

cartographic perspectives

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messages

MESSAGE FROM THE EDITOR

It has been over 5 years (March of 1989) since the first issue of *Cartographic Perspectives* was published. Since that time *CP* has become a primary contributor to the dissemination and advancement of cartographic information. Two years ago we adopted a blind review process for articles and every attempt is made to review them within a few months. We strongly believe that in a rapidly evolving field such as ours that it is critical to disseminate the ideas and work of scholars and practitioners in a timely fashion (before the information is stale and out-of-date). To this end, we have made a commitment to publish accepted manuscripts within one year or less of their acceptance date.

You will notice that this issue of *CP* marks our second color issue (Spring 1993 issue was the first) and we still plan to publish one color issue per year (at no color-page charge to the authors). Other changes over the last year include an increase in the number of articles and pages per issue. By far, however, the biggest change and challenge for *CP* comes with this issue (although we have been

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known to say that for every issue we have done). Four of the articles discuss the development of multimedia prototypes on a Macintosh. We have provided these interactive, graphic supplements in electronic form via the internet on anonymous ftp.

The ftp host is: *alpha2.csd.uwm.edu*
Username: *anonymous*

The password is your entire e-mail address.

To get the files type the following:
cd pub/cartographic_perspectives

To retrieve individual files type:
get filename

(where *filename* is the prototype file name). The file names are:

aspens.sea.hqx (The prototype accompanying "Proactive Graphics for Exploratory Visualization of Biographical Data")

malaria_dreams.sea.hqx (The prototype accompanying "The Armchair Traveler Plugs in: Multimedia Cartography as a Visual Supplement to Travel Writing")

archive.sea.hqx (The prototype accompanying "Creating Interactive Media on CD-ROM" and "Using High-Resolution Digital Scans in Multimedia Cartographic Applications")

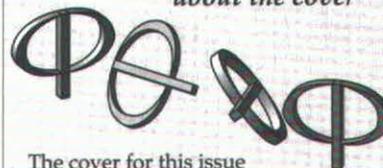
A ReadMe file is also available for each prototype. The files should be downloaded as an ASCII transfer. You need to have a Binhex converter on your Mac (Binhex 4.0 or StuffIt Expander). Once a file has been un-Binhexed it is self-extracting, executable, and does not require Macromedia DIRECTOR to be resident. Once you have downloaded the files to your computer (you are on your own here) you can play them by double clicking on the application icons. The files will be available

on anonymous ftp until January 1, 1995 after which date requests for the files via the internet need to be made to the Editor (sona@csd.uwm.edu).

The prototypes were created using Macromedia DIRECTOR. The system requirements are a Macintosh (sorry to you DOS and Windows types) running System 7 (or later), 4 MB of free RAM, and a 13" color monitor (*malaria_dreams.sea.hqx* will also run on a 9" screen. The *archive.sea.hqx* file requires 16 or 24 bit.).

If you are unable to ftp you can get the prototypes on four 3.5" floppy disks (Macintosh format). Send requests to the Editor along with a check (payable to NACIS) for \$12. □

about the cover



The cover for this issue was designed and produced by Kristin Watson and Glen Pawelski, both of The H.M. Gousha Company. The image was generated on a Macintosh computer using Terra Data's GEOCART projection software. The geographic base was projected as a Lambert Azimuthal Equal-Area and then exported as an Adobe ILLUSTRATOR 1.1 file. The outline of North America was opened in Adobe ILLUSTRATOR 5.0, the lines were joined, the continents were filled with a light gray color, and the background was filled with black. The EPS file was then opened in Adobe PHOTOSHOP 2.5, where the speckle was added to the image and the lightness and contrast tool was used to adjust the values. A rectangular area was then selected and lightened with the levels dialog box. The image was saved as an EPS file and placed back into ILLUSTRATOR where it was added to the rest of the design. The final image was opened in QUARK XPRESS 3.3. The color used for the cover is Pantone 3025 C.

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feature articles

Designing Animated Maps For A Multimedia Encyclopedia

Between January and June 1993, GeoSystems—an R. R. Donnelley and Sons Company—compiled and produced thirty animated maps for the 1994 edition of the *New Grolier Multimedia Encyclopedia*. Animated subjects requested by Grolier included the American Revolutionary War, World War II, and Magellan's circumnavigation of the world. I collaborated with GeoSystems as a private consultant, providing design specifications for the series. In this paper, I discuss some of the cartographic challenges GeoSystems faced in condensing these complex events into brief (4-5 minute) animations.

David DiBiase

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The *New Grolier Multimedia Encyclopedia* is a single CD-ROM disk containing some 33,000 articles drawn from the 21-volume *Academic American Encyclopedia*. The textual material is cross-referenced with photographs, video and audio clips, animated scientific and technical illustrations, and some 250 static reference maps. The disk is available in both Macintosh and Windows formats. Grolier's is one of four major CD-ROM-based general reference products, along with Compton's *Multimedia Encyclopedia*, Microsoft's *Encarta*, and the World Book's *New Illustrated Information Finder*. After computer games, these encyclopedias are some of the largest-selling of the approximately 1,000 CD-ROM titles now on the market, and competition for market share is intense. About 2.5 million CD-ROM titles were purchased in 1992, and market analysts expect that annual sales will exceed 37 million units by 1995 (Colligan 1994).

INTRODUCTION

"Multimedia maps" play a major role in Grolier's marketing strategy for its 1994 edition. Grolier's primary motivation for introducing this new category of reference material seems to have been to enhance its competitive position relative to other CD-ROM-based encyclopedias. For GeoSystems, collaboration with Grolier represented an opportunity to assert its leadership in custom commercial cartography in a new and rapidly growing market. For a university cartographer, this was an exciting chance to apply academic interests in map animation to the development of an innovative product that would reach a large audience. It was also an interesting experiment in the mass-market potential of dynamic thematic cartography.

Grolier's commission for 30 animated maps was contingent on the success of five prototypes, which GeoSystems had to research, design, compile and produce in just one month. As it turned out, each animation required approximately 200 hours of work from concept to finished product. Grolier specified historical subjects and, in a couple days of brainstorming with GeoSystems' staff, drew up outlines for the animations. My role in the project was to devise graphic specifications for the series and to figure out how best to synthesize the digital compilations produced by GeoSystems into finished prototypes. When it quickly became clear that I could not keep up with GeoSystems' researchers and

compilers, I enlisted the help of several of my colleagues in Penn State's Deasy GeoGraphics Laboratory. Once graphic standards and production processes were established, GeoSystems supervisor, Dan Etter and his staff took over production from start to finish.

BEHIND THE SCENES

Six frames from one of the prototypes, Magellan's circumnavigation of the world, are shown in Figure 1 (page 19). The animations were designed to be smaller than the standard 13" computer monitor for two reasons. First, Grolier specified dimensions of 400 by 280 pixels so the animations would fit in the smallest color Macintosh screen. In addition, greater memory and processor speeds are required to make the animation run smoothly as the animation increases in screen size, and Grolier wanted to ensure acceptable performance on entry-level personal computers. Motivated by a similar concern, Grolier also specified that the animations run at a rate of five frames-per-second. The effect of this constraint is most apparent during zooms and pans, which appear as series of distinct frames rather than smooth transitions.

The pace of the animations was a bone of contention throughout the project. Mindful of its youthful audience, Grolier wanted the animations to be as fast-paced as possible. GeoSystems and I were concerned that sufficient time be provided for viewers to read the narrative text and the map. Finally, we settled on a three seconds pause for each new narrative phrase. Although this pause may not allow users sufficient time to take in all of the changing elements, they should be able to pick up what they missed the first time around in subsequent viewings.

All the finished animations that GeoSystems delivered to Grolier were silent pictures. On the CD, however, the animations are "talkies." Grolier's post-production team wrote scripts, hired professional announcers, and recorded voice-overs to supplement the typographic narratives on the maps. The narratives were needed because not all personal computers have sound cards. However, the sound tracks increased the file size of the animations so much that only 15 of the 30 animations GeoSystems created could be fit on the CD.

Shaded terrain imagery is an important design element in most of the animated maps. Unlike most other map elements, however, the terrain imagery was not created from digital sources. Over the years GeoSystems has built up an extensive library of terrain artwork created by artists with airbrush and graphite. The terrain shading that appears in the "Growth of Civil Aviation in the United States" (Figure 2, page 19) was scanned from that collection. Since the projection and scale of the artwork was fixed, our map design options were somewhat constrained. We are now collaborating with GeoSystems in developing procedures for generating custom terrain imagery using ARC/INFO and a global digital elevation model called ETOPO5.

Over the course of this project, we exploited several of Phil Gersmehl's animation metaphors (Gersmehl 1990), including pointers, sprites, and color cycling (featured in the Civil Aviation prototype). It is not always obvious what the best metaphor is for a particular geographic phenomenon. Also, it was difficult to exert precise control over the routes we wished the sprites and pointers to trace out over the map. For example, the flight paths shown as color cycles (Figure 3, page 19) had to be programmed separately for each different cycling direction.

Figure 4 (opposite page) illustrates the design and production procedures GeoSystems adopted for the project. Like most cartographers, we are accustomed to starting the design process by considering carefully the

It is not always obvious what the best metaphor is for a particular geographic phenomenon.

opportunities provided and the constraints imposed by the final presentation medium. The presentation media in this case were to be QUICKTIME movies for the Macintosh version of the CD and AVI-format movies for the Windows version. QUICKTIME is Apple Computer's protocol for presentation of video and animation on the Macintosh; AVI is its Windows complement. GeoSystems did not, however, ship QUICKTIME or AVI to Grolier; instead they shipped original animations created with Macromedia DIRECTOR, which Grolier's production team converted to QUICKTIME. This scenario allowed Grolier to make last-minute editorial changes but denied GeoSystems the opportunity to control the quality of the end product. This led to several disappointments, particularly in the Windows version.

Macromedia DIRECTOR is a multimedia authoring software and has versions for both Macintosh and Windows (see Macromedia DIRECTOR 4.0 review for the Macintosh on pages 42-43 in this issue). It is widely used for programming interactive and animated presentations. Animations created in DIRECTOR version 3.0 for the Macintosh are composed of up to 512 "castmembers," which can be bitmapped graphics, text objects, or QUICKTIME movies. Up to 24 castmembers can appear in any one frame, and these can move about, change color, or be replaced by other castmembers independently over time. The animator assembles the castmembers and choreographs their actions in a separate window called the "score." Columns in the score represent frames in an animation; rows are called "channels." The channels (identified by icons) provide control over the duration of each frame, color palettes, transition effects, and stereo sound. The "script" channel holds procedures coded in DIRECTOR's native programming language, called "Lingo." Cells in the 24 numbered channels below contain the castmembers. In a sense, channels are analogous to layers in an illustration package: castmembers in higher-numbered channels appear above those in lower-numbered channels (DIRECTOR 4.0—which was released shortly after this project was completed—provides more channels and allows larger casts).

A castmember can be made opaque or translucent with respect to others below it. GeoSystems overlaid its scanned gray-scale terrain imagery with translucent color fills to discriminate British territory from Spanish claims prior to the American Revolution and used a set of opaque castmembers to enlarge an inset map for a larger-scale view (Figure 5, page 19).

Every castmember in the DIRECTOR movies—every point, line, and area symbol—had to be digitized individually. Coastlines, rivers, lakes, and contemporary political boundaries were either created using the map projection programs GEOCART and AZIMUTH, or adapted from existing

USING MACROMEDIA DIRECTOR

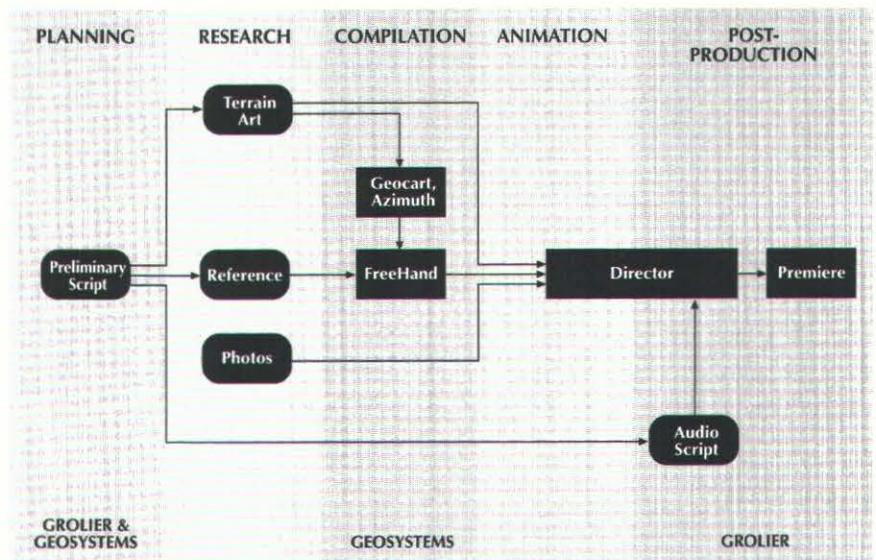


Figure 4: Flow diagram outlining the design and production sequence for the "multimedia maps" in the "New Grolier Multimedia Encyclopedia." Rectangular boxes represent software programs; rounded boxes stand for other resources.

GeoSystems products. Projections were specified to match the terrain art and then exported as Adobe ILLUSTRATOR-format PostScript or PICT files. The map projection files were then imported as layers in Aldus FREEHAND. FREEHAND drawing tools were used to create thematic symbols and typography in registry with the map projections.

Every graphic element that was slated to become a castmember in DIRECTOR was assigned to a unique drawing layer in FREEHAND. Figure 6 (page 19) shows elements of the zoom sequence suggested in Figure 5 assembled as layers in a FREEHAND file. Notice that all elements are monochromatic; GeoSystems assigned all colors in DIRECTOR to avoid the unwanted dithering that tends to occur when color bitmaps are exported from one program to another. Once all the graphic elements were created and registered in FREEHAND, the animator turned on one layer at a time and then cut and pasted castmembers into DIRECTOR's cast.

MAP RESEARCH AND COMPILATION

GeoSystems did all the historical research required for these animations in its own library of maps, atlases, and other reference materials. The researchers compiled map content from at least three different sources to avoid copyright infringement, and to ensure that the animations would be credible condensations of contemporary scholarship.

Grolier had specified that the animations should be approximately five minutes in length. This posed formidable challenges in condensing complex subjects such as the Civil War, the diffusion of prehistoric peoples in North America, and the rise and fall of ancient civilizations from 3,000 BC to the time of Christ.

In general, most of the compilations included far too much historical detail to present in these brief animations. As a result, the animators needed to edit and synthesize the compiled materials rather than simply string together a series of frames. Researchers and compilers would have spent far less time if voice-over scripts had been provided in advance. However, Grolier's strategy was to let the cartography determine the content and then to write accompanying voice-overs at a later time. I have come to believe that this was a wise strategy, although our work may have been more efficient if "graphic scripts" had been prepared as a first step (Monmonier 1989). Frankly, we didn't have enough lead time to plan as carefully as we would have liked. Who ever does?

REFLECTIONS

Grolier was satisfied enough with the prototypes to commission 25 more animations. GeoSystems produced these in about 90 days. Grolier's new edition started shipping late in 1993. Since I am not privy to their sales statistics, I cannot say if multimedia maps succeeded in enhancing Grolier's standing in the CD-ROM encyclopedia market. GeoSystems has been retained to create a new series of reference maps for the encyclopedia, however, which suggests that Grolier was pleased with their efforts.

It is interesting to consider the implications of products like Grolier's multimedia maps on geography's most venerable form of expression, the atlas. A CD-ROM disk may lack the authenticity of a large and beautifully illustrated book, but resources such as these will soon become accessible in the home via fiber optic networks and interactive television. What form might a thematic atlas take when the toll gates open onto the information highway?

If focus groups and consumers respond well to this product and others like it, it won't be long before more efficient production techniques and more sophisticated animations will be developed. But at least, with apologies to Campbell and Egbert's (1990) review article of a few years

ago, Grolier's multimedia maps demonstrate that animated cartography is not just scratching the surface anymore.

Thanks to GeoSystems for authorizing the presentation and publication of this material. I am particularly grateful to GeoSystems' animation crew, including Dan Etter, Roger Petrilli, Tara McCoy, Paul Yatabe, and Martha Mason, as well as my colleagues at Deasy GeoGraphics, especially Martin von Wyss, Catherine Reeves, Willy Vancura, and Jim Sloan, for making those four months so memorable.

Campbell, Craig S. and Stephen L. Egbert. 1990. Animated cartography: thirty years of scratching the surface. *Cartographica*. 27(2): 24-46.

Colligan, Bud. 1994. To the winner goes the standard. *NAB Multimedia News* (Winter): 16-17.

Gersmehl, Philip J. 1990. Choosing tools: nine metaphors of four-dimensional cartography. *Cartographic Perspectives*. 5: 3-17.

Monmonier, Mark. 1989. Graphic scripts for the sequenced visualization of geographic data. *Proceedings of GIS/LIS '89* (Orlando FL): 381-389.

This paper was presented at the 90th Annual Meeting of the Association of American Geographers, San Francisco, California on March 30, 1994.

Entre Enero y Junio de 1994, GeoSystems y R. R. Donnelley and Sons Company, compilaron y produjeron 30 mapas animados para la edición de la Enciclopedia New Grolier Multimedia. Los temas requeridos por Grolier incluyen La Guerra de la Revolución Americana, La Segunda Guerra Mundial, y el Viaje Náutico de Magallanes alrededor del Mundo. Yo colaboré con GeoSystems como consultor privado, proveyendo especificaciones de diseños para esta serie. Este compendio incluye los retos cartográficos que confronta GeoSystems para condensar eventos muy complejos de animación de 4-5 minutos.

Entre janvier et juin 1994, GeoSystems - une société R. R. Donnelley & Sons - a composé et produit trente cartes animées pour l'édition 1993 de The New Grolier Multimedia Encyclopedia. Les sujets animés demandés par Grolier comprenaient la guerre de Sécession, la Seconde guerre mondiale et les voyages de Magellan autour du monde. J'ai collaboré à titre privé avec GeoSystems en qualité de conseiller et j'ai établi des spécifications pour la série. Dans ce document, j'expose certains des défis cartographiques rencontrés par Geo Systems dans la condensation de ces événements complexes en de brèves animations durant 4 à 5 minutes.

