer) and, as Hon. Secretary, Tony Campbell, British Library Map Library, Great Russell Street, London WC1B 3DG, to whom contributions (*The J.B. Harley Research Fellowships Trust Fund*) or enquiries may be sent.

ACSM 20th Annual Map Design Competition
The American Cartographic Association of the American Congress on Surveying and Mapping (ACSM) is again sponsoring their annual Map Design Competition to promote interest in map design and to recognize significant design advances in cartography. The Map Design Competition is open to all mapmakers in the United States and Canada. Noted cartographers and designers judge entries based on achievement of stated objectives, color, overall design and impression, craftsmanship, and typography. The winning entries will be exhibited on February 15-18, 1993 at the ACSM Annual convention in New Orleans, Louisiana. Entries may also be displayed at a number of other national and international professional functions and will become part of the permanent collection of the U.S. Library of Congress. All winners will receive notification at least two weeks before the ACSM Annual Convention. Cash prizes will be awarded in various categories. Only maps completed and/or published in 1992 are eligible. The deadline for entires is December 15, 1992. For more information contact: Ms. Dierdre Bevington-Attardi, ACSM Map Design Competition, c/o Cartographic Division, National Geographic Magazine, 1600M Street NW, Washington, D.C. 20036.

1492: An Ongoing Voyage
In August The Library of Congress opened a major Quincentenary exhibition, *1492: An Ongoing Voyage*. The exhibition addresses the worlds of America and the Mediterranean on the eve of 1492, and looks at Columbus's voyages and their continuing consequences in the Americas from 1492-1600. The exhibition draws extensively on the rich collections of the Library of Congress and is complemented by objects from other institutions such as the Pierpont Morgan Library, Tulane University, the San Antonio Museum of

Art, the Museum fur Volkerkunde (Vienna), the Alters Art Gallery, and from private individuals.

The exhibition includes an introductory film as well as 20 highlighted stations that feature outstanding treasures from the 15th and 16th centuries. *1492: An Ongoing Voyage* is divided into three sections: "On the Eve of 1492," "The Atlantic Voyage," and "Europe Claims America." Among the items on display in the exhibit are The Library's unique 1531 Huejotzingo (Mexico) Codex (an illuminated document, on display for the first time), Caspar Vopell's 1543 manuscript terrestrial globe, a 14th century sea chart (portolan) of the Eastern Mediterranean, the 1507 Johann Ruysch world map in Ptolemy's *Geographia*, Diego Gutierrez's map of America, and Martin Waldseemuller's 1507 *Cosmographiae Introductio* in which the name America first appears.

1492: An Ongoing Voyage will be on view in the Madison Gallery of the James Madison Memorial Building, 101 Independence Avenue, S.E. from August 13, 1992 through February 14, 1993. Hours for the exhibition are 8:30 a.m. to 9:30 p.m. Monday - Friday, and 8:30 a.m. to 6 p.m. Saturday and Sunday.

Database on Geological Maps Now Available As USGS Report
The United States Geological Survey (USGS) has released its bibliographic database of published geological maps for areas in the United States and its Territories. The database, called GEOINDEX, contains up-to-date information on geologic maps published by the USGS, State geological surveys, geoscience societies, and other publishers. The database is accompanied by USGS search and retrieval software called GSSEARCH.

GEOINDEX originated in the

late 1970s to manage bibliographic data from the USGS Geological Map Indexes (GMIs). The database was converted to DOS in the mid 1980s. GEOINDEX includes all data on the GMIs, as well as data collected through mid-1991. GSSEARCH was developed by the USGS to search GEOINDEX and other fielded databases on a microcomputer. The hardware requirements are an IBM-compatible microcomputer (AT style or newer recommended), high-density 5.25 floppy disk drive, hard disk with 16 megabytes space available, EGA color monitor, 512K RAM, system configuration: 20 files, 20 buffers. The software requirements are DOS 3.20 (or higher).

A report on the database, entitled *GEOINDEX Database on Geologic Maps Accessible Using GSSEARCH Search and Retrieval Software*, has been prepared by H. Kit Fuller and Gregory B. Gunnells, and is available in two parts. Open-File Report 91-575-A (documentation only) is available for $3.25 (paper) or $4 (microfiche); Open-File Report 91-575-B (database, search software, and documentation) is available for $84 (14 5.25 high density floppy disks). These items can be ordered from USGS Books and Open-File Reports, Box 25425 Federal Center, Denver, CO 80225. Include payment with your order.

Michelin Job Opportunities
Michelin Travel Publications has immediate opportunities for cartographers at their U.S. headquarters in Greenville, South Carolina. These individuals will participate in all phases of map making and printing with responsibility for compilation, computer-aided design, preparation and on-press quality assurance of maps. Qualified candidates need a Bachelor's or Master's degree in cartography or directly related

field, with a minimum 3.0 GPA, or 3-5 years professional experience. Knowledge of Macintosh, PC, and UNIX workstation, and versatile programming skills are also needed. Familiarity with cartographic software, data base development and maintenance is required. Send resume and salary requirements to: Dept. CP, Michelin tire Corporation, P.O. Box 19001, Greenville, SC 29602-9001.

cartographic events

EVENTS CALENDAR 1992

August 1992- February 14, 1993: **The Exhibition 1492: An Ongoing Voyage**. Library of Congress, Madison Gallery of the James Madison Memorial Building, 101 Independence Avenue, S.E., Washington, D.C.

September 30- October 4: **24th Annual Conference of the International Visual Literacy Association Imagery in Science and the Arts**. Pittsburg, PA. Contact: Dr. Barbara Seels, Instructional Design and Technology, 4A16 Forbes Quadrangle, University of Pittsburg, Pittsburg, PA 15260; (412) 648-7338, fax (412) 648-5911.

October 6-9: **GISDEX, the Geographic Information Systems Conference and Exposition, Focusing on the Use of GIS in the Federal Government**. The Washington Hilton, Washington, D.C. Contact: USPDI, Inc. (301) 445-4500, fax (301) 445-5722.

October 14-17

North American Cartographic Information Society XII Annual Meeting

The North American Cartographic Information Society will hold its twelfth annual meeting at the Ramada Inn in St. Paul, MN. The preliminary program for this year's meeting is listed on pages 31 - 33 of this issue of *Cartographic Perspectives*. For more information contact Dr. Jeffrey Patton, Program Chair, Department of Geography, University of North Carolina at Greensboro, Greensboro, NC 27412; (919) 334-5388.

November 6-12: **GIS/LIS 1992 Annual Conference and Exposition**. San Jose, CA. Contact: ACSM, 5410 Grosvenor Lane, Bethesda, MD 20814; (301) 493-0200, fax (301) 493-8245.

1993

February 15-18: **ACSM/ASPRS Annual Convention**. New Orleans, LA. Contact: ACSM, 5410 Grosvenor Lane, Bethesda, MD 20814; (301) 493-0200, fax (301) 493-8245.

February 15-18: **7th Annual Symposium on Geographic Information Systems in Forestry, Environmental and Natural Resources Management.** Vancouver, British Columbia, Canada. Contact GIS 93 Symposium Office, Suite 305, 1040 Hamilton Street, Vancouver, British Columbia, Canada, V6B 2R9; (604) 688-0188, fax (604) 688-1573.

May 3-9: **16th International Cartographic Conference - ICC '93**. Cologne, Germany. Contact: conference Secretariat, AKM Congress Service, Clarastrasse 57, GH - 4005 Basel, Germany.

May 5-8: **Geotechnica , the International Fair and Congress for Geosciences and Technology**. Cologne, Germany. Contact : KolnMesse U.S. Representative Office, German American Chamber of Commerce Inc., 666 Fifth Avenue, 21st Floor, New York, NY 10103-0165; (212) 974-8836, fax (212) 974-8838.

April 6-9: **Association of American Geographers Annual Meeting**. Atlanta, GA. Contact: Kevin Klug, AAG, 1710 16th St. N.W., Washington, D.C. 20009-3198; (202) 234-1450.

June 5-10: **84th Annual Conference of the Geography and Map Division Special Libraries Association.** Cincinnati, OH. Contact: Ms. Alice C. Hudson, Chief, Map Division, N.Y.P.L., 5th Avenue and 42nd Street, New York, NY 10018; (212) 930-0588.

June 21-25: **XVth International Conference on the History of Cartography.** Newberry Library, University of Chicago, Chicago, IL.

NACIS *news*

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Vice President: **Jeff Patton,** Department of Geography, University of North Carolina-Greensboro, Greensboro, NC 27412; (919) 334-5388.

Secretary: **Craig Remington,** Geography Department, University of Alabama, Tuscaloosa, AL 35487; (205) 348-1536.