ACKNOWLEDGMENTS

REFERENCES

EDITOR'S NOTE

RESUMEN

SOMMAIRE



Proactive Graphics for Exploratory Visualization of Biogeographical Data

*Barbara P. Buttenfield and
Christopher R. Weber*

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Developments in software functionality afford new opportunities for cartographic visualization that improve capabilities for data exploration. By using proactive tools such as animation and hypermedia, users may browse database contents to view the organization of the data as well as the organization of the database. When visual tools are proactive, users initiate queries and steer data presentation in a manner consistent with the associative power of the human intellect. This paper argues for increased emphasis on proactivity in designing cartographic displays. A hypermedia implementation is presented for a biogeographical database. Software functions include animation and hypermedia for browsing data at multiple scales and times. Issues of graphical design and hypermedia navigation are emphasized.

EXPLORATORY VISUALIZATION

Traditionally, cartographic displays have been designed for illustration. Reference and navigational maps illustrate the geography of a place; thematic maps depict statistical measures or the results of modeling and analysis. Cartographic illustration fills an important niche in geography, which like many scientific disciplines, relies heavily upon observation and good description. It is equally important to consider analytical roles for graphics in geographical research, and several authors have argued convincingly that cartographic displays may be designed for analysis as well as for illustration (MacEachren 1994; Buttenfield 1993; MacEachren et al 1992; Buttenfield and Mackaness 1991; Buttenfield and Ganter 1990; MacEachren and Ganter 1990).

DiBiase (1990) identifies four areas in which maps contribute to a research process: presentation, exploration, confirmation, and synthesis. Notably, the final three areas are based in analytical roles. Exploration graphics provide visual means to search for patterns and trends that may or may not be anticipated. In confirmation, graphics may be applied to pose hypotheses and make deductions. Graphical tools for synthesis are used in support of inference and induction. MacEachren's (1994) monograph in environmental science exemplifies maps in each area.

GIS applications offer a broad context for analytical graphics. In GIS environments, where so much of the information stream is iconic, users can look at map displays but cannot use them to direct analytical tasks. They can change a map's appearance (its symbology or data classification, for example), but this is only a part of analysis. What is needed are GIS software functions that manipulate maps to manipulate the underlying data. These functions will empower users to steer spatial modeling, to perform cartometric analysis, to access on-line documentation, and to perform spatial query (Buttenfield 1993).

This paper focuses upon spatial query, which is a form of data exploration. Graphical displays can facilitate database exploration, relying upon the natural acuity of viewers to search for possibly contradictory patterns. In addition, graphical displays may guide database query design, providing visual means to identify either logical inconsistencies or barriers to information access. The biogeographical example presented below implements graphical tools to direct database query and proposes graphical tools to mediate database navigation.

As a form of visual thinking (DiBiase 1990; Arnheim 1971), the key to success in data exploration lies in the ability to manipulate information freely. For example, exploration of enumerated data can be accomplished by generating a series of choropleth maps, each with a slightly different classification scheme. Egbert and Slocum (1992) have implemented software tools for this type of data exploration. However, designing exploratory graphics requires a certain responsibility, of course, since it is well known that biases may be introduced in the packaging of any factual information. Visual presentation of spatial data is no exception. Viewers have perceptual and cognitive limitations that can be partially compensated for by utilizing good principles of cartographic design. The ideal spatial data exploration software should allow users to initiate data queries iconically and to steer data exploration in a manner consistent with the associative power of the human intellect.

This is not a new idea. In 1945, President Roosevelt's Science Advisor, Vannevar Bush, developed the concept of a *Memex*, a tool for linking any two items in a large collection of information. Bush (1945) stated that the human mind operates most efficiently by association and "logical leaps" (as opposed to exhaustive tracking along a single logical sequence). From a contemporary human factors perspective, software systems offering query by association are easier to learn and use than systems offering relational (Boolean) query (Lachman et al 1979; Smith and Weiss 1988).

Two aspects of user requirements must be recognized when developing software tools that rely upon association. First, there is the issue of information distribution. Sir Francis Bacon's maxim that "Knowledge is power" applies to GIS, as it does to any automated information management system. In an associative environment, the receiving of information (through a successful data query, e.g.) is likely to generate a demand for further information. Distribution is facilitated by many software tools (most notably data and image compression and graphical user interfaces [GUI]). However, advancements in software functionality increase the complexity of the software overall.

This raises the second aspect of user requirements: information access. Awareness that information is available is likely to increase the demand for that information. Database users expect that mechanics of information delivery remain transparent. Their interest is in studying the problem at hand not in having to grapple with the technology of access. There is an increasing number of GIS users, such as geologists, foresters, and urban planners, whose knowledge of spatial data is deep and whose interest in developing system expertise is shallow. Adoption of database query tools that rely on associative thinking and avoid steep learning curves will make spatial data accessible to these users and deliver a huge benefit to the scientific and lay public alike.

Developments in hardware and software engineering bring opportunities for the creation of tools supporting these requirements. Animation provides visual exploration of seriated data (Monmonier 1993) and applications for exploring temporal change abound in the literature (see for example the bibliography by Buttenfield et al 1991). Multimedia tools integrate multiple modes of presentation, including text, still graphics, animation, sonification, and video capture. Monmonier (1992) and MacDougall (1992) present excellent examples of how multimedia can be applied to spatial data exploration.

In a cognitive sense, multimedia expands the channels available to viewers for information processing. This can benefit data exploration in several ways. Offering multiple modes of presentation tends to increase user engagement with the working environment and often enhances user expectations (Scaletti and Craig 1991). Because human sensory systems

PROACTIVE GRAPHICS AND GIS

Adoption of database query tools that rely on associative thinking and avoid steep learning curves will make spatial data accessible . . . and deliver a huge benefit to the scientific and lay public alike.

Hypermedia extends multimedia by linking the multiple modes . . . effectively transforming the user's role from interactive graphics into what can be called "proactive graphics."

excel at specific types of tasks, dividing information among several sensory modalities may reduce the complexity of the overall message (Brown et al 1989). For example, the visual system has acuity for contrast, motion, and fine detail. The auditory system excels at detecting serial patterns and attending to tasks requiring only peripheral attention. This is why it is possible for a person to drive a car through rush hour traffic while attuned to a news story on the radio.

The drawback of simple multimedia is that viewers do not have choices about what they see next. Even with "hot buttons" and interactive menu selection, viewers are limited to an information stream that has been anticipated by system designers. For database query, this means that one can only find items that have been explicitly stored in the database. When contradictory patterns are uncovered, spatial and temporal inference may be impeded.

Hypermedia extends multimedia by linking the multiple modes transparently, permitting associative browsing and effectively transforming the user's role from interactive graphics into what can be called "proactive graphics." The term "proactive" is used here in its conventional sense of taking action before it is requested or mandated. Its connotation is assertive. The prefix "pro" is taken from the Greek *pro* meaning "prior" or "before." Interactive computing provides capabilities to respond to system dialog boxes and menus, although it is limited capabilities to take actions anticipated by system designers (e.g., opening and saving files in pre-determined formats, generating displays according to system graphic defaults). Proactive computing, also referred to "hyper-active" computing (Laurini and Thompson 1992), simulates a system responsive to commands and queries that may not have been anticipated by system designers (Buttenfield 1993).

Users of proactive systems move with apparent freedom between modes of presentation, choosing the mode best suited to the focus of their interests. For example, someone working with a biogeographical database may prefer to see a three dimensional terrain surface with cartographic symbols depicting annual and cumulative tree growth. Another user might prefer either a statistical view provided by frequency histogram or a tabulation of actual data values. Proactive database queries should allow toggling between these modes of presentation at any point in exploration. To date, GIS system designers have not incorporated proactive tools for database query, although iconic tools to change map appearance have become common.

Many current activities implementing proactive browsing tools are not reported in conventional publishing outlets but can be viewed simply by "surfing" the internet. Fully operational proactive systems incorporate a scripting language for users to define their own commands or navigational links. Examples of scripting languages include "html" (hypertext macro language) on WAIS and MOSAIC, which has limited graphical functions. The scripting language used for the hypermedia application described in this paper is called "Lingo," and forms part of the Macintosh-based package Macromedia DIRECTOR.

A HYPERMEDIA EXAMPLE:
RADIAL GROWTH IN
TREMBLING ASPENS

The example prototype¹ is based on Jelinski's (1987) dissertation research associating environmental constraints in the Waterton Lakes National Park with radial growth of trembling aspens. Trembling aspens reproduce asexually, and therefore, the clones are genetically identical, which

¹ The prototype for *Aspens* is available on floppy disk and through anonymous ftp (file name: aspens.sea.hqx. For information on obtaining a copy see the *Message from the Editor* (page 1).

makes them ideal candidates for biogeographical study. Jelinski was interested in the apparent contradiction that radial growth rates were higher where local environmental conditions (elevation, precipitation, and soils) were more harsh. His analysis was based on numerical modeling.

After Jelinski completed his work, the authors of the prototype created a hypermedia version of his database with the intent of revisiting the research problem from a perspective of exploring apparently contradictory patterns using software tools that were both iconic and proactive. Iconic tools were chosen to embed database navigation into a metaphor of map use. Users can pose queries of the form "Zoom into the map and show me the data for this particular study site" by clicking on a map symbol representing the study site. The query "Present a statistical summary of this site's data" is enabled by clicking on the study site label. Proactive tools were chosen on the premise that exploration would be most productive when the information stream could be manipulated freely. The authors felt that proactive graphical tools should improve distillation of contradictory patterns simply by improving access to all possible views on the database.

The data includes radial growth aggregated at two levels of resolution and collected for a forty year time period (1947-1986). Six study sites within the Park are identified at the coarse level of resolution, based upon differing environmental factors. At a finer level of resolution, each study site contains either five or six aspen clones. Two study sites lie on the prairie that is at the mouth of a sinuous valley, have a low annual precipitation (75 - 100 mm.), and soils composed of glacial outwash and debris. Two other sites are located four kilometers up the valley: one in alpine grassland and the other at a higher elevation near the treeline. A fifth site lies in the same valley three kilometers beyond, where precipitation is less arid (100 - 124 mm.). A sixth study site lies to the south in a different valley, where precipitation is high (124 - 155 mm.), soil is fertile, and local conditions would appear optimal for aspen growth. The contradiction is that, for the forty year period in question, radial growth is not maximized at this site but in the prairie sites, where conditions are more hostile.

The set of user requirements accounted for in designing the hypermedia document were straightforward enough to predict but somewhat complicated to implement. Users browsing the database want continual access to both graphical information and the geographic descriptions summarized above. Provision of the graphical information has to be flexible because it is difficult to predict a user's desire to view data as a table of numerical values, as a statistical chart, or in map form. Regardless of the presentation format, the level of resolution and the specific year must be clearly indicated. Temporal and spatial presentations have to remain stable, meaning that if a user changes the spatial resolution, the timeframe should not change.

Lastly, the hypermedia document needs to be designed in a dynamic rather than a static format. Two purposes are served by this. First, animation or a changing display lets users recognize a graphic that is at least active if not proactive. The sooner graphical activity is recognized, the more quickly data will be explored. Second, the purpose of the visual presentation format is to make the geographical contradiction apparent so that users do not have to dig it out haphazardly from the volume of data. The visual display is intended to put the question "Why do aspens grow more rigorously in hostile conditions?" on the table. It is not the purpose of the graphic to answer the question so much as to let the question drive the user's curiosity about information contained in the database. The

USER NEEDS FOR EXPLORING CONTRADICTIONARY PATTERNS

DESIGN AND IMPLEMENTATION

graphical impression guides database browsing. Since the contradiction becomes evident over time, a dynamic display format is the obvious choice for visual emphasis.

The document's graphical design is centered around an animation draped over fishnet terrain. In the animation, changing symbol size represents annual incremental growth, and symbol color (hue and saturation) represents cumulative growth for the forty year (1947-1986) period. Size progressions are scaled according to Flannery (1971); the eight-shade color progression ranges from saturated yellow (low cumulative growth) to low value green (high growth). The animation operates at two levels of resolution. At the coarse level, leaf symbols depict growth for the six study sites, and the terrain model covers the entire Waterton Lakes National Park (Figure 1 [top], page 17). Six different animations are available at the fine level (Figure 1 [bottom], page 17), showing growth for the five clones selected at each study site. The map symbol chosen for this level depicts a clump of trees to represent the forty aspens sampled in each clone. Marginalia include a bar graph showing all years of aspen growth, a map legend identifying color classes, a timeline cumulating growth patterns year by year, and an "Information/Help" button.

The implementation is a working prototype with full hypermedia functionality. As described above, the default view is cartographic. Alternatives for statistical graphics or numeric tabulation are available at any time. Instructions for changing the display are provided by clicking on the "Information/Help" button, as are text screens containing geographical descriptions of the Park and the study sites. Informational displays on trembling aspens include text, range maps for North America, and photographic images. Information about the authors is also available. The animation runs by default—the screen display remains dynamic even if the user takes no action. The animation can be paused, enabling users to freeze the animation to examine aspen growth for specific years. Iconic toggles are also available, allowing the user to change the zoom in to a finer level of resolution or to pan across to view a different study site.

Implementing scale changes on demand has proven to be the most intricate programming task to be solved. Users viewing data who toggle to the finer level of resolution will want the map scale to change but the time period to remain the same. One option is to store all possible timeframes (40) for all possible map views (six study site maps and one Park map) as 280 individual castmembers and write a Lingo script to direct which one should appear for the current year in display. This solution would entail very large storage requirements. The option that is implemented reads in growth values at the start and computes seven simultaneous views as the animation years go by. Regardless of what study site a user zooms to (or when) symbol size and color are available for the correct site in the correct year. All that really needs to be decided at the system level is which of seven sites (rather than which of 280 views) to display.

This design responds to user requirements stated above. Browsing and data queries are both iconic. The user can follow associative thinking and logical leaps to view maps, statistics, text or metadata, and in these respects, the prototype is proactive. It is not however, fully proactive, since it lacks a scripting language for viewers to develop their own links and command structures. In order to implement these types of proactive functions, users will need to have access to existing navigational paths. Here too, graphical tools can contribute to proactivity.

Implementing scale changes on demand has proven to be the most intricate programming task to be solved.

Graphical tools can be used to examine or explore the structure of the hypermedia document itself, as well as reinforcing the spatial metaphor (Tilton and Andrews 1994). A map displaying existing hypermedia links provides users an exposition of the authored relationships and database paths they may travel. It provides system designers with a visual display of the document's navigational structure during development and contributes to system debugging or expansion. The objective to achieve in a proactive environment is to meet the objective that all displays appear to lead to other displays. System designers rely on users' natural curiosity to see what lies behind the panel.

At the extreme, hypermedia systems can be designed such that every item on the screen is "hot": no matter where a user clicks, a navigational link is enabled. Some commercial hypermedia products (for example, Microsoft Corporation's encyclopedic atlas *Encarta*) are designed this way. Other products, such as Borland's *Just Grandma and Me* offer screens where discrete items are "hot." The Aspens prototype is implemented with discrete navigational links. Users quickly figure out that where navigational links exist; they are most often attached to green objects or green text items.

Figure 2 (page 18) shows a navigational map of the current version of the Aspens prototype. In the Figure, the bar graph icons represent timelines that appear in all map views. The conic section icons represent map legends appearing in all map views. Icons depicting pages of text, photographic images, and maps identify screens of analogous content. Lines between icons identify working navigational links.

At present, this navigational map is not available in the prototype, although versions of it have been used during design and implementation, if only to keep track of what has been implemented to date. Users at present have neither a comprehensive idea of the extent of the database they may query nor an idea of where icon links might take them. Many users do not realize at first that items in the display are "hot" because their appearance differs from the radio buttons and checkboxes customary in other multimedia and hypermedia displays. However, it takes only a brief demonstration to alert users to the rich fabric of navigational links underlying any hypermedia document. Very quickly, users are clicking on anything and everything to identify "hot" items embedded in the graphical display. Making the navigational map available at any point in the prototype could serve users who become disoriented.

Presentation of the navigational map could serve a more proactive role. While providing information about the organization of the prototype (and by implication, of the database), the graphic itself could provide an active mechanism for improving database query and access. Benoit Mandelbrot (1994) was recently quoted as saying, "Pictures are very helpful in understanding complicated phenomena by finding out how simple components get organized. You look at something and understand where to look next." If the purpose of a graphic is to identify where to explore next, why not embed that graphic with software tools to go there and explore it? It's more than a rhetorical question, and programming tools currently exist to address the issue. Moreover, cartographers are ideally suited to generate such tools, given the strong disciplinary tradition attending to graphical design and communication.

One can envision many applications for generating a proactive version of a navigational map. For example, many screens in the current prototype are "dead ends" in the sense that the only available navigational path retraces the previous link. Again, this is identifiable to users, since the cursor changes shape on these screens and starts to blink. For example,

NAVIGATIONAL LINKS

While providing information about the organization of the prototype (and by implication, of the database), the graphic itself could provide an active mechanism for improving database query and access.

the numeric tabulation screens are currently dead ends. If accessed from the Park map, one can only return to the Park map. One can imagine a user who wants to set up a link to jump from the numeric table listing data for each study site to a map of one of the sites. A proactive navigational display might include graphical functions on a proactive navigational map such that the link is established simply by dragging a line from the table icon over to the study site map icon.

Another proactive application for a navigational map would reflect the frequency with which particular navigational links are traveled by perhaps scaling the width of links according to the number of times each has been accessed. For efficiency, links that are not used could be eliminated to tailor the document to a particular class of users. Alternatively, specific paths could be rendered inactive by recoloring or "graying out" links. This might be beneficial for securing access when portions of the database undergo revision or update, without shutting down access to the entire database. The recoloring would also alert users who view the navigational map that a database upgrade is in progress.

SUMMARY

This paper argues for integrating proactivity into graphical displays to assist with database query and the exploration of contradictory patterns. Proactive graphics permit spatial tasks to be accomplished iconically and provide a means for users to focus upon the substance of their research instead of having to attend to system commands. The natural curiosity of users to find out what lies over the next hill can be exploited successfully in designing proactive database query tools that rely on associative intellectual skills. Embedding such tools seamlessly into graphical displays allows direct manipulation of information, which is a comfortable type of interface metaphor for most users.