Treasurer: **Edward J. Hall,** 410 McGilvrey Hall, Kent State University, Kent, OH 44240-0001; (216) 672-2017.

Past President: **James F. Fryman,** Department of Geography, University of Northern Iowa, Cedar Falls, IA 50613; (319) 273-6245.

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MEMBERSHIP INFORMATION

For membership in the North American Cartographic Information Society please fill out the form at the back of this issue with your name, address, name of your organization, your position and mention your cartographic interests along with a check payable to NACIS to Edward J. Hall, Treasurer, Map Library, 410 McGilvrey Hall, Kent State University, Kent, OH 44242-0001. Membership fees for the calendar year are as follows:

Individual/Regular
$28.00 U.S.
Students: $8.00 U.S.
Institutional: $58.00 U.S.

Membership fees include subscription to *Cartographic Perspectives* and are due January 1.

Minutes of the NACIS Board Meeting March 21, 1992 St. Paul, Minnesota

President Dodd called the meeting to order at 9:00 a.m. The following Board members were present: Hull McLean, John Sutherland, Fred Fryman, Jeff Patton, Jack Dodd, Ed Hall, Jim Minton, Ruth Rowles, Craig Remington, and Ron Bolton. Also present were Chris Baruth (Executive Director), Mike Peterson (Chair, Editorial Board) and Greg Chu (Chair, Local Arrangements Committee).

Treasures Report
President Dodd asked that the minutes from Board Meetings of October 20, 21, and 23, 1991 be accepted and called upon Ed Hall to present the Treasures Report. Hall reports a balance of $23,203.10 in the NACIS account. Hall reports on a declining rate of interest being earned on the balance. He spoke concerning the need to establish a bank account which will allow unlimited deposits and withdrawals without a loss of interest income. Dodd suggests the present as timely in terms of centralizing financial operations to Milwaukee and asked Baruth to explore banking options in Wisconsin. Hall reports the membership of NACIS totals 280 active members, 44 institutional, 197 personal and 39 students.

NACIS XII
Jeff Patton, program chair, announced a call for papers for the St. Paul program in various publications. Further announcements will be made through a direct mailing from our existing list of potential participants. The Board asked that Cartographic Animation be added to the suggested topics list on the call for papers. The paper submission

deadline was moved back to June 1. Dodd offers the support of the Board to aid Patton in any way possible. Greg Chu addressed the Board concerning local arrangements and offered potential guest speakers. The local program schedule will be distributed for discussion during our summer telephone conference. Brent Allison will be a co-chair with Chu on local arrangements. Chu is investigating possible local field trips, transportation requirements and scheduling. The Map Library at the University of Minnesota will offer a reception on a non-banquet night with a gathering at Chu's restaurant to follow. Two concurrent workshops will be held at the University of Minnesota. One will address the uses of CorelDRAW software and the other will deal with animation cartography. Enrollment is limited to 20 participants in each workshop. A fee schedule was adopted as follows: Corel Workshop - $50 for full conference participants, $100 for non conference participants and $35 for students.

Animated Cartography Workshop - $70 full, $125 non, and $45 student. Interest continues for incorporating a workshop with McIntosh platforms as offered on past occasions. Five enrollment slots will be set aside in each workshop for student participation. The possibility of a Sunday workshop session exists if demand warrants. Concluding remarks on NACIS XII were offered by Ron Bolton as he praises the preparation which has taken place to insure a successful meeting.

NACIS XIII
The Board reviewed several potential sites for the Washington meeting as offered by Bolton. Final selection went to the Quality Hotel in Silver Springs, Maryland. Dates for the meeting will be finalized so as not to conflict with N.C.G.E. Fred Anderson and Al

Herman were suggested as possible local arrangement representatives.

NACIS XI Final Report
The Board accepted a Final Expense/Income Report from Baruth on the Milwaukee meeting. In summary, the report showed expenses totaling $6266.80 and receipts totaling $6665.50 for a positive balance of $398.70. Total conference attendance was reported at 92 participants. Sutherland made a motion to maintain the same fee structure for full participants to NACIS XII as was established for NACIS XI. The motion was seconded and passed. Jim Minton made a motion for a daily registration fee to be set at $25 for students and $45 for all other conference participants excluding meals. The motion was seconded and passed.

Cartographic Perspectives
Baruth announced that Sona Andrews had received approval from her Dean to assume editorship of C.P. Baruth read a report prepared by Andrews which outlined her progress through this transitional period. Patton points out that the Publications Committee has in the past worked with the Editor in the selection of feature articles. The Board asks for the Publications Committee Chair (Mike Peterson) to work on revising the name of the Committee to better reflect it's function. Further, the term of service on the Committee and the professional composition of the Committee members will be reviewed. An emphasis on academic representation on the Publications Committee was felt to be an asset in projecting a scholarly image of C.P. The Board joins in the principal that C.P. should take on the style of the Editor. Formerly allotted funds for publication software have not been spent and remain at the disposal of

the Editor. Dodd ask Baruth to convey to Andrews the need to publish C.P. in a timely manner. Dodd further receives Board support for production of a brochure which promotes C.P. in order to broaden subscription. Chu suggests that the Review Committee for refereeing articles be placed in a more prominent page position in C.P. Ed Hall asked to be released from the responsibility of maintaining the current data base for C.P. mailing labels. It was agree that this task would be moved to Milwaukee. Bolton asks Dodd to select with the Editor a suitable time frame for C.P. production. The Board joins in thanking Dave DiBiase and his staff for their years of service on Cartographic Perspectives.

NACIS Dues Increase
This matter was tabled for later discussion.

Nominating Committee
Fred Fryman asked that an announcement be placed in C.P. for nominations to Board positions. Dodd encourages members of NACIS who have not served on the Board to consider running for a seat. Terms expire this year for Bolton, McLean, Fontanez and Hall. A question arose concerning the maintenance of a permanent record of election results. Dodd will contact Diana Riveria for clarification on this matter.

Membership Growth Subcommittee
In response to her interest, Barbara Trapido has been asked to serve on the subcommittee. Dodd will select a new chair.

Centralization and Incorporation
Baruth reports that centralization of NACIS operations continues in Milwaukee. Incorporation of the Society in Wisconsin has been renewed with Baruth as the register agent.

Mission Statement
The question arose concerning the language of our mission statement as it relates to our non-profit status for postage permits. Baruth will investigate permit application procedures for mailings from Milwaukee.

NACIS XIV
The Board discussed potential sites for this meeting, drawing from responses to a questionnaire placed before the membership. Dodd suggests the use of a private research group to help in site selection to relieve Bolton of this arduous task. The Board felt that NACIS should continue to seek advisement from the membership as to future sites. Patton spoke in favor of Asheville, North Carolina. As in the past, the problem of finding members to serve on a local arrangements committee limited site options. Several members of the Board spoke convincingly of the merits of Ottawa. Here the point was made that our Society's name has not lived up to our conference sites selection along with a general desire to incorporate more Canadians into NACIS Minton and McLean will investigate facilities and planning for an Ottawa conference.

Cartographic Users Advisory Council Representative
Ed Hall was nominated to be the NACIS representative to C.U.A.C. He accepted the nomination and was elected to the post. McLean offers a motion calling for NACIS to support C.U.A.C. through a $50 annual contribution. The motion passed after discussion. Patton offers a motion calling for NACIS to support the Society's representative to C.U.A.C. with a nominal contribution in order to help defray the costs of attending meetings. After discussion a figure of $50 was arrived upon by the Board. The motion was

amended, voted upon, and passed.

Notebooks for President and Vice President

Dodd spoke of the value of maintaining a notebook to be passed through the succession of Presidents to aid in the continuity of the Society's management. He is now collecting such a notebook.

Other Business

Minton asks that it become a practice of the President to present a "State of the Society" report to the Board which would address committee assignments, duties of office holders, and other matters which reflect upon the well being of the Society. The suggestion met with Board support. Baruth asked that a committee be formed to address digital technology in the library setting. Chu suggested a future workshop on the matter. Chu further suggests that Pat McGlamory might offer another conference session concerning this important topic. After brief discussion and yielding to the pangs of hunger, President Dodd finds that all necessary business has been completed and adjourns at 5:10 p.m.

Craig Remington, Secretary

EXCHANGE PUBLICATIONS

Cartographic Perspectives gratefully acknowledges the publications listed below, with which we enjoy exchange agreements. We continue to seek agreements with other publications.

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

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 CCA. 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. B V Gutsell, founder and 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 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. This 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 six times annually, this news magazine of Geographic Information Systems technology offers news, features, and coverage of events pertinent to GIS. Contact: Julie Stutheit, Managing Editor, GIS World, Inc., P.O. Box 8090, Fort Collins, CO 80526; (303) 223-4848; fax: (303) 223-5700.