A working prototype of radial growth in aspens demonstrates that proactive tools are amenable to data exploration. However, many obvious hypermedia links are missing. Users have suggested incorporating photographs of the study sites, capabilities for rotating the terrain surfaces, reversing the animation, and (most commonly) the ability to jump to a specific year in the animation. The prototype also lacks functions to extract data, maps or text information and save it to a file, even though these items are stored and accessible. For these reasons, it is referred to as a working prototype, as opposed to a full-blown proactive database query system.

The aspens prototype is presented to strengthen the argument that graphics can be utilized for analysis as well as for illustration. Here, the analysis is exploratory, and the graphic display provides a clear indication of the contradiction between environmental conditions and radial aspen growth. Iconic tools facilitate exploration because users can manipulate the form in which data is accessed from the database. These tools are proactive in the sense that users make their own choices about what parts of the database they will browse next. Further, database browsing is accomplished by map browsing—direct manipulation of the icon representing the item of interest. While it is true that the item on the map is not the same as the feature it represents, querying the map item becomes a direct metaphor for querying the database.

One can extend the metaphor to other types of analytical tasks, where proactive tools could be designed to steer computations or perform cartometric analysis or locational modeling. Incorporating proactivity would in every case provide a metaphor where changing the information display would change the state of the system, of the model, of the database, or of its access paths. This approach moves software tools for

geographical analysis beyond designing a transparent interface. It proposes throwing the interface away. The idea may seem radical and, indeed, is fraught with questions about who takes responsibility for preserving data versions and who protects users from themselves. These are important issues that must be addressed.

Integration of proactive tools is likely to improve the insights that can be gained from the incredible volumes of digital geographical data that continue to become available. And, it is likely that direct manipulation tools and metaphors will become conventional in information systems software simply because the direct manipulation metaphor is so seamless to users. It is completely natural to adapt to direct manipulation interfaces once they are recognized. Weiser (1991) comments that what is at first novel becomes commonplace when it becomes invisible. For example, no one consciously reads a street sign or the floor indicator on an elevator. "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it" (Weiser 1991, 94). Cartographic emphasis on designing visual displays that maximize effective communication can lend major insights into the design, implementation, and evaluation of proactive software tools. Here is a scientific niche just waiting to be filled.

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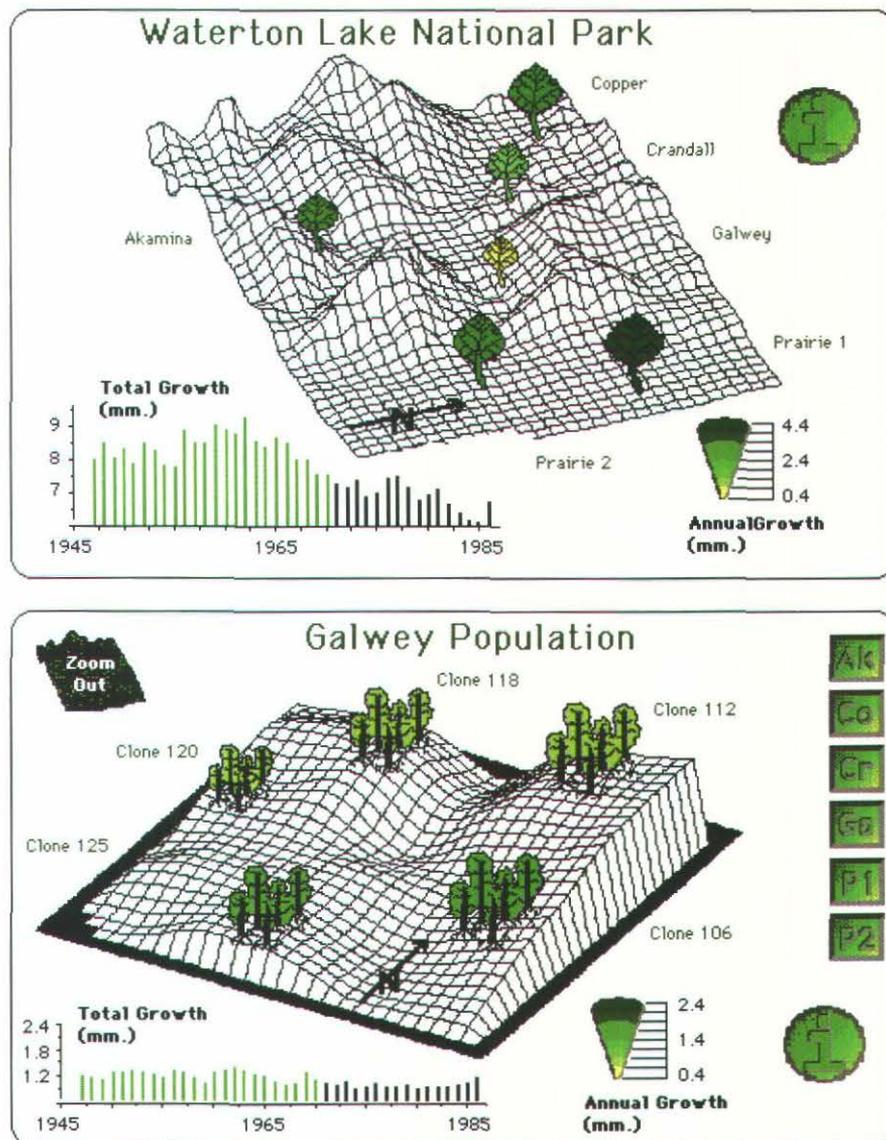


Figure 1. Two sample screens from the aspens prototype. Upper image shows coarse resolution view, lower image shows one of six finer resolution views, for Galwey study site. Items appear in their approximate locations. Green items provide navigational links to other parts of the database.

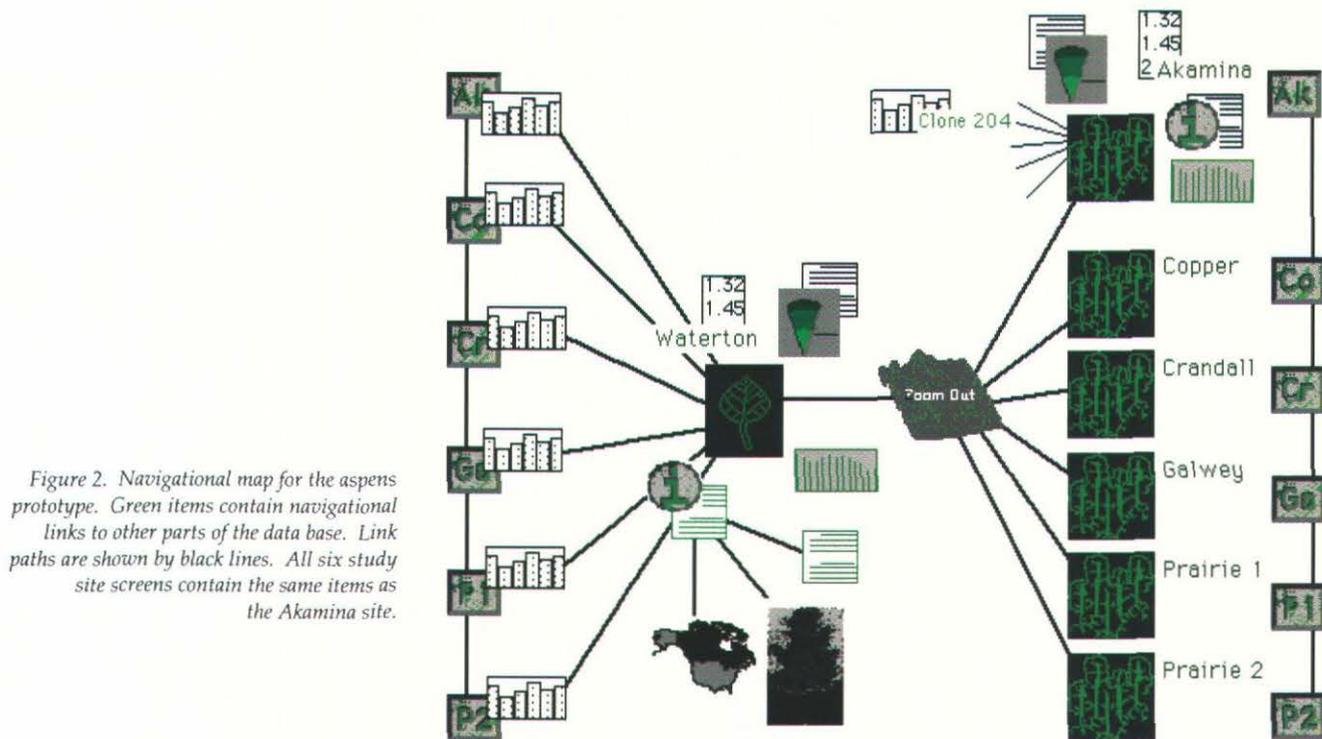


Figure 2. Navigational map for the aspens prototype. Green items contain navigational links to other parts of the data base. Link paths are shown by black lines. All six study site screens contain the same items as the Akamina site.

RESUMEN

Los avances en la funcionalidad del software ofrecen nuevas oportunidades para la visualización de la cartografía, lo que permite mejorar la exploración de datos. Por medio de herramientas proactivas, tales como: animación e hipertexto, los usuarios pueden ver la información sobre los datos, como también la organización de los mismos. Cuando las herramientas visuales son proactivas, los usuarios pueden preguntar y manejar la presentación de datos de manera consistente con el poder asociativo del intelecto humano. Este compendio enfatiza la necesidad de incrementar proactividad en los diseños cartográficos. También se presenta la implementación hipertexto para información de datos biogeográficos. Las funciones del software incluyen animación e hipertexto para la búsqueda de datos en tiempos y escalas diferentes.

SOMMAIRE

De nouveaux développements des fonctionnalités logicielles offrent à la visualisation cartographique de nouvelles opportunités qui améliorent les possibilités d'exploration des données. Grâce à des outils interactifs tels que l'animation et les hypermédias, les utilisateurs peuvent naviguer à travers une base de données pour observer l'organisation des données et celle de leur base. Lorsque les outils visuels sont interactifs, les utilisateurs entament l'interrogation et dirigent la présentation des données d'une manière qui convient au pouvoir associatif de l'intellect humain. Ce document plaide pour une emphase accrue sur l'interactivité dans la conception des expositions cartographiques. Une exécution hypermédiatique est présentée pour une base de données biogéographiques. Les fonctions logicielles incluent l'animation et les hypermédias pour passer en revue les données à des échelles et des heures multiples. Les questions traitant de la conception graphique et de la navigation hypermédiatique sont soulignées. □

The Armchair Traveler Plugs In: Multimedia Cartography as a Visual Supplement to Travel Writing

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Travel writings, such as Stuart Stevens's West African adventure, *Malaria Dreams*, provide readers with interesting and entertaining stories. However, because they seldom give adequate treatment to the geographic, historic, cultural, and political issues, they leave the reader with an incomplete impression of the landscape. The accounts of these journeys can benefit from an interactive "visual supplement" that contains animations, maps, photos, drawings, graphs, and sounds. A visual supplement can complement the text and augment a reader's overall experience. This paper presents some issues pertinent to creating effective visual supplements and includes examples from a prototype for *Malaria Dreams*.

INTRODUCTION

Travel writing, once a genre preoccupied with detailed, factual descriptions, has recently acquired a lighter tone. The disturbing, complex journeys of contemporary Lévi-Strausses and Conrads languish on shelves in favor of accounts that transform faraway locales and peoples into the settings and casts for exotic comedies of errors. These books are often light in substance as well as tone. The authors recognize that readers with a sporadic yen for the unfamiliar might be troubled by facts and concepts, and so they simply omit subjects that fail to entertain.

Literary lightness also makes it easy to omit maps, photographs, and diagrams. Although the omissions are not a problem for editors who view travel books as pure escapism, they can be troubling for those readers whose interest is piqued by the unfamiliar facts, statistics, dates, names, and locations that many current authors seem to gloss over or toss aside. These omissions are a prime reason why a travel book often needs the enrichment of a visual supplement—an interactive, multimedia, animated "knowledgebase,"¹ rich in background details that increase the content and dimensionality of the book.

Malaria Dreams by Stuart Stevens (1989), though thoroughly entertaining, is a perfect example of a travel account in need of a visual supplement. It narrates the adventures of two professedly unprepared and misinformed Americans who careen across Africa in a ramshackle Land Cruiser. The protagonists, Stuart and Ann, tour six African countries—the Central African Republic, Cameroon, Chad, Niger, Mali, and Algeria—beginning in the tropics, crossing the Sahara Desert, and ending up on the shores of the Mediterranean. Despite the vast area covered, the reader learns less about West Africa's lands, peoples, topographies, climates, and cultures than about how well Stuart and Ann confronted and surmounted various difficulties.

Fortunately, as "travel-lite" books such as *Malaria Dreams* are rising in popularity, accessible multimedia authoring programs are becoming

¹ Abbe Don (1990) describes a knowledgebase as a hypermedia database from which the user retrieves blocks of multimedia information, such as individual graphics, text passages, animated sequences, and musical excerpts.

increasingly available. These programs (such as Macromedia DIRECTOR) are useful in creating visual supplements to travel books or other geographical texts. While the creation of interactive multimedia presentations was previously only open to those with computer programming skills, DIRECTOR and similar packages allow non-programmers to become multimedia authors and encourage talented graphic designers, animators, educators, authors, and cartographers to create their own programs directly.

This new technology opens the door to the possibility of generating much needed visual supplements to the recent form that travel literature has taken. With this hypothesis in mind, I decided to attempt to employ this new technology to create a visual supplement for Stevens's *Malaria Dreams*. The objective in creating a visual supplement to *Malaria Dreams* was not to produce a comprehensive, encyclopedic knowledgebase. Neither the time nor the resources were available to do so. Instead, an "operational prototype" was created (Des Roches 1994) in order to explore the design challenges and usefulness of visual supplements. The prototype is a scaled-down yet fully functional example of a visual supplement's effectiveness. A selectively representative operational prototype is similar in quality or concept to a marketable visual supplement and affords an efficient demonstration of how the re-telling, restructuring, and re-formatting of a recent travel book can enrich the reader's overall experience.

Construction of the visual supplement was carried out in two stages. The first step, and by far the most time-consuming, was the collection and creation of raw material needed for the program. This included researching, compiling, scanning, modifying, creating, and designing maps, photographs, music, and statistics. However, this very process and the fact that the user does not have to go through it her/himself are what make visual supplements so appealing. Although the average reader wants to know more about subjects in the book, s/he is probably not willing to research the material for months on end. In the grand tradition of Britain's Domesday Project (Openshaw and Mounsey 1987), *Malaria Dreams*'s visual supplement serves as an organized collection of geographic and spatial information. This information is available in multiple formats and, most importantly, in a single package.

The second stage in creating the visual supplement was the construction of the interactive program. For this task, the multimedia and animation package Macromedia DIRECTOR was chosen because it allows virtually any digitizable media to be incorporated into a presentation, its software is flexible, and its range of multimedia and animation functions are extensive. Although not usually mastered in a single sitting, DIRECTOR is far more user-friendly than most comparably complex software (see Macromedia DIRECTOR 4.0 review for the Macintosh on pages 42-43 in this issue).

The basic structure of the program was simple and patterned after Monmonier's (1993) "navigation" and "narration" concepts for creating dynamic cartographic programs in which the user can either "navigate" through various interactive, interlinked map interfaces² or initiate a "narrative sequence" (a non-interactive play-through). The visual supplement combines these two approaches in a hierarchical, hypermedia

CONSTRUCTION OF THE SUPPLEMENT

² An interface is any interactive computer screen within a program. It usually contains buttons or similar elements which, when activated, perform a function. Interfaces can also be keyboard-command oriented in which case the user must type in a command to activate a function.

CONSIDERATIONS IN PROTOTYPE DEVELOPMENT

In order to achieve the greatest effectiveness, multimedia information must be visualized through a clear, accessible, engaging interface.

format—what Monmonier and Gluck (1994) call an “open script.” In this approach, users choose individual narrative sequences, which, when completed, will either return users to the previous interface or allow them to choose another sequence. The supplement is interactive throughout; users can return to any previous interface, stop, or pause in the program at any time. The prototype is illustrated in Figures 1-4 (pages 38-39) with a series of representative snapshots and written descriptions.³

A major concern for any multimedia application is the memory requirements of the program. A complete visual supplement to *Malaria Dreams* (including color photographs and video clips) would require most, if not all, of the 660 MB of memory available on a CD-ROM. As CD-ROM drives are still not as common as floppy disk drives, a compressed prototype supplement was created to fit on a 1.5 megabyte floppy disk. This limitation severely restricted the incorporation of sounds, complex color images, and three-dimensional terrain representations because their memory needs dramatically exceeded those of simpler multimedia elements. Consequently, only a few examples of these complex features were included in the operational prototype. Their effectiveness in enhancing the overall program was amply demonstrated, but most disk space was allotted to less memory-intensive features.

Another problem encountered is the computer screen itself. The stage (or “playing area”) was formatted for Macromedia DIRECTOR’s smallest default screen setting (nine inches) in order to make the program compatible with as many Macintoshes as possible. This tiny workspace, coupled with a current standard screen resolution of 75 dots per inch compels cartographic generalization, and detailed maps become both impractical and annoying. However, the program’s multimedia nature makes detailed maps unnecessary because the animated overlays and transformations (Figure 5, pages 38-39) allow even the simplest map’s information content to transcend the spatial limitations imposed by screen resolution and size.

In order to achieve the greatest effectiveness, multimedia information must be visualized through a clear, accessible, engaging interface. A large repository of graphic information is of no use to a reader who finds using it tedious or confusing. An intuitive and engaging multimedia interface that provides both clarity and accessibility will appeal to the user both aesthetically and logically. This is achieved by continually giving the user context and by providing continuity. The main way to orient and guide users is through intelligent interface design. Maps are the logical choices for the interfaces in this program, as the subject matter is geographic in nature (Lindholm and Sarjakoski 1993). These interfaces must be easy to comprehend and use. It is essential, for instance, that users navigating around the supplement be continually aware of where they are. To prevent users from becoming baffled and disoriented, all buttons leading back to the map interfaces from interfaces or sequences further down in this hierarchical structure are miniatures of the maps in these interfaces (Figure 6, pages 38-39).

One of the most appealing (although memory-intensive) ways to provide context for multimedia presentations is through sound. For example, in the supplement created for *Malaria Dreams*, sound is used to provide context during the introductory sequence: traditional music from

³ The prototype for *Malaria Dreams* is available on floppy disk and through anonymous ftp (file name: malaria_dreams.sea.hqx). For information on obtaining a copy see the *Message from the Editor* (page 1).

the Central African Republic (where Stuart and Ann spent the first third of their journey) sets the stage and underscores the African milieu. If used extensively throughout the program, sound would further enhance and contextualize the reader's experience. A "voice-over" could be used with animated maps, decreasing the need for explanatory text⁴ and allowing both the author and the viewer to concentrate on graphic elements. Sound could also provide the proper pronunciation and accent of native place names and other unfamiliar words.

Continuity in the use of text is also essential. While voice-overs are useful in accomplishing this purpose, they are also memory-intensive. As an alternative (the one used for *Malaria Dreams*), a "running verbal commentary" accompanying the graphics is also effective (Monmonier 1992). The "commentary" for *Malaria Dreams* is strictly textual and accompanies almost every sequence. It describes the action on stage in relation to the relevant section or passage in the book. This link to the printed version of *Malaria Dreams* is reinforced by spelling place names in the same way as the text does. Though often subtle, spelling makes a statement about the author's point of view; spellings are often contested, and choosing one version of a word over another may privilege a certain perspective. Though the supplement author's sympathies might lie elsewhere, using the literary author's spellings in the visual supplement keeps the continuity of the program intact.

Continuity and context are also maintained through growing maps that zoom in on or enlarge a portion of a map (Figure 7, pages 38-39). Ruggles (1987) considers "growing maps" one of the most effective ways to provide continuity, for they avoid disorienting the user by providing a common point of reference. Again, the user is guided through the program and is not allowed to become lost.

Photographs probably provide the strongest visual context since they can convey the information from several lines of text in a single image. However, since these are static entities, care must be taken to avoid using too many photographs and thereby degrading the overall dynamism of the experience by creating a slide-show presentation. There was never much danger of this abuse in the operational prototype for *Malaria Dreams* because even simple black-and-white photographs consumed appalling amounts of memory.

Both context and continuity can be endangered by the dynamic cartographer's fascination with elaborate graphical sequences such as terrain flybys. These sequences should be avoided unless they are carefully designed and contain sufficient points of reference. For example, in the supplement to *Malaria Dreams*, while the most elaborate sequence (a three-dimensional topographic rotation) has the terrain of West Africa transforming from a cross-sectional to an oblique view to demonstrate variations in topography (Figure 8, pages 38-39), it also displays the locations of familiar cities to reacquaint the viewer with the landscape. As recommended by Campbell and Egbert (1990), an attempt has been made to balance each sequence's information content with its graphic integrity. With flybys, it is important to remember that, although they can be impressive, if they are poorly conceived or sloppily executed, they can disorient users who are not yet familiar with the landscape being represented.

Though the supplement author's sympathies might lie elsewhere, using the literary author's spellings in the visual supplement keeps the continuity of the program intact.

⁴ In the interests of the hearing-impaired user, explanatory text should never be completely supplanted by the voice-over.

Though not primarily used for context or continuity, visual and sonic cues such as color changes, flashes, and beeps help keep the user engaged. These cues can be combined if a single one is deemed insufficient to grab the user's attention. In the *Malaria Dreams* program, for instance, sound announces a change between maps or graphs in cases where movement might be too subtle or in cases where there is no movement per se, but there is color alternation among objects (such as changing emphasis from one country to another). Although these color changes are usually dramatic enough to register on their own, it has been suggested that color generally is not as effective a signal as movement (Dorling 1992). The viewer is sure to acknowledge the changes on the screen if each color transition is accompanied by an attention-getting beep. Superimposing multiple indicators of change can then make up for elements that individually are not effective signals.

A final consideration in constructing a reasonably informative visual supplement is the "politics of information" described by Abbe Don (1990). Just as the cartographically naïve are prey to every Mercator-based map they encounter, some users of knowledgebases tend to believe that "information presented or generated by computers is true, objective, and comprehensive" (Don 1990). Although the operational prototype discussed here is inherently incomplete, readers who perceive a full commercial supplement as broadly encyclopedic are vulnerable to the program author's agendas or biases. Whether covert, overt, or completely unintentional, this manipulation of information is inevitable. No one supplement (or supplement author) can possibly include every piece of information related to a given book. Someone, somehow, must decide what is to be included and what will be left out. It is important to note that the multimedia author's decisions about links and interactivity affect the textual content as much as anything else.

CONCLUSIONS

Although this paper is but a skeletal treatment of the issues involved in creating a visual supplement to a travel text, the "operational prototype" admirably performs its role as a visual supplement to *Malaria Dreams*. The feedback it has received from people of varying backgrounds (cartographers, human geographers, and Afrologists—some of whom have actually read the book) has been very positive. Their suggestions have also been crucial in fine-tuning the program's clarity and accessibility.

Visual supplements can address a growing need. As readers become increasingly aware of multimedia and its capabilities, they will begin to demand books with multimedia components. The demand will probably not be limited to travel accounts; indeed, any book with a geographic orientation is fair game for supplementation by multimedia and dynamic cartographers. This may even result in writers who find their popularity waning if they refuse to join the ranks of the interactively supplemented.

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EDITOR'S NOTE

La aventura del oeste de Africa de Stuart Stevens, "Malaria Dreams", ofrece al lector historias interesantes y divertidas. Sin embargo, no presenta un tratamiento adecuado de la geografía, la historia, la cultura y los asuntos políticos, dejando al lector con una visión incompleta del panorama. Los relatos de estos viajes se benefician de un "suplemento visual" interactivo que contiene animación, mapas, fotos, dibujos, gráficos y sonidos. Un suplemento visual puede complementar el texto e incrementar la experiencia del lector. Este trabajo presenta algunos asuntos pertinentes a la creación de suplementos visuales efectivos e incluye ejemplos del prototipo de "Malaria Dreams."

RESUMEN

Les écrits de voyage, tels que *Malaria Dreams*, l'aventure ouest-africaine de Stuart Steven, offrent aux lecteurs des histoires intéressantes et distrayantes. Pourtant, et parce qu'ils portent généralement peu d'intérêt aux questions géographiques, historiques, culturelles et politiques, ils laissent au lecteur une impression incomplète du pays. Les rapports de voyages pourraient profiter d'un "supplément visuel" interactif comprenant animations, cartes, photos, schémas, graphiques et sons. Un supplément visuel peut renforcer le texte et rehausser l'expérience totale du lecteur. Ce document présente quelques questions pertinentes à la création d'un supplément visuel efficace et inclut des exemples d'un prototype pour *Malaria Dreams*. □

SOMMAIRE

Using High-Resolution Digital Scans in Multimedia Cartographic Applications

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Since June of 1993, the Geography Department at the University of Wisconsin-Milwaukee has been engaged in a research project to develop the *Archive of Native American Maps on CD-ROM*. A major component of this project involves the creation of high-resolution scans of the maps in the archive. This paper discusses several issues encountered in the acquisition, manipulation and display of these scanned images. The issues include scanning resolution, file compression, palette shifts, and image tiling.

INTRODUCTION

The Geography Department at the University of Wisconsin-Milwaukee has been engaged in a research project funded by the National Endowment for the Humanities Reference Materials/Tools Division to create an archive of Native American maps on CD-ROM. A large part of the project, which is more fully described in Sona Andrews's paper (pages 31-36), involves the creation of high-resolution digital scans from 35mm slides of the maps that are being assembled for the archive. This paper discusses several issues encountered in the acquisition, manipulation, and display of these scanned images. The issues include scanning resolution, file compression, palette shifts, and image tiling.

SCANNING RESOLUTION

One of the primary goals of the archive is to provide researchers with extremely high-quality images at a resolution that achieves at least a thirty times magnification of a 35mm slide when viewed on a standard computer monitor. The first step in assessing the scanning technologies available for

creating these images was to establish the resolutions that would be necessary to obtain the desired magnifications.

Digital scanning technologies replicate images by creating bit map, or raster, files in which the information used to recreate the images is stored in a table of rows and columns (see Figure 1). When the image is displayed on a computer monitor, the computer translates the table cells into picture elements (pixels for short). The bit value for each cell determines the color of that pixel. For example, for a black and white image, a cell with a value of 0 will produce a white pixel, a cell with a value of 1 will produce a black pixel. The density of the table cells, or pixels, establishes the resolution of the image,

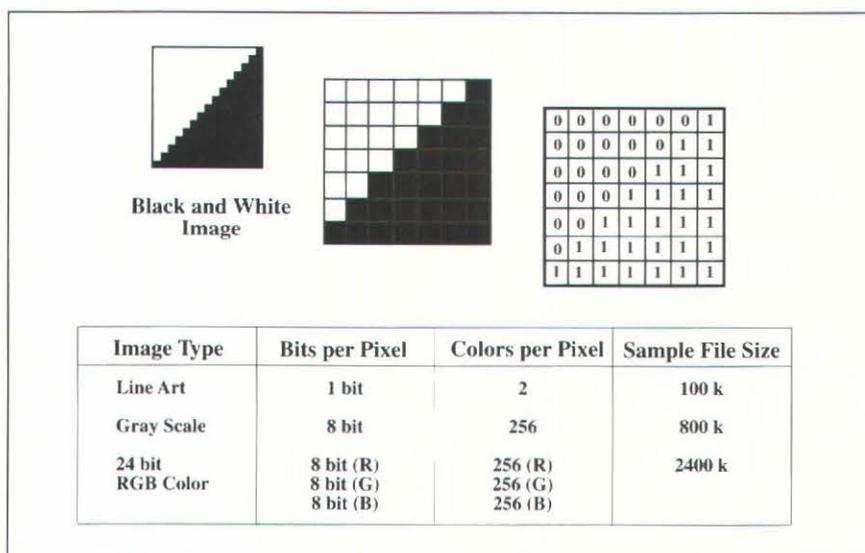


Figure 1. Bit-map files store the information used to recreate images in a table of rows and columns. When the image is displayed on a computer monitor, the computer translates the table cells into picture elements (pixels for short). The bit value for each cell determines the color of that pixel; the number of bits per pixel determines the file size and resolution of the image.

which in turn determines how sharp the image will be when it is displayed. Most computer monitors are about 13" along the diagonal and have a grid of pixels 640 wide by 480 high for a resolution of approximately 72 pixels per inch (ppi). File sizes for gray-scale or color images are larger because more information per pixel is needed. For example, gray-scale images require 8 bits of information per pixel, whereas photo realistic color requires 24 bits of information per pixel.

For multimedia, images are generally scanned at low resolutions so that the full image can be displayed at sizes up to 640 x 480 at 72 ppi (full screen on a standard computer monitor). This is considerably less than the resolutions needed for the archive. However, at the time that we began trying to determine the resolutions we needed, the only formulas available for high-resolution scans were those used for printed output.

The standard formula for determining the appropriate scanning resolution for a printed image is: take the halftone lines per inch and multiply them by two times the scaling of the image. For example, to print a 35 mm slide at eight by ten inches with a halftone screen of 150 lines per inch; you would scan the slide at 2175 ppi ($150 \times 2 \times 7.25 = 2175$ ppi). With this formula, an increase in scanning resolution will result in the printed output having either an increased density of the printing dots within the same area or a larger printed area. However, when scanning for output to a monitor, the only variable that can change is the size of the image since the resolution of the monitor remains constant. Consequently, the formula can be simplified considerably—the resolution of the monitor is multiplied by the amount of the desired enlargement. For example, for a 30 times magnification of a 35mm slide, you would scan the slide at 2160 ppi ($72 \times 30 = 2160$ ppi).

With this formula in hand, we were in a position to evaluate and test the available scanning technologies—two of which are mentioned here. One that seemed promising at first was Kodak's Photo CD. With Photo CD, the slides are scanned at a reasonable cost (\$2.00-\$5.00 a slide) and returned at five different resolutions on a CD-ROM (see Figure 2 below). While Photo CD looks promising for many applications, its highest resolution is only capable of producing a magnification slightly over the minimum we were hoping to achieve, and after running a number of tests, we decided that this wasn't quite high enough for many of the detailed maps in the archive. As a result, a Nikon LS 3510-AF slide scanner that could achieve magnifications of slightly over 44 times was purchased. Figure 2 compares the five resolutions of Photo CD with the resolution produced by the Nikon scanner. Figure 3 (page 37) compares a portion of a map, scanned at the highest Photo CD resolution, with the same area scanned on the Nikon.

One of the design criterion for the archive stipulated that it should be able to be used on a standard multimedia computer system. However, presenting high-quality images at the resolutions used in the Archive raised a number of issues for meeting this criterion. One issue was that some form of image compression would be needed so that all 400 or so images could fit on one CD-ROM. The second concerned whether the images would be viewed in 8 bit,

For multimedia, images are generally scanned at low resolutions so that the full image can be displayed at sizes up to 640 x 480 at 72 ppi (full screen on a standard computer monitor).

System	Image Size (in pixels)	Image Size (in bytes)	Enlargement
Kodak Photo CD	192 x 128	72 K	1.9 x
	384 x 256	288 K	3.9 x
	768 x 512	1.1 MB	7.8 x
	1536 x 1024	4.5 MB	15.5 x
	3072 x 2048	18.0 MB	31.0 x
Nikon LS- 3510-AF	4257 x 2881	35.1 MB	44.1 x

Figure 2. Comparison of the five 35mm scan resolutions from Kodak's Photo CD process with the maximum resolution for a 35mm slide from a Nikon LS-3510AF transparency scanner.

16 bit, or 24 bit color. A third issue was that some form of memory management system would be needed so that the images could be viewed from within the archive application.

COMPRESSION

Compression algorithms fall into two general categories: lossless and lossy. Ones that are lossless retain all information from the original file but store it more efficiently by eliminating duplications in the pixel information (i.e. they create a more efficient table structure). The original file can be replicated exactly without any loss to image quality, and changes made to a decompressed file can be saved and compressed again without degrading the image. The drawback is that only moderate savings in file size can be achieved. Lossy compression algorithms, on the other hand, can compress files by ratios as high as 100 to 1. However, they achieve these ratios by throwing away information from the original file that is perceptually less critical. This means that, although a decompressed file is visually similar to the original, it is not identical. Consequently, once a file is compressed, it can be decompressed and viewed, but it cannot be edited and resaved without incurring generational image quality loss.

Figure 4 shows the effect of moderate and high JPEG compression applied to one of the images from the archive. JPEG is a standard established by the Joint Photographic Experts Group for developing lossy compression algorithms. The image on the left is not compressed, the image in the middle has been compressed moderately, and the image on the right has been subjected to high compression. The severe pixelization that appears in the image on the right results from compression artifacts that are indicative of high JPEG compression. We have found that, with the maps in the archive, we can consistently achieve a compression ratio of about 30 to 1 without noticeable image quality degradation. This ratio allows all of the images to fit onto one CD-ROM and still have space to accommodate the text database and application.

One drawback to the use of image compression is that the time needed to decompress the images as they are called into the archive program can result in sluggish performance. In order to speed this process, we employ a software decompression accelerator that reduces decompression times by a factor of five. This essentially allows the images to be decompressed and read into the program as quickly as the CD-ROM drive can read the data.

COLOR BIT DEPTH

The color bit depth at which the images in the archive are displayed has a tremendous impact on image quality. Systems that use 24 bits draw from a palette of millions of colors to display an image, while 16 bit systems draw from a palette of thousands of colors. However, 8 bit systems draw from a palette of only 256 colors, and in the process of reducing the thousands or millions of colors used to display an image down to a standardized palette of 256, image quality is substantially degraded.¹ When viewed in 8 bit color, the usefulness of many of the images, especially the detailed low-contrast images that make up a substantial portion of the archive, was considerably reduced.

This raised the dilemma of trying to maintain image quality but still making the archive accessible to a wide range of users. Although 16 bit

¹ By using customized palettes that select the best 256 colors to represent an image, 8 bit color can be significantly improved. However, this substantially reduces the amount of compression that can be achieved.

color is quickly becoming a display standard for multimedia computer systems, we had hoped to make the archive available for use on 8 bit systems as well. Initially, we had envisioned creating the images in 24 bit color and using the same images in 16 bit and 8 bit systems. This strategy works beautifully for 16 bit systems, but not for 8 bit systems. In Macromedia DIRECTOR, 24 bit images viewed in 8 bit color undergo a noticeable palette shift which further degrades the image (see Figure 5, page 37). This palette shift occurs as the result of two non-related conditions. First, Macromedia DIRECTOR, the authoring software being used, requires that the application be created to run in either 24 bit or 8 bit color. If a 24 bit application is run in 8 bit, it results in the palette shift. This can be resolved by creating a separate 8 bit version of the archive. However, the second condition complicates this solution. The decompression accelerator used in the archive creates the same palette shift when 24 bit images are displayed on an 8 bit system. Consequently, it would require the creation of a separate non-accelerated version of the archive in order for it to be viewed on 8 bit systems. Given that many of the images are of questionable value when viewed in 8 bits, it was decided that the only version of the archive that would be distributed at this time would be for 16 bit and 24 bit systems.

Another issue encountered in working with image file sizes as large as those in the archive is that the computer must have enough RAM (random access memory) available to store the entire image while it is being viewed. Images of the size included in the archive would require a computer with over 30 MB of RAM—a level well above the five to six megabytes found in standard multimedia computer systems. Most image processing programs such as Adobe PHOTOSHOP or DEBABELIZER overcome this problem by using virtual memory that allows the program to use part of the hard drive as if it were RAM. However, multimedia authoring programs such as DIRECTOR generally do not have virtual memory capabilities, and consequently, alternative methods for presenting these large images in systems that have about five or six megabytes of RAM needed to be developed. After investigating several different options, a strategy in which the images are systematically cut into 320 x 240 pixel (1/4 screen) tiles was adopted.² Controls are provided in the archive that allow users to scroll through the tiles as if they were panning around the entire image. Each tile is only about 225 kilobytes in size and no more than four tiles (one screen's worth) are presented at any one time. As a result, less than one megabyte RAM is dedicated to displaying the tiles, and the entire archive application can run on a system with about 4 MB of free RAM.