Information Design Journal. Triannual publication of the Information Design Unit. Features research articles reporting on a wide range of problems concerning the design and use of visual information. Contact: Information design journal, P.O. Box 185, Milton Keynes MK7 6BL, England.

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.

NACIS XII

October 14-17, 1992
St. Paul, Minnesota

NACIS XII
Conference Schedule
(Preliminary)

Wednesday Oct. 14

2:00 p.m. Registration Begins

2:00 - 5:00 NACIS Board Meeting

7:30 - 8:00 OPENING SESSION
Welcome to The Twin Cities
Greg Chu

Welcome to NACIS XII
Jeff Patton

8:00 - 9:00 **Opening Address**
John Fraser Hart, Professor,
Department of Geography, University of
Minnesota.

9:00 - 11:00 **Opening Exhibits/
Posters (Cash Bar Social)**

Thursday, Oct. 15

8:30 - 10:00 a.m. SESSION A
**"Child Development and Carto-
graphic Education"** Papers by
Psychologists and Cartographers on how
children develop spatial awareness and the
implications for geographic and carto-
graphic education. Organizer - Henry W.
Castner.

CONCURRENT SESSION B
"Federal Mapping Agencies"
Organizers - Ron Bolton and Charles
Harrington.

10:00 - 10:30 Break

10:30 - 12:00 SESSION C
**"The Development of Spatial
Awareness"** A panel discussion of
Session A's papers on this topic.
Organizers - Herbert Pick and Henry
Castner.

CONCURRENT SESSION D
**"Electronic Atlases and Digital
Data Bases"** Organizer - Thomas
Hodler.

12:00 - 1:00 Lunch Break

1:30 - 5:00 p.m. Technical and
Local Tours
--**Minnesota Department of Transporta-
tion**
--**Riverboat Tour of the Twin Cities Area**
--**Minnesota Historical Society Map
Collection**

ANNUAL BANQUET
6:30 - 7:30 **Cash Bar**

8:30 - 9:00 **President's Remarks**
Jack Dodd

9:00 - 10:00 **Banquet Address**
Arthur H. Robinson, Professor
Emeritus, Deptartment of Geography
University of Wisconsin - Madison.

Friday, Oct. 16

8:30 - 10:00 a.m. SESSION E
**"Software Use in Cartographic
Production with an Emphasis on
the Small Lab"** Organizers - Joseph
Stoll and Donna Schenstrom.

CONCURRENT SESSION F
**"Communication and Cognition
in Mapping"** Organizers - Scott
Fruendschuh, Riley Jacobs and Margaret
Pearce.

10:00 - 10:30 Break

10:30 - 12:00 SESSION G
**"Interactive Videodisc Mapping
Project"** Organizers - Sona Andrews,
Chris Baruth, David Tilton and Yvonne
Bode.

CONCURRENT SESSION H
**"Map Librarians Speak to Geog-
raphers and Cartographers: What
We Can Do For You and How
to Get What You Need From Us"**
A series of brief presentations followed by
an extended panel discussion. Organizer -
Nancy Kandoian.

12:00 - 2:00 p.m.   **Lunch Buffet
and Annual Business Meeting**

2:00 - 4:00 SESSION I
"Cartographic Education" A panel
discussion of current trends in university
cartographic education. Panel includes
representatives from academia, the public
sector, and commercial cartographic firms.
Organizer - Keith Rice.

Concurrent SESSION J
**"Map Librarians and Digital
Data"** Organizers - Patrick
McGlamery, Jim Minton and
Johnny Sutherland.

4:00-6:00 **NACIS Board Meeting**

Saturday, Oct. 17

Workshops
Buses leave at 8:30 a.m. for workshops at
the University of Minnesota.

9:00-12:00 **Map Producition and
Design using Corel Draw** - Greg
Chu (**Note**: This is a morning session only.
If there is enough interest, it may be
repeated in the afternoon.).

9:00-4:30 **Macintosh Animation**
Michael Peterson, Riley Jacobs, John
Krygier, Catherine Reeves, David Tilton.

9:00-4:30 **IBM-Based Animation** -
Phil Gershmel.

Social events for non-workshop
participants:

8:30-12:00 **Visit to the Megamall
"Mall of America"**

1:30-? **Treasure Island Casino**
(Casino will provide shuttle).