High-resolution scans increase the complexity of multimedia development considerably, and the issues discussed briefly in this paper have taken us months of testing and research to determine. For centuries, cartographers have found themselves in a position of shaping new technologies to accommodate large, detailed graphics, and multimedia is proving to be no exception. As an industry, multimedia has, with rare exception, accepted the size of the monitor as the limit of its design space. However, as cartographers, we find ourselves having to push that limit in order to accommodate the special needs of presenting maps.

In Macromedia DIRECTOR, 24 bit images viewed in 8 bit color undergo a noticeable palette shift which further degrades the image.

CONCLUSION

² The archive prototype that is available through anonymous ftp (file name archive.sea.hqx.) uses a tiling system that was developed in the early stages of the project. Instead of 1/4 screen tiles that provide a 50% visual overlap, the prototype uses full screen tiles that incorporate only about a 25 to 20% visual overlap. For information on obtaining a copy see the *Message from the Editor* (page 1).

ACKNOWLEDGMENTS

The *Archive of Native American Map on CD-ROM* is solely funded by a National Endowment for the Humanities Reference Material/Tools Division grant (#RT-21464-93) awarded to Sona Andrews, David Tilton, and Mark Warhus. The work is being carried out in the Geography Department at the University of Wisconsin-Milwaukee. Dr. G. Malcolm Lewis at the University of Sheffield in England is working as a consultant on the project, and the project's Advisory Committee is comprised of experts in the fields of Native American History, Geography, Cartography, and Anthropology. The grant began in July of 1993 and runs through December of 1994.

EDITOR'S NOTE

This paper was presented at the 90th Annual Meeting of the Association of American Geographers, San Francisco, California on March 30, 1994.

RESUMEN

Desde junio de 1993, el Departamento de Geografía de la Universidad de Wisconsin-Milwaukee, está trabajando en un proyecto de investigación para desarrollar un archivo de mapas sobre los indios americanos en CD-ROM. Un componente importante de este proyecto es la exploración de los mapas existentes. Esta investigación trata diferentes aspectos como: la adquisición, la manipulación y la exhibición de imágenes. También incluye la exploración, la compresión de archivos, la colocación de paletas y la reproducción de mapas originales.

SOMMAIRE

Depuis juin 1993, le Département de géographie de l'université du Wisconsin à Milwaukee s'occupe d'un projet de recherche de développement de l'archivage de cartes amérindiennes sur disque optique numérique (CD-ROM). Une composante essentielle de ce projet inclut la création de balayages haute résolution des cartes des archives. Ce document discute de plusieurs problèmes rencontrés dans l'acquisition, la manipulation et l'exposition des images résultant du balayage, qui comprennent la résolution du balayage, la compression des fichiers, les décalages de palette et le quadrillage de l'image.



Creating Interactive Media on CD-ROM

The Department of Geography at the University of Wisconsin-Milwaukee is developing a research oriented, visual database of North American Indian maps on a CD-ROM. This project is funded by a grant from the National Endowment for the Humanities, Division of Research Programs. The CD-ROM will contain maps, extensive descriptions, and catalog information about the maps. The digital maps and text will be linked through a hypermedia interface. This archival database is intended to function as a research tool for scholars studying the cartography, landscape perception, cognition, art, and history of Native Americans. This paper presents an overview of the project, a brief discussion of the technology used, sample images and database information, and a description of how the interface functions.

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CD-ROM technology provides a new and exciting storage and access media. The number of CD-ROM titles has escalated in the past few years and their projected distribution and development in this year alone is anticipated to be in the millions. There are a number of ways that cartography and cartographic products can benefit from this media. One such project currently underway in the Geography Department at the University of Wisconsin-Milwaukee is to create a CD-ROM that will function as a multimedia, research tool on pre-twentieth-century North American Indian and Inuit maps. The primary components of this archive are approximately 400 high-resolution digital map images, a hypermedia database containing basic data and catalog information, and a computer interface linking the images and database. The project is a good example of how multimedia can be used as a tool for cartographic research and demonstrates a way that interactive multimedia can improve and enhance geographic research and education.

INTRODUCTION

Much of the post-Columbian history of North America has been about the contestation of territory conceived and represented on maps. While European-style maps are the subject of a huge scholarly literature, American Indian maps—though vital in the description and understanding of the native world—remain understudied, unexplored, and at times undiscovered to most researchers. Such maps are indeed among the most precious intellectual records of the Indian and Inuit civilizations of North America.

BACKGROUND FOR THE PROJECT

Surviving examples are scattered in a large number of libraries, archives, museums, and private collections. They are cataloged as maps, manuscript documents, and ethnological artifacts and are currently not available for study as a coherent corpus of information. The hypermedia archive we proposed and subsequently received funding for is designed to bring these widely scattered images together, making them readily available for scholars to research, examine, and study.

ARCHIVE COMPONENTS

Given the technology available to date, the most effective method for obtaining high-resolution digital images of the maps for the archive was to create a digital scan from a color slide or transparency of the original item. Making scans directly from the original maps was not feasible due to a number of constraints. These included the fact that many of the maps are rare artifacts and cannot leave the libraries or museums in which they are housed. Furthermore, the cost of site visits for on-site scanning to all of these locations would have been prohibitive. Even if these obstacles could have been overcome, many of the maps were fashioned on materials (bark, skin, tusks, etc.) that are not suited to flat bed or drum scanners. The decision to scan from slides was the only viable solution.

The resolution quality of the images was an important and primary consideration. The images for the archive are scanned from 35mm color slides at a 36 bits per pixel bit depth and a resolution of up to 3175 pixels per inch.¹ They are stored as Macintosh PICT files and are designed for display on a computer monitor at a resolution of 72 ppi. Each file yields an image size that would be approximately 40" by 60" when output at full magnification and a file size of approximately 40 MB. This is equivalent to 45 times magnification of the 35mm slide. Color correction and enhancement is performed on each image as needed after the initial image scan.

Four sizes of images are created from each scan. They range in size from 240 x 180 pixels up to 4350 pixels x 2950 pixels at 72 ppi. Images larger than 640 pixels x 480 pixels are systematically cut up into tiles. However, the archive application does not reassemble a tiled image in sections of more than 640 pixels x 480 pixels at any one time. Users view these tiles by scrolling through them from within the archive application. The four image sizes are as follows: 1) approximately 240 x 180 pixels at 72 ppi, 2) 640 pixels x 480 pixel (i.e. full screen) at 72 ppi, 3) 1280 pixels x 960 pixels at 72 ppi (systematically cut up into four 640 pixel x 480 pixel tiles that are displayed individually by scrolling from one tile to the next within the archive application), and 4) a range from 1280 pixels x 960 pixels up to 4350 pixels x 2950 pixels in size (systematically cut up into 320 x 240 pixel [i.e. quarter screen] tiles that are displayed four tiles at a time by scrolling through them from within the archive application).

By tiling the scans, the images can be viewed a few tiles at a time. The effect to the archive user is a sense of panning around a highly magnified image. However, since only a few tiles are shown at a time, it makes the images much more manageable to display on standard multimedia computer systems. The images are then compressed using JPEG compression algorithms, greatly reducing all files of a single map down to an average of 1 MB. By taking advantage of the CD-ROM's tremendous storage capacity (around 650 MB), it is possible to provide detailed images for the approximately 400 identified extant maps.

In addition to the digital images, each map image has a record in a hypermedia database. The database includes such information as the map title, who drew the map, the date and size of the map, the cultural area and tribe related to the map, the geographic region depicted on the map, and the material the map was made of. Many of the fields in the database are searchable. In addition to traditional searching techniques, the database includes hypermedia links. Hypermedia is a form of multimedia in which associations between pieces of information or ideas are identified

By tiling the scans, the images can be viewed a few tiles at a time. The effect to the archive user is a sense of panning a highly magnified image.

¹ This resolution and bit depth were selected after a significant amount of discussion, testing, and experimentation. The specific considerations and solutions are presented in David Tilton's paper on pages 26-30.

by pre-defined, user-activated links. For example, if two of the maps use similar symbols, they may be linked so that one map can be accessed directly by activating a hypermedia link from within the other map's record.

Accompanying each map record is an abstract that describes the map's origin and the circumstances pertaining to its creation. A full description is also given for maps when detailed information was available. The full descriptions range in length from approximately 200 to 3000 words. The information in the database and the descriptions come from material that is documented either through the original source, a contemporary account, or an historical account of the map. It will be up to researchers using the archive to investigate and hypothesize about these images, what they mean, and what they meant to the society and people who created and used them. The archive, therefore, is designed as a research tool and is a product of the technology and methodology it represents. In other words, it is not and was not intended to be a definitive, researched thesis of these maps.

The interface is what adds functionality to the archive.² Its design requires the archive user to point and click with a computer mouse. In the initial phase of the project, a prototype interface was designed to assess the general functionality of elements in the archive. Screen samples from the preliminary interface design are shown in Figure 1 (page 36). Each map record contains multiple screens of information. The initial screen includes a small image of the map in the upper left, some database information about the map (title, maker, region, etc.), and buttons for accessing other information related to this map. If the user clicks an arrow button at the lower right of the screen, they are provided with a description of the map in a scrolling window. If they click on the magnifying glass below the small image, the entire map image appears on the computer screen (Figure 2, page 36). Enlargements of any section of the map are available by moving the pointer over the image and clicking the mouse (Figure 3, page 36). A set of controls at the bottom right of the screen allow the user to see other areas of the map.

The map example shown in Figures 1-3 is a manuscript map painted on deerskin and commonly referred to as the Catawba map. Another example of an archive map is Captain John Smith's map of Virginia, 1612 (Figure 4, page 34). At first glance, this European map does not look as though it belongs on a CD-ROM of Native American Maps. While many of the maps on the archive were actually drawn by the hand of a North American Indian, there are almost as many maps that are either European redrawings of Native maps or European maps that contain acknowledged or documented Native American sources. This later category of maps is important to the study of Amerindian cartography, and for that reason, they are included in the archive. Captain John Smith's Virginia is an example of this later type of map. Special interactive graphics have been incorporated in the archive for such maps in order to show the extent of the Native American contribution and content. For example, on the Smith map, a button is provided to remove the information supplied by Indian

While many of the maps on the archive were actually drawn by the hand of a North American Indian, there are almost as many maps that are either European redrawings of Native maps or European maps that contain acknowledged or documented Native American sources.

² The archive interface displayed in this article was developed for prototype purposes in the initial stages of the project by David Tilton. The interface has been significantly modified since the prototype and potential archive users will notice an improvement in both its appearance and functionality. The prototype for *The Archive of North American Indian Maps on CD-ROM* is available on floppy disk and through anonymous ftp (file name: archive.sea.hqx). For information on obtaining a copy see the *Message from the Editor* (page 1).

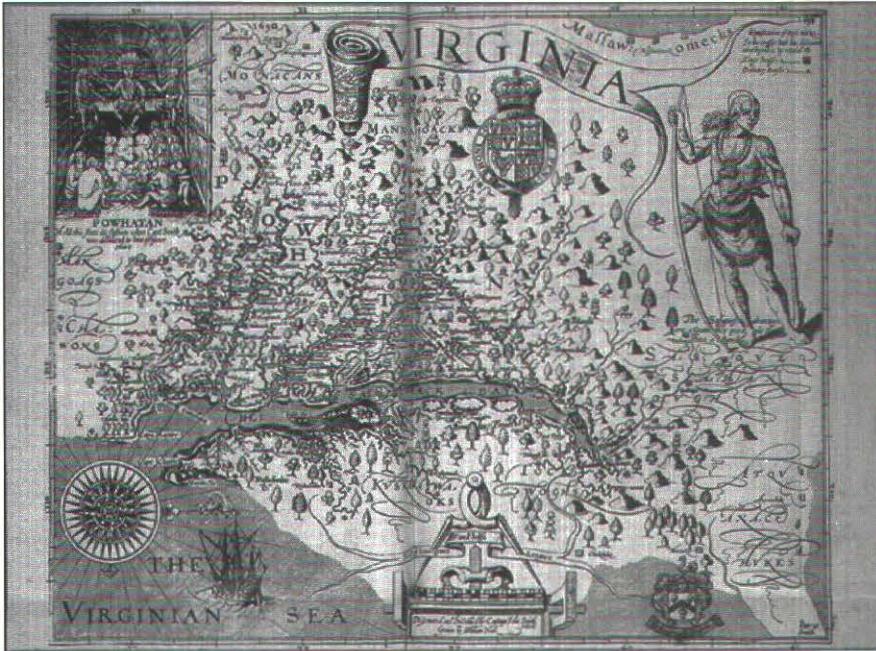


Figure 4. European maps such as this 1612 map of Virginia by John Smith often made extensive use of information provided by Native Americans. These maps are included in the archive to document the significant contribution made by Native Americans to the European mapping of North America.



Figure 5. Archive users will be able to visualize the extent of information provided by Native Americans on European maps such as this one by John Smith (see figure 4) by clicking a button that literally dissolves away the information supplied by Native informants.

sources (using a dissolve technique), leaving only the information that the Europeans had gained from direct experience (Figure 5, page34).

EQUIPMENT

The primary equipment used to create the archive consists of a Macintosh Quadra 950 with 64 MB RAM and a 1 gigabyte drive, a 3.5" 2 gigabyte hard drive, a 3.5" 128 MB optical cartridge drive, dual monitors, and Nikon LS3510AF slide scanner. The scanning, image processing, database, and authoring software includes Microsoft WORD (for entering text), FILEMAKER PRO, Nikon scanner software, PHOTOSHOP, DEBABELIZER, and Macromind DIRECTOR. The final product is designed for the Macintosh platform.³

CONCLUSION

It is our hope that this project will bring a new focus to the access and study of American Indian maps. Hypermedia allows researchers to have access to additional related data and images that could be cross-linked through the database. CD-ROM appears to be an appropriate delivery media for this project because it can accommodate the massive storage requirements of the archive (the digital images alone will require over 600 megabytes: the relational database and interface will require an additional 10 to 20 MB).

³ Although funding was provided for development on the Macintosh platform only, a version of the scans has been saved in a format suitable for crossplatform development.

The *Archive of Native American Map on CD-ROM* is solely funded by a National Endowment for the Humanities Reference Material/Tools Division grant (#RT-21464-93) awarded to Sona Andrews, David Tilton, and Mark Warhus. The work is being carried out in the Geography Department at the University of Wisconsin-Milwaukee. Dr. G. Malcolm Lewis at the University of Sheffield in England is working as a consultant on the project, and the project's Advisory Committee is comprised of experts in the fields of Native American History, Geography, Cartography, and Anthropology. The grant began in July of 1993 and runs through December of 1994.

This paper was presented at the 90th Annual Meeting of the Association of American Geographers, San Francisco, California on March 30, 1994.

Le Département de géographie de l'université du Wisconsin à Milwaukee est en train de développer une base de données visuelles, axées sur la recherche, des cartes amérindiennes sur disque optique numérique (CD-ROM). Ce projet est subventionné par une allocation de la Division des programmes de recherche du National Endowment for the Humanities. Le disque optique numérique contiendra des cartes, des descriptions détaillées et des informations sur le catalogage des cartes. Les cartes et le texte numériques seront reliés grâce à une interface hypermédiate. Le but de cette base de données d'archivage est de servir d'outil de recherche aux érudits qui étudient la cartographie, les perceptions du paysage, la cognition, l'art et l'histoire des Amérindiens. Ce document présente une vue d'ensemble du projet, une brève discussion de la technologie employée, des échantillons d'images et de données et une description du fonctionnement de l'interface.

El Departamento de Geografía de la Universidad de Wisconsin-Milwaukee está desarrollando un proyecto de investigación orientado a la exploración de mapas de los indios de América del Norte en un CD-ROM. Este proyecto es subsidiado por una beca del National Endowment for the Humanities, Division of Research Programs. El CD-ROM incluirá mapas, descripciones detalladas, e información catalogada sobre los mapas. Los mapas digitales y el texto se unirán a través de un conector hipermedio. El propósito de esta información es para ser usada como una herramienta de investigación para estudiantes de cartografía, de percepciones visuales, de conocimiento, de arte y de la historia de los indios americanos. Este compendio presenta una visión general del proyecto, una breve discusión de la tecnología usada, imágenes e información de datos y una descripción del funcionamiento del sistema.

ACKNOWLEDGMENTS

EDITOR'S NOTE

RESUMEN

SOMMAIRE



Color figures for "Creating Interactive Media on CD-ROM," pp. 31-36.



Figure 1. Three screens from the Southeast Indian Map record included in the "Archive of North American Indian Maps on CD-ROM" prototype. The initial screen (left - shown at approximately 51% of original size) provides a thumbnail (240 x 180 ppi) image of the map and database information such as the map's title, publication, and region, etc. Two subsequent screens (right - shown at approximately 24% of original size) provide access to the map's description, publication information, and bibliography. Clicking on the thumbnail image or on the magnifying glass button will produce a full screen enlargement of the map (see figure 2).

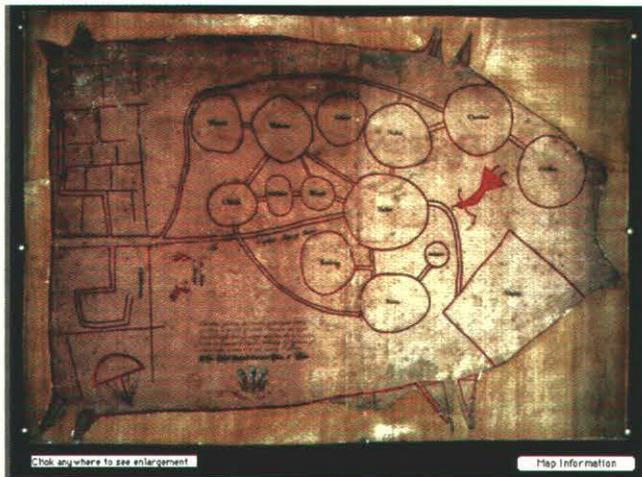


Figure 2. A full screen (640 x 480 ppi) enlargement (shown here at approximately 38% of original size) can be accessed by clicking on the thumbnail image or magnifying glass button available in the screens shown in figure 1. Tiled enlargements of the map can be accessed by placing the mouse pointer over the image and clicking (see figure 3).

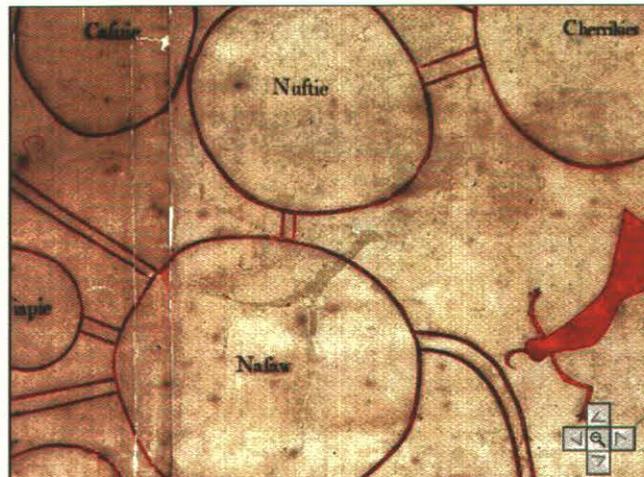


Figure 3. A tiled enlargement (shown here at approximately 38% of original size) of a portion of the Southeast Indian Map (see figure 2). Adjacent tiles can be accessed by using the arrow buttons in the lower right portion of the screen.

Color figures for "Using High-Resolution Digital Scans in Multimedia Cartographic Applications," pp. 26-30.

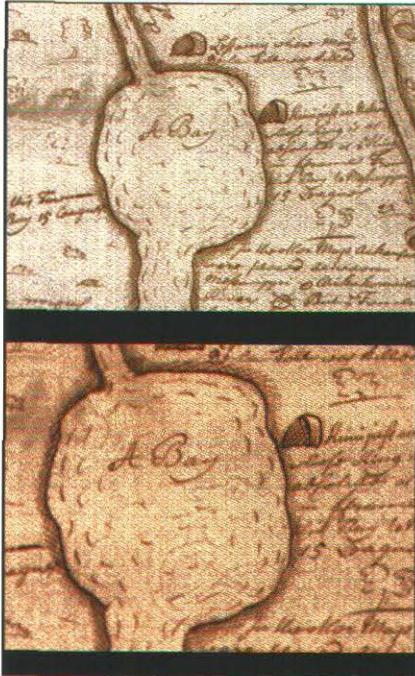


Figure 3. A portion of a map scanned at the highest Photo CD resolution (2230 ppi) compared with the same area from a 3175 ppi scan on a Nikon LS-3510AF.

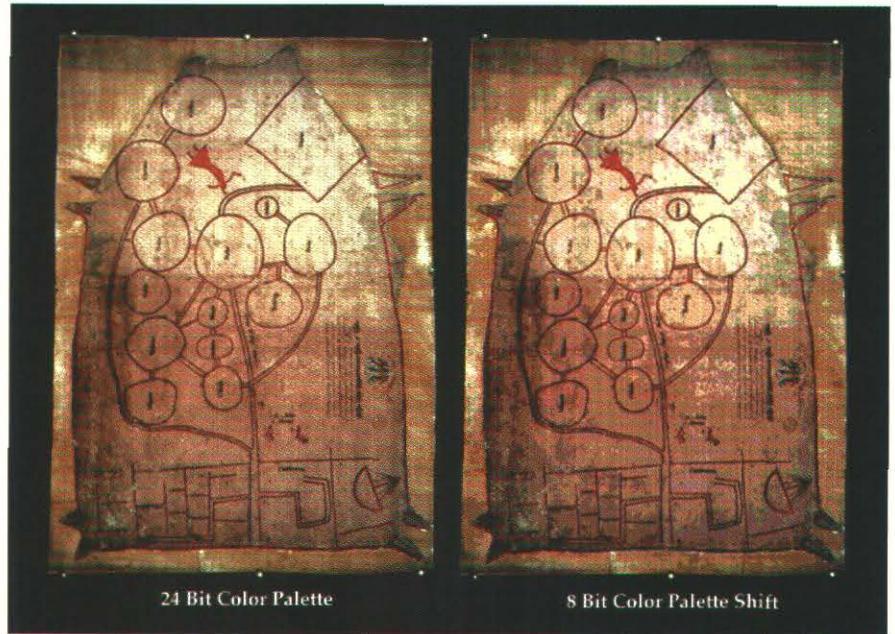


Figure 5. In Macromedia DIRECTOR, 24 bit images viewed in 8 bit color undergo a noticeable palette shift which significantly degrades the image.

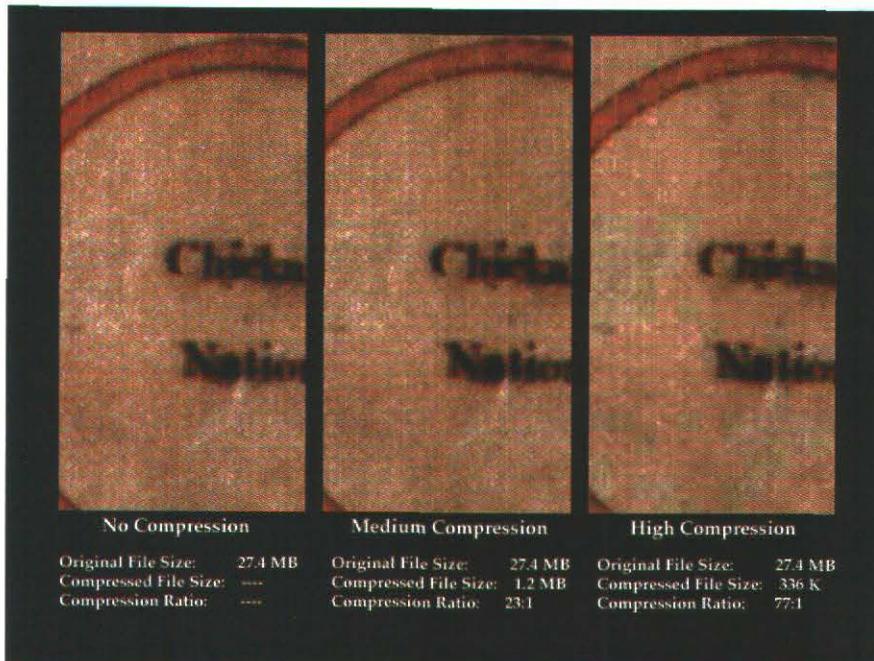


Figure 4. The effect of moderate and high-image compression on file size and image quality.

Color figures for "The Armchair Traveler Plugs In," pp. 20-25.



Figures 1 and 2: After a snappy introduction that includes music and animation, the viewer is delivered to the main menu/main map. At this point, the user is invited to pursue (navigate through) information on any of the countries visited by Stuart and Ann or to choose a General Subjects option (for those topics that do not fit neatly within a national boundary).

Figure 3: From the subject menu, the user can either view (or review) additional subjects, return to the main menu to select another country, or quit the supplement altogether.

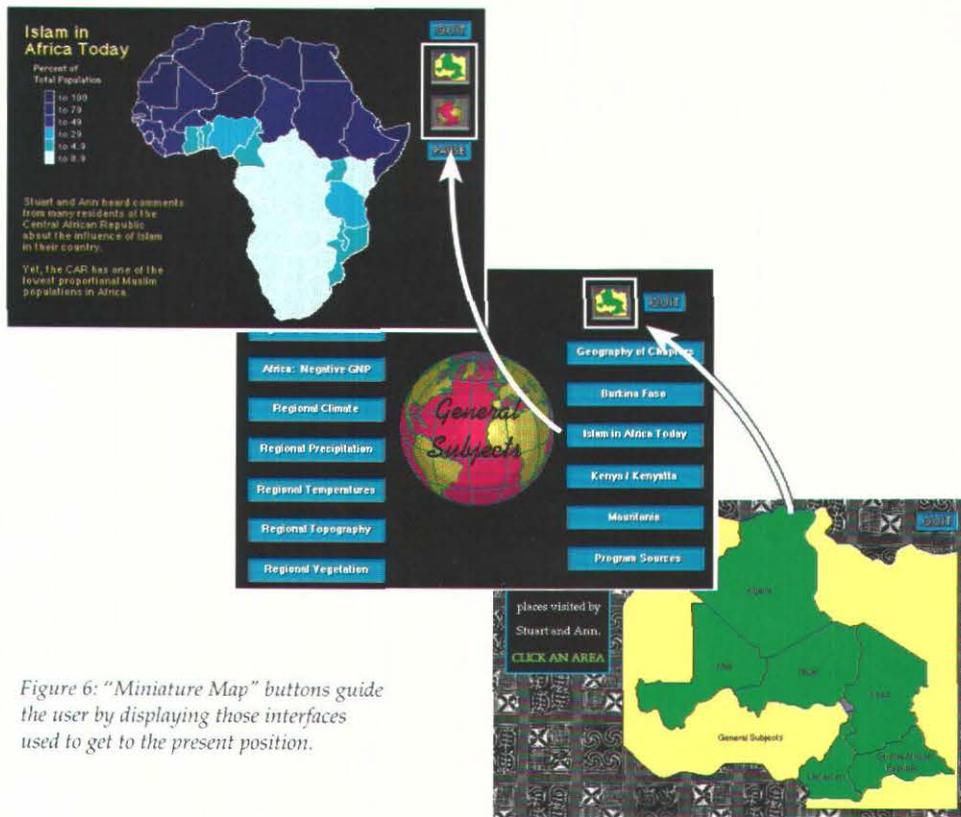


Figure 6: "Miniature Map" buttons guide the user by displaying those interfaces used to get to the present position.

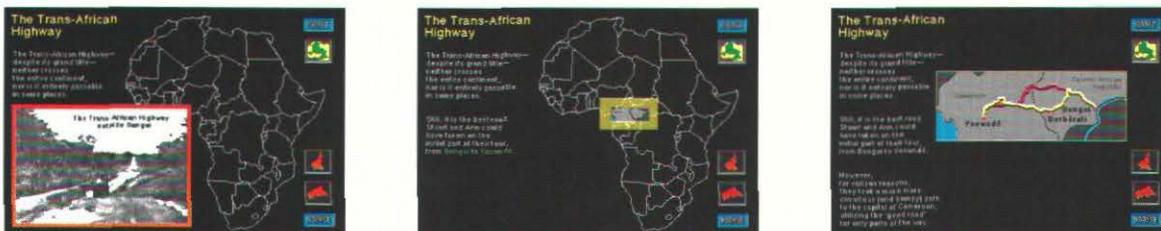


Figure 4: Upon clicking Cameroon, for instance, the user will find her/himself at a secondary menu with several different subject "buttons." A click on any of these initiates an animated multimedia event, exemplified by the Trans-African Highway sequence. The user is returned to the sequence's subject menu after the event has finished playing.

Color figures for "The Armchair Traveler Plugs In," pp. 20-25.

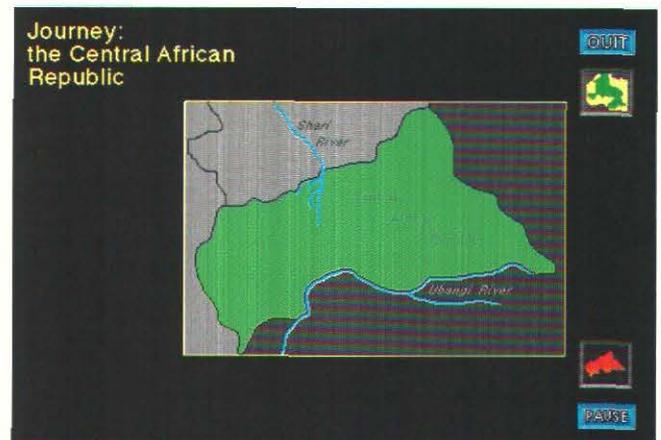
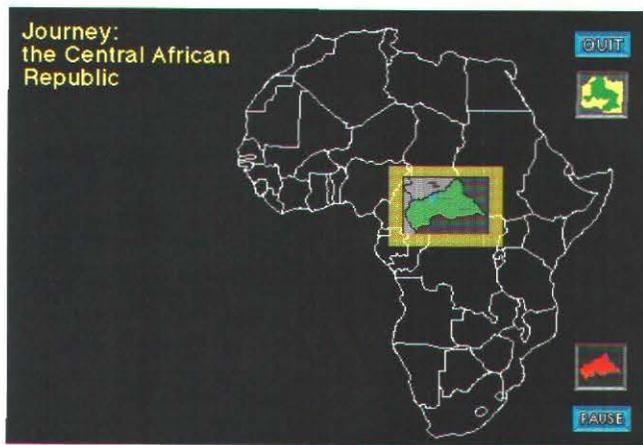


Figure 7: "Growing Maps" put map excerpts into context.

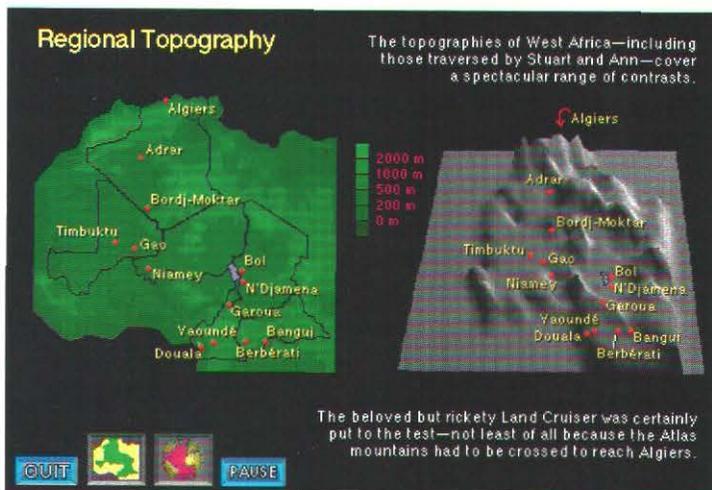
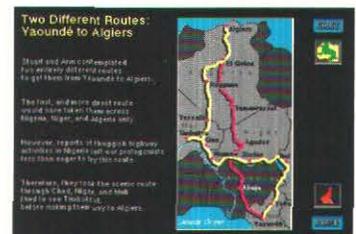
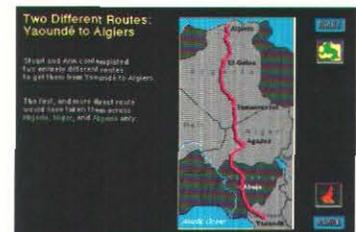
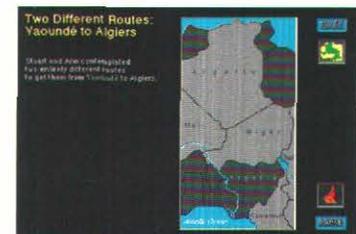
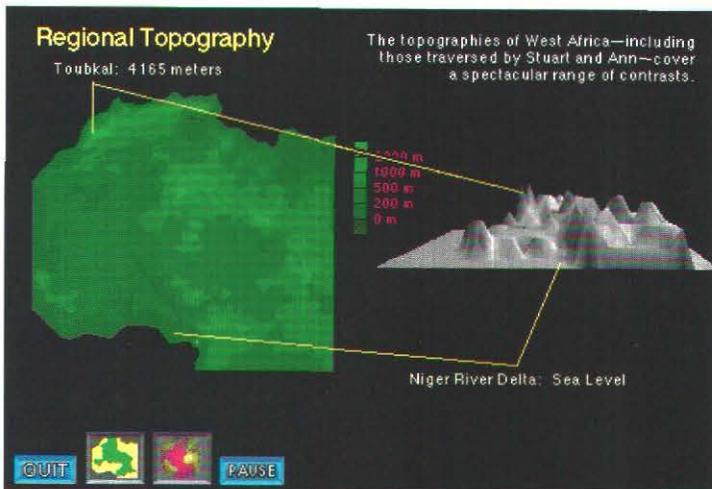


Figure 5: Sequential animated overlays make the simplest map rich in information.

Figure 8: Topographic "fly-bys" enhance understanding of the landscape.

cartography bulletin board

Compiled by
James Anderson, Jr., Director
Florida Resources & Environmental
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Several cartography labs have started to use multimedia techniques for the communication and display of cartographic information. In this issue of *Cartographic Perspectives* the *Cartography Bulletin Board* features multimedia activities at two universities and provides an overview and assessment of two authoring programs used for multimedia development.

Multimedia Cartography at the University of Wisconsin-Milwaukee

by David W. Tilton
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Univ. of Wisconsin-Milwaukee

For the past four years the Department of Geography at the University of Wisconsin-Milwaukee has been engaged in multimedia cartography research projects. One project, that is in the final stages of production, is a level three interactive videodisc on cartography funded by the United States Department of Education, College and Library Technology and Cooperation Grants Program. The videodisc features over 700 maps and images from the internationally renowned American Geographical Society Collection at the University of Wisconsin-Milwaukee. The maps date back as far as the 12th century and represent a diverse range of map

subjects, printing techniques, regions, scales, temporality, and mapping practices. Each map is represented on the videodisc with a set of images that include the whole map image, systematic tiled enlargements, and selected close-ups that highlight specific features on that map. An extensive database includes information for each map such as the method of execution, latitudinal and longitudinal extent of the mapped area, cartographic themes, comments, etc. The interface for the database allows the user to search specific database items or browse through the images on the videodisc. The videodisc also has over 20 minutes of motion video illustrating select concepts of map creation and use; and a short documentary on the creation of the videodisc and how to use it. The disc is scheduled for distribution in the Spring of 1995.