5:00 **Wine and Cheese Reception**
University of Minnesota Map Library &
Cartography Laboratory.

Workshops

NACIS XII

IBM-based Map Design and Production

Saturday, 10/17/92
9:00-12:00 noon

Cost $50 ($100 for non-registered participants, $35 for registered students)

You will receive hands-on training in creating maps using Corel Draw! 3.0. The differences between traditional and computer-assisted design methods will be analyzed. Participants will receive a set of public domain base map files to take with them.

Software and Instructor:
Corel Draw! 3.0 - Gregory Chu, Director, cartography Lab, University of Minnesota.

NOTE: This workshop may be offered again in the afternoon depending on the response.

IBM-based Animation

Saturday, 10/17/92
9:00-4:30

Cost $70 ($125 for non-registered participants, $45 for registered students)

You will learn the basic principles of designing and producing dynamic animated maps for broadcast purposes. The workshop will be conducted with a combination of lectures, explanations, demonstrations, and hands-on exercises. There will be opportunities for questions.

Software and Instructor:
Autodesk Animator - Professor Philip J. Gershmel, University of Minnesota.

Macintosh Animation

Saturday, 10/17/92
9:00-4:00

Cost: $75 ($125 for non-registered participants, $45 for registered students)

You will explore the basic principles and techniques of cartographic animation using a variety of software demonstrated by five different instructors. Twenty five Macintosh IIci computers will be available so that workshop attendees will have hands-on experience in creating their own animations.

Software and Instructors:
MacChoro II, Adobe Premiere and QuickTime - Michael Peterson, University of Nebraska at Omaha.
Hypercard - Riley Jacobs, University of Nebraska at Omaha.
Macromind Director - John Krygier and Catherine Reeves, Pennsylvania State University; David Tilton, University of Wisconsin-Milwaukee.

FEATURED PAPERS

Each issue of *Cartographic Perspectives* includes featured papers, which are refereed articles reporting original work of interest to NACIS' 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 from presenters at the annual meeting and from other sources. 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.

FUGITIVE CARTOGRAPHIC LITERATURE

Information of interest to map makers, librarians, and educators appears in diverse publications. We invite synopses of reviews, news, and papers found in outlets not usually associated with cartography, map librarianship, or geography.

TECHNICAL GUIDELINES FOR SUBMISSION

Cartographic Perspectives is designed and produced in a microcomputer environment. Therefore, contributions to CP should be submitted in digital form on 3.5" diskettes. Please send a paper copy along with the disk, in case it is damaged in transit.

Text documents processed with Macintosh software such as *WriteNow, WordPerfect, Word,* and *MacWrite* are preferred, as well as documents generated on IBM PCs and compatibles using WordPerfect or Word. ASCII text files are also acceptable.

PostScript graphics generated with Adobe *Illustrator* or Aldus *FreeHand* for the Macintosh or Corel Systems' *Corel Draw* for DOS computers are preferred, but generic PICT or TIFF format graphics files are usually compatible as well.

For those lacking access to microcomputers, typed submissions will be cheerfully accepted. Manually produced graphics should be no larger than 11 by 17 inches, designed for scanning at 600 dpi resolution (avoid fine-grained tint screens). Continuous-tone photographs will also be scanned.

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.

Submissions may be sent to: Sona Karentz Andrews, Department of Geography, 208 Sabin Hall, 3413 N. Downer Avenue, University of Wisconsin-Milwaukee, Milwaukee, WI 53211; (414) 229-4872, fax (414) 229-3981; e-mail: sona@csd4.csd.uwm.edu.

NACIS membership form

North American Cartographic Information Society
Sociedad de Información Cartográfica Norte Americana

Name/Nombre:

Address/Dirección:

Organization/Afiliación profesional:

Your position/Posición:

Cartographic interests/Intereses cartográficos:

Professional memberships/Socio de organización:

Membership Fees for the Calendar Year*/
Valor de nómina de socios para el año:
Individual/Regular: $28.00 U.S./E.U.
Students/Estudiantes: $8.00 U.S./E.U.
Institutional/Miembros institucionales:
$58.00 U.S./E.U.

Make all checks payable to/
Manden sus cheques a:
NACIS
c/o Edward J. Hall, Treasurer
Map Library
410 McGilvrey Hall
Kent State University
Kent, OH 44242-0001

*Membership fees include subscription to *Cartographic Perspectives* .

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.