The department has also received a grant from the National Endowment for the Humanities, Division of Research Programs to create an *Archive of North American Indian Maps*. The goal of this project is to develop a research oriented visual digital database of North American Indian and Inuit Maps on a CD-ROM. This CD-ROM will contain Native American and Inuit maps, plus descriptions and catalog information about the maps (see articles by Andrews [page31-36] and Tilton [26-30] in this issue). The maps and text will be digital and linked through a hypermedia interface. This archival database is intended to function as a research tool for scholars studying the cartography, landscape perceptions, cognition, art, and history of Native Americans; as well as serving as a curatorial tool. The project grant runs from July 1993 to December 1994. CD-ROM distribution is anticipated in early 1995. □

Multimedia at Penn State

by David DiBiase & John Krygier
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Department of Geography
The Pennsylvania State University

Until about 1990, Deasy GeoGraphics, like many other university cartography laboratories, relied on photomechanical methods to produce thematic maps, graphs, and diagrams for the print medium. PostScript-based, computer-assisted methods have all but supplanted the traditional technologies since then. But the computerization of cartographic practice has affected more than just how we design and produce conventional products. Computerization and networking have made animated and interactive products feasible, while the high profile of "multimedia" and "the information highway" in the popular press is changing clients' expectations of our products and services. Cartography is becoming a multimedia enterprise.

We are happy to accept Jim Anderson's invitation to report on the status of multimedia at Deasy GeoGraphics. To avoid the confusion inherent in the term "multimedia," we will refer specifically to two types of newer products that are not based in the print medium: computer animations and interactive software for instructional presentations or data visualization.

Our initial experiments in animation included the diffusion of AIDS in Ohio and Pennsylvania produced in collaboration with geographer Peter Gould, and a paleo ocean circulation demonstration for Penn State's Earth System Science Center. Design issues confronted in these and other projects were explored in a seminar on cartographic animation supervised by Alan MacEachren, which resulted in a videotape called *Elementary Approaches to*

Cartographic Animation. These experiments were beneficial in developing both theoretical and practical expertise in animation, but two years passed before we were called upon to apply our abilities in a professional project. Then in 1993, several Deasy staff members consulted with GeoSystems, the mapping unit of R.R. Donnelley and Sons Company, in the design of 30 animated thematic maps for the *New Grolier Multimedia Encyclopedia* (see the article by DiBiase on pages 3-7, 19 in this issue). At present we regularly produce animated resources for a multimedia supplement to a new textbook on Earth System Science (described below).

It is a very big step from developing computer animations that users can watch to developing interactive software that users can control. Despite its non-geographic subject matter, our first interactive multimedia authoring project was an ideal learning vehicle: in 1992, a faculty member of Penn State's Recreational Studies Department commissioned Deasy to produce a multimedia "kiosk" display for their new Professional Golf Course Management Program. The kiosk was intended for use at professional conferences of golf course administrators to recruit sponsors for student internships. John Krygier developed the application in Macromedia's DIRECTOR software to run on a Macintosh computer. The application consists of a series of still images (young, well-groomed golfers smiling on luxuriant greens) and QUICKTIME movies (model simulations of ideal golf swings) intended to capture the attention of passing conference attendees. Users navigate by mouse click or key stroke through a sequence of text and images that explain the Golf Course Management Program. At the conclusion of the display the viewer is presented

with an electronic form by which users can register as a prospective sponsor.

As the result of another MacEachren seminar (this one on cartographic visualization) Deasy staff (principally Catherine Reeves and David DiBiase) developed a map interface called SLCViewer for exploratory analysis of multivariate global climate model data by Earth System scientists. SLCViewer was programmed in a language called IDL for use on UNIX workstations. The interface allows analysts to superimpose three or more spatial data variables over one or four planimetric maps, and facilitates experimentation with data classification and graphic symbolization options.

In 1993, a team of developers including Deasy GeoGraphics staff (John Krygier, Jason Cupp, and Catherine Reeves) and Penn State instructional designer Tim Robinson began work on a multimedia supplement to a new textbook on Earth System Science entitled *Gaia-The Earth System*. The multimedia supplement is intended for use by course instructors in classroom presentations (using computer projection technology) and will be available to students in campus computer labs. The development team is busy adapting concepts and illustrations appearing in the text into approximately 275 discrete multimedia "resources." Resource types include static images and tables, animations (such as a three-dimensional model of Earth whose surface appears to warm more in lower latitudes than higher ones due to the geometry of Earth-Sun relations), sequential resources that allow instructors to unravel complex topics by stepping through a series of displays that are built-up element by element (for example, a sequence of graphs and diagrams that identifies and finally combines the several physical processes that account for

mid-latitude atmospheric circulation), hierarchically-nested resources containing embedded information that can be revealed by clicking a contextually-linked area of the screen (such as a geologic time scale in which epochs are nested within periods, which are nested within eras, which are nested within eons), and interactive models that produce graphic or numeric solutions, according to the rules of an underlying algorithm, in response to the user's manipulation of a display (Imagine, for example, a generic system diagram in which the two components are represented as a framed bar graphs. Attached to each component is a slider. Dragging a slider perturbs the component. If the system is specified as a negative feedback loop, the system responds by returning to equilibrium, a process that looks like oscillating pistons gradually coming to rest).

The resources are accessed through an interface that makes it easy for an instructor or student to create and modify a custom menu of the resources required for a particular lecture. This custom menu appears in the menubar of all resources, permitting instructors to move easily from one resource to another in any order. The interface and resources are being developed with Macromedia DIRECTOR 4.0 (see overview that follows) in combination with 3-D modeling (Strata STUDIO PRO), 2-D illustration (Aldus FREEHAND), and various mapping software programs.

How else to conclude such a report but to speculate about the future? At present, approximately one-third of the Deasy staff is engaged in multimedia development. We expect the Gaia courseware project to continue for another year or two. After that, who knows? Perhaps, as Colin McEnroe of the Hartford Courant wrote recently in a syndicated

column, "... in 10 years or so, interactivity is going to be like disco. We'll be wondering why we did it so much." But we doubt it. With the quality and quantity of undergraduate university education perennially under fire, instructional multimedia is likely to continue to be in demand, if only to provide administrators with tangible evidence that they are doing something. And hard-pressed public universities competing for student credit hours will rely more and more on multimedia to expand distance education programs. From our perspective, multimedia has excellent potential to be a viable, revenue-producing service that allows us to apply our expertise in geographic information design in projects that enrich higher education. □

Macromedia DIRECTOR 4.0 An Overview

by John Krygier
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The Pennsylvania State University

Macromedia DIRECTOR 4.0 is a multimedia development tool available for the Macintosh and Windows environments. DIRECTOR facilitates the integration of a range of media (graphics, video [QUICKTIME format], sound, etc.) and the construction and "scripting" of interactive "movies." DIRECTOR movies can be created, saved, and played as uneditable "projectors" on both Macintosh or Windows platforms. DIRECTOR projectors can be distributed free of royalties to Macromedia and do not require DIRECTOR software to play. The overview provided here is meant to give a basic introduction to DIRECTOR and to some of its capabilities.

The DIRECTOR interface is based upon a movie metaphor. A

"cast" window collects all the diverse elements used in a movie. These elements include paint objects (bitmapped PICT graphics or images), text objects, QUICKTIME movies, color palettes (2, 4, 8, or 24 bit color), sounds, and scripts (programs written in DIRECTOR's object oriented language "Lingo" that control objects in the movie). Many of these cast elements can be created or edited within DIRECTOR.

Paint objects can be created and edited in DIRECTOR's moderately sophisticated paint window. The paint window contains tools and functions common to most bitmapped paint programs: tools for drawing shapes and lines, creating bitmapped text, color swaps, gradients, object manipulation, etc. Paint objects can also be imported from other software packages. For example, Aldus FREEHAND can be used to create maps and graphs and a screen capture utility can be used to create a PICT file. This can in turn be imported into and modified in the paint window. Text objects can be created and edited; their font, style, color and size modified in the text editing window. Color palettes can be created or customized in the color palette window (eight different modifiable palettes are built into DIRECTOR, including Macintosh and Windows system palettes and NTSC-safe colors). Lingo scripts can be written and modified in a scripting window that has full search and replace capabilities as well as automatic compilation and scripting debugger. Sounds and QUICKTIME movies can be imported, used, and played (but not edited) in DIRECTOR.

The action (an animation, interactive graph, etc.) in a DIRECTOR movie takes place on the "stage"—the screen of your computer monitor. The "score" window organizes the various cast

members that appear on the stage as well as their associated effects and Lingo scripting. The temporal dimension of the score window (running left to right) consists of a series of "frames" each representing one (modifiable) unit of time. Each frame column in a DIRECTOR movie (running up/down) contains information concerning timing (tempo in frames-per-second, timed waits, wait for mouse-click, wait for QUICKTIME movie to finish, etc.), color palette used, transition between the current frame and the next frame (52 built-in transitions are available), two sound channels, Lingo scripting for the frame (e.g., pause, wait for the mouse click, then beep and play a QUICKTIME movie), and 48 "channels" for paint, text, and QUICKTIME objects (e.g., you can have up to 48 different objects on the stage in any one frame). To animate a moving circle, for example, you would place a round paint object in the first frame, then place the same object in the second frame offset to the right an inch, then place the same object in the third frame offset another inch, etc. Transitions and timing can be set for each frame. The final frame could have a short Lingo script which tells the movie to go to the beginning of the sequence and play it again, thus creating a movie loop.

While DIRECTOR provides a means for creating animations, its real power is in creating interactive movies via the "Lingo" scripting language. Lingo is a relatively sophisticated object-oriented programming language that is a combination of HyperCard's "HyperTalk" and C++. Lingo scripts can be located in different places in a DIRECTOR movie: in the movie script, in the cast script, in a particular instance of a cast member, and in a frame script. The "movie script" contains various global scripts, such as a command to install a customized

menu upon the start of the movie or a command to change the cursor to a different shape when it is over particular objects on the stage. The movie script also contains lingo subroutines which can be called from anywhere in the movie. For example, a subroutine called "stepForward" contains a short program which tells the movie to advance the next frame when the "stepForward" command is issued. The "stepForward" command can be programmed to issue when the user clicks on a paint object button with a right arrow. Thus it is also possible to program a particular cast member—the "cast script." The right arrow paint object itself contains a Lingo script which issues the command "stepForward" when the object is clicked. The "stepForward" subroutine is then called from the movie script and the movie advances.

Scripting in particular paint or text objects may become problematic if clicking on the same object must result in different actions at different places in the movie. For example, the first right arrow button in a movie may need to "stepForward" but the last one needs to go to and play a different movie. It is possible to have two right arrow cast members each with different cast scripts but it is more efficient to take advantage of DIRECTOR's ability to script a particular instance of a cast member. The coding is removed from the cast member itself and is located in the score window. For example, in the first frame of a movie the right arrow button is selected in the score window and scripted with the "stepForward" command; in the last frame the right arrow button is selected in the score window and scripted with a "playNextMovie" command (a second subroutine located in the movie script). Finally, Lingo scripting can be placed in a particular frame, the "frame

script," telling the movie to do something when it arrives at that frame. For example, the frame script could tell DIRECTOR to pause, wait for the click of the mouse anywhere on the stage, then advance to the last frame of the movie.

Taken together, the numerous places for scripting a DIRECTOR movie provide a very flexible and powerful environment for the creation of interactive multimedia products. Using subroutines programmed in Lingo one can create interactive slider bars, graphs, maps, and model simulations which react to the actions of the user. For example, a graph representing a simple two-variable feedback system can be programmed so that a user can drag a point resting at one of the system's equilibrium points to an unstable location and watch the point work its way back to a stable equilibrium. In this case, the changes in the location of the paint object point are calculated by a Lingo subroutine. Each different location on the graph provides a different unstable location and will take a different path (and a different amount of time) to reach equilibrium. Advanced object-oriented programmers, then, will find Lingo flexible and powerful. A major advantage of DIRECTOR is that it provides the means for scripting fully interactive model simulations while remaining easy to learn and use for basic animation and multimedia. In my experience, new users can be creating animations and scripting in DIRECTOR within a few hours.

Macromedia DIRECTOR is available at a substantial educational discount. It is helpful to have a 68040-class Macintosh or 486-class DOS/Windows machine with at least 16 Mb of RAM and two monitors (one for the stage and one for the script and cast windows). Manuals for DIRECTOR 4.0 are extensive and helpful,

and online help is available. A DIRECTOR discussion group is available via e-mail, providing access to numerous advanced DIRECTOR users. To subscribe to this discussion group address a note to the following address:

LISTSERV @ UAFSYSB.BITNET

Type the following in the body of the note:

*subscribe DIRECT-L
firstname lastname*

(where firstname lastname
are your first and last name)

Since this group receives over 50 messages each day, the digest option should probably be used. Send a note to the same address after your subscription is accepted, but put the following in the body of the note:

SET DIRECT-L DIGESTS □

LINKWAY LIVE: An Authoring Tool for DOS and Windows

*by Laurie Molina
Institute of Science and Public Affairs
Florida State University*

LINKWAY LIVE is a product developed by IBM corporation for a DOS (and now a Windows) environment. It functions by using folders, fields, pictures, buttons, and media objects to create a multimedia presentations. These basic components (with the exception of media objects) are easily mastered. Teachers have been using LINKWAY for a number of years and with the improvements available in LINKWAY LIVE and LINKWAY

LIVE for Windows, they find that they can produce even more sophisticated productions with less scripting knowledge.

LINKWAY LIVE has been used to develop a number of cartographic programs including *The NGS Picture Atlas of the World*, *The Seven Man-Made Wonders of the World*, *The Small Blue Planet*, and Florida State University's CD-ROM DOS version of the *Atlas of Florida*. At the start of the *Atlas of Florida* project only one member of the development team had experience with LINKWAY but with excellent technical support and some practice, the staff quickly learned the basic structure and short cuts that make the program a useful authoring tool.

There are a number of multimedia authoring software packages to choose from on both DOS and Mac formats. Authoring programs range in price from a couple hundred dollars to thousands of dollars. The cost of the program is not necessarily indicative of its sophistication or quality.

Before selecting a program it should be decided as to which effects are most needed. Knowing what the potential audience will have access to is also a consideration. For example, LINKWAY LIVE can produce the highest quality and largest window of video available, unfortunately unless equipped with a specific video (DVI) card, the product cannot be viewed. Other capturing cards can be used at a lower price but the resolution and size of the video window decreases dramatically. Based on cost and user compatibility LINKWAY LIVE video does not hold any special advantage over other authoring tools. It does, however, have a special feature called M-Motion that permits video to be played in a window on the computer screen from a videodisc, VCR, or live broadcast while your computer program is on. This is

especially helpful in order to combine sources of information and maintain television resolution on the computer screen.

LINKWAY LIVE can produce quality audio but at the expense of memory space. Audio files are extremely large and should only be used sparingly in a LINKWAY program. Although the technology continues to improve and some programs have cut audio file sizes considerably, if audio is a major part of a project, consideration should be given to other programs capable of handling large files. LINKWAY does handle data very well and has pre-programmed tools for entering data for multimedia projects. Scrolling and custom size WINDOWS and files of many kinds are easily accommodated in LINKWAY LIVE. There is a limited font selection and the first version of LINKWAY LIVE had no special characters (italics or bold). However, the new LINKWAY LIVE for Windows does allow you to use all of the fonts, special characters, and tools available in Windows.

Any authoring system should be tested for color and LINKWAY is no exception. Most standard file formats work just fine, thus saving tedious conversion time. LINKWAY LIVE allows you to put hidden objects, very small or large objects, and as many objects as you want on each page of your folder, making the possibilities seem endless. You can script a basic DOS "print" command and have your text files printed from a button on the screen. Transitions, navigation buttons, and special effect buttons are consistent and easy to use in LINKWAY LIVE. Although they are always the same they can also be easily altered with a code found in the reference manual. The use of auto execution buttons can make a change that will last over the entire project and provide consistency.

Animation can be done in LINKWAY LIVE but like the cartoonist, it is done cell by cell and is quite cumbersome. If multiple animations are what you need, finding another program is advisable.

Although LINKWAY's scripting is very simple to use, it is not easy to find the documentation for it the first time through the manual. In general, the manuals for authoring tools are problematic but LINKWAY LIVE does have an outstanding technical support group who will answer your questions or call you back in a reasonable amount of time.

LINKWAY is a useful program for developing simple projects with some sophisticated features. With time, exploration, and practice a very complex project can be developed with excellent support and at a low cost. LINKWAY LIVE is definitely worth exploring for many DOS or Windows format projects. □

technical notes

MOSAIC AND THE WORLD WIDE WEB

by Michael E. Ritter
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NCSA's Mosaic is a global hypermedia browser that allows you to discover, retrieve and display information from all over the Internet. Mosaic is a part of the World Wide Web project (AKA the Web or WWW). The Web was created in 1989 by Tim Berners-Lee at the European Laboratory for Particle Physics, CERN, in Geneva, Switzerland as a distributed hypermedia environment for sharing information among

scientists. A global hypermedia environment lets you "travel" down the information superhighway by means of hyperlinks (terms, icons, or images) in documents that point to other related documents on remote servers. The Web's unique ability to handle multimedia documents has grown to be an important means of distributing text, video, and audio information across the Internet. Only Web servers display multimedia documents, but others, like Gopher, can provide images and transfer software and data to your computer.

Mosaic is one of several software interfaces that can tap the multitude of resources of the Web as well as other aspects of the Internet. Mosaic can browse the Internet for text-based material but it also has built-in multimedia "capabilities." Once located, Mosaic can launch viewers for displaying images, movies, or sound files. Mosaic also has the capability to connect to Gopher, WAIS, and FTP servers and launch Telnet sessions. Mosaic is an extremely versatile and user-friendly interface.

Installing and Getting Started With Mosaic. Mosaic is capable of running on a Windows PC, Macintosh, or under X-Windows on most UNIX-based workstations (e.g., IBM RS/6000, Sun Sparc, DEC, SGI). The functionality of the software is similar across the three platforms with obvious differences in application configuration and basic layout of the document view window. Installing Mosaic is a fairly easy and straight forward process.

Installing on a Windows PC. Mosaic requires a minimum 386SX-based machine with 4MB of RAM running Windows 3.1 in enhanced mode. The recommended configuration is a 33-MHz or faster 80486-based machine with

at least 8MB of RAM. Windows Mosaic requires a WinSock 1.1 - compliant Windows sockets library (WinSock DLL or winsock.dll) installed on your machine to provide TCP/IP networking under Windows. Check with your local network administrator on the availability of a sockets library for your workstation. Shareware versions of this software can be found at FTP servers on the net. You must also have the 32 bit extensions to Windows installed on your machine. Windows 32 bit extension software and the compressed version of Windows Mosaic can be retrieved from NCSA's FTP site (ftp.ncsa.uiuc.edu). Once retrieved and decompressed, the program is basically ready to run except for a few minor changes to the default settings in the mosaic.ini file.

Mosaic will come configured with default settings for menu choices, fonts, homepage pointer, displaying in-line images, etc. These can all be edited by loading the Mosaic initialization file (mosaic.ini) into any text editor and changing the desired settings.

You will need to provide Mosaic with the location of audio players and graphics and video viewer. NCSA has suggested shareware versions of viewers that you can download from their FTP site if you need them. Lview, Winjpeg, and Wingif all work well with Mosaic. Mpeg movies can be viewed with Mpeg32e.

From your Windows File Manager drag and drop the Mosaic executable file onto a program group in Program Manager to create a Mosaic Icon. Double click on the icon and the application and the document view window should appear on your desktop (Figure 1). Once you have finished installing Mosaic you can test your connection by linking to NCSA's "Starting Points" document under the menu of the same name. Refer to the various "readme" files available for Mosaic if you encounter installation problems. In most cases installation problems arise from socket problems or the TCP/IP connection. Your local Internet network administrator can usually solve these problems.

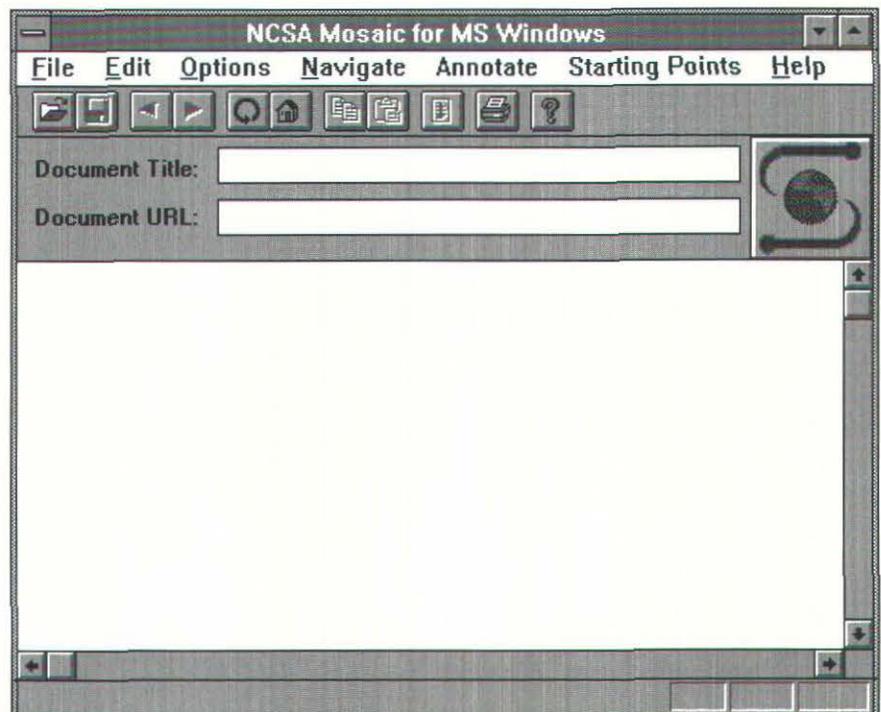


Figure 1. Mosaic for Windows document view window

Installation on Macintosh.

Mosaic for the Macintosh requires System 7 or later, MacTCP 2.0.2 or later (MacTCP 2.0.4 or later is recommended), 4 MB or more of memory (NCSA Mosaic requires a memory partition of at least 2 MB) and a hard disk. Valuable installation information is found in the various readme and QuickStart files that accompany Mosaic for the Mac and a user would be wise to look at them before attempting installation. It will be necessary to unStuff and unBinHex the Mosaic file with STUFFIT EXPANDER or another data compression program before starting the installation.

Drag the NCSA MOSAIC icon onto the hard disk and double click on the Mosaic icon to launch the application. A window should appear on the screen indicating that you are connected to the Mosaic Home Page (Figure 2). Mosaic for the Mac will display a majority of the files it encounters. However, additional software will be required to view some images, movies, and sounds.

Mosaic comes configured to use JPEGView for GIF and JPEG files, and GIFConverter for TIFF

images. SIMPLEPLAYER and SPARKLE are used to view QUICKTIME movies and MPEG movies respectfully. AU sounds can be decoded and listened to through SOUNDMACHINE. Mosaic is configured to handle BinHexed files with STUFFIT EXPANDER.

How Mosaic works. World Wide Web documents are written in Hypertext Markup Language (HTML) that is a simple language that encodes text and incorporates the ability to include a graphics file as a part of the document (Berners-Lee and Connolly 1993). Clients and servers use a standard transfer protocol known as HyperText Transfer Protocol (HTTP) to send and retrieve information across the Internet (Berners-Lee 1993a).

The Web utilizes a Universal Resource Locator (URL) to identify individual pieces of information residing on computers anywhere across the network (Berners-Lee 1993b). A URL specifies the type of server application you are linking to and the physical location of the information. A URL can be attached to a word, line of text, or

a graphic in a hypertext document. In MOSAIC these text hyperlinks are highlighted in blue and underlined. A typical URL is composed of three parts: the code for the type of file being accessed (HHTTP protocol code), the server's address, and the pathname of the file containing the document to be retrieved. The format used is:

```
resource://host.domain[:port]/
path/filename
```

where the resource is either an:

- http - a file on a World Wide Web server
- file - a file on your local system or a file on an anonymous FTP server
- gopher - a file on a Gopher server
- WAIS - a file on a WAIS server

The resource can also be Telnet or news. The following URL links to NCSA's Web server to display the PC Windows Mosaic Home Page:

```
http://www.ncsa.uiuc.edu/
SDG/Software/WinMosaic/
WinMosaicHome.html
```

The first portion of the URL tells Mosaic what kind of protocol to use, in this case it is a HyperText Transfer Protocol because it is linking to a Web server. The address of the server follows (www.ncsa.uiuc.edu). The path, /SDG/Software/WinMosaic/, points to where the home page document (WinMosaicHome.html) is located. Mosaic and HTML shield users from URLs most of the time because the URL is embedded in the HTML document source code that generates the hyperlink between documents across the Web.

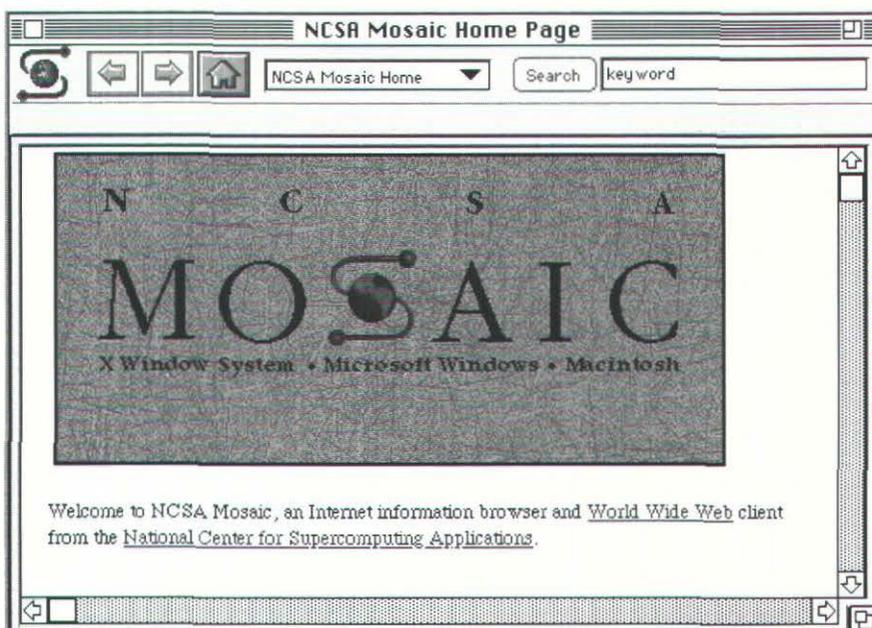


Figure 2. Mosaic for Macintosh document view window

Hyperlinks are highlighted with color or underlined in Mosaic. Hyperlinks may lead the reader forward or backward in the HTML document, to a particular portion of a document, or to any other document on the Web. To connect directly to a document, use the drop down File menu and choose "Open URL," fill in the text box, and click "OK." Mosaic also allows you to tag documents and place them in a hot list, similar to a bookmark list for those familiar with gopher software. This is an efficient way of collecting your favorite URLs.

Among Mosaic's many features is its ease of downloading files from remote servers. This is done by choosing the "Load To Disk" pick from the "Options" menu and then clicking on the item you wish to transfer to your workstation. After clicking on the item to be downloaded you will be prompted for a path and file name. Any type of file can be transferred in this way.

Serving as an interface to the multimedia world of the Web is Mosaic's real strength. Text or icon hyperlinks can quickly transfer sound images, animation, or movies to your workstation where they are viewed by an external player or viewer. Web documents often contain embedded images or graphics that also serve as hyperlinks to other images or documents on the Web. Transfer of documents with inline images on less powerful machines can be very slow, especially when network traffic is heavy. You can improve your performance by setting the "Display Inline Graphics" in the "Options" menu to off.

Mosaic is fast becoming a popular browser of the World Wide Web and Internet. A new electronic mail discussion group has been started devoted to users of Mosaic. To subscribe to the list send e-mail to:

MOSAIC-L on
LISTSERV@UICVM.BITNET
(Bitnet)
or
LISTSERV@UICVM.UIC.EDU
(Internet)

In the first line of the message (not in the subject) enter the following:

SUBSCRIBE MOSAIC-L Your
Name

Mosaic possesses a number of other features that make navigating the World Wide Web and the rest of the Internet easy. These features are best investigated by personally obtaining the software and trying it out. Once Mosaic is up and running on your workstation you can point it to NCSA's home page to access their on-line guides to Mosaic. NCSA's "What's New Page" keeps you abreast of new servers and services. Numerous Web servers are coming on-line each month with enormous amounts of information being uploaded daily for viewing and retrieving.

References

Berners-Lee, Tim. 1993a. Hypertext transfer protocol. <ftp://info.cern.ch/pub/www/doc/http-spec.ps>.

Berners-Lee, Tim. 1993b. Uniform resource locators <ftp://info.cern.ch/pub/www/doc/ur16.ps>.

Berners-Lee, Tim and Connolly, Daniel. 1993. Hypertext markup language. <ftp://info.cern.ch/pub/www/doc/html-spec.ps>.

Note. The Mosaic software and NCSA's home pages offer information about the world of hypermedia and more detailed instructions on the use and customization of Mosaic for your workstation. You should also refer to the "readme" files that accompany Mosaic for detailed installation information. □

cartographic events

1995

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

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



NACIS XV

October 25 - 29
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Wilmington,
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reviews

ATLAS REVIEW

*Historical Atlas of Canada.
Volume II. The Land Transformed,
1800-1891*

R. Louis Gentilcore, Editor.
Toronto: University of Toronto
Press, 1993. 184 + xxii pp., 265
maps, 197 graphs, 48 illustrations,
22 population pyramids, 14 tables,
5 lists. \$95.00.
(ISBN 0-8020-3447-0)

Reviewed by John H. Long
The Newberry Library
Chicago, Illinois

The first thing one notices about this atlas is its folio size; the pages measure fourteen and one-half inches tall by ten and one-half inches wide, and it weighs about three and one-half pounds. The numbers of maps, graphs, etc. (listed above) come from a count of items in the table of contents, which identifies everything except the three or four dozen inset maps. The heart of the atlas is the fifty-eight plates, each one a two-page spread densely packed with information on a single subject. The plates are organized into eight thematic sets, each introduced by a brief text. There is the usual front matter and at the back of the book a set of "Notes" that specifies sources and, sometimes, gives information about the making of the plate. There is no index. In the edition under review, the text, place names, and map features are in English; a French language version is also available.

The *Historical Atlas of Canada* is a work of three volumes. This volume, although standing second in organizational order, is the third to be published. It presents the results of research by fifty-six

Canadian scholars – mostly geographers and historians – who, as the authors of the plates, gave their time, knowledge, and expertise without remuneration. Scores of others helped by checking sources, editing, drawing maps, and much else. This tremendous undertaking (the full project) was conceived in the early 1970s and, in this volume, it has reached its ultimate fruition.

In the foreword, William G. Dean, overall director of the atlas project, says its purpose "is to present a clear interpretive insight" into Canadian history "with a major emphasis on the changing socioeconomic patterns over time in the lives and livelihood of ordinary people" (p. [xvii]). The plates and maps are true to this vision in their subject matter and presentation. The atlas also is supposed to serve as "an indispensable reference work as well as a major research quarry reflecting contemporary views in historical geography, history, and cartography" (p. [xvii]).

Open the atlas at random, as most readers are likely to do, and one is immediately struck by the attractiveness, not to say beauty, of whichever plate is revealed. The various elements of every plate are arranged both functionally and artistically: the principal map (or maps) usually occupies the center, is surrounded by graphs, smaller maps, illustrations, and like materials on supplementary topics, and is accompanied by two or three blocks of text to help the reader interpret the maps and other graphics. Colors not only are very attractive but also are remarkably clear and distinctive. There is no standard map scale or set of scales for this atlas; instead, the size and extent of every map appear to be customized not only to accommodate the data but also to fit harmoniously with other elements on the plate. The projection is not identified. The scale of

each map is indicated by a representative fraction, but only the one or two more important maps on a plate are likely also to carry a graphic scale of miles and kilometers. The artistry is especially evident in the arrangement of shapes, the choices of colors, the line weights, the choice of symbols, and the manner in which patterns are presented. The paper is opaque without being too heavy and has a matte finish that keeps the type and line work crisp and easy to read. The printer has done a superb job of keeping the colors precisely in register.

Whereas the graphs, tables, and other supplementary materials are usually enclosed in rectangular borders that double as scales of time and quantity, most maps float free on the plate, unencumbered by borders, by lines of longitude and latitude, or by north arrows or other indicators of orientation (the implicit orientation is to the north). Where the edge of a map does not naturally make a clean break (as along a shoreline), it is airbrushed to give a feathered effect to the transition from subject area on the map to white space on the plate. This is the style in all three volumes of the atlas, and it dates back to the initial planning of the project. The overall effect gives every plate thematic and visual coherence while leaving the various elements so loosely structured as to encourage (if not require) browsing or a kind of visual free association.

Unfortunately, there are serious problems that affect the utility of the atlas and some have to do with the cartography. On plate 40, for example, inconsistent treatment of symbols is demonstrated on a trio of nearly identical maps that use graduated circles to symbolize quantities of farm products. The first map lets both rivers and boundaries show through the circles, the second map's circles are transparent to rivers but not to

boundaries, and circles on the third map obliterate everything beneath them. In the center of plate 56, there is a multi-part, two-color graph of social welfare institutions that lacks a key to the colors; it is not hard to infer the meaning of the graph but that does not excuse the lack of a legend. At the top of plate 17, a map of fur production displays a network of heavy black lines (district bounds, perhaps) that are not identified in the legend or the text. The map of "Cleared Land, 1842" on plate 14 is a dot map on which the dots appear in interesting patterns within townships. As in all maps of this type, the number of dots (communicating quantity) and their positions (communicating pattern of distribution) are the key elements. How frustrating to learn from the back notes that the dots have been plotted according to a randomizing program, implying that the positioning of the dots is completely artificial and is not related to any characteristic of the data. However, the most frequent and frustrating experience is encountering maps that feature a spectacular but confusing mass of overlapping graduated circles (the quantitative symbol used most often). Inevitably, the reader is left wondering what can be inferred from such a display, other than an abundance of the particular phenomenon. No atlas as large, as complicated, and as densely packed with data as this one is can be entirely free of glitches and small errors in design and execution, but the problems described above are neither isolated nor unusual; they are representative samples of what too often confronts the map reader who examines the details of the plates and tries to grasp their message.

On a number of plates, the base maps employed to show distributions are colored to distinguish between "settled area" and presumably empty land. The term

"settled area" is never defined. It could mean population density above some minimum level. A comparison with the dot maps of population distribution reveals a very close correlation between the distribution of people recorded in the censuses and the settled areas, although the 1851 "settled area" south of Dalhousie and Chaleur Bay is much larger than it is for later censuses and is larger than appears warranted by the population distribution map for 1851. Plate 5 implies that all land used by Indians in 1891 lies outside the settled areas, and that "settled area" means territory occupied by people of European background. The Indian reserves fall in the non-settled area. Perhaps by 1891 there no longer were any Indian settlements, and perhaps the key really is population density, but whatever the standard is, it should be made clear to the reader. This is more than a matter of vogueish political correctness, for it speaks the editors' fundamental conceptions of the nature of Indian culture and of the subject matter of the atlas. It may be one of the issues of interpretation that later researchers will dig out of this "research quarry reflecting contemporary views."

How easy or difficult is it for a reader to find the information and insights that the authors and editors have poured into this book? That is a question that must be asked of every reference work. For example, can a reader quickly and easily find a long lost fur trading post or military garrison in this atlas? Trading posts and garrisons are mapped here, but, without an index, the answer is: no, it will require time and effort. Of course, anyone trying to compile an index would be frustrated by the floating maps and text because they bear no coordinate system with which to make references. What about plain topical research into a subject

like population? Even though several plates are explicitly concerned with demography, information about population is also presented on a number of plates concerned with other subjects. The table of contents is a good one, but it is not meant to function as anything except a table of contents, and having to search it for the titles of maps and graphs on population is an unattractive chore. By the standard of accessibility, this atlas fails, and that may discourage readership.

Hundreds of talented, accomplished, and dedicated people, some of whom labored at this project for nearly two decades, did a marvelous job of gathering a treasure of historical knowledge and insight, and then they put it almost out of reach by casting it in a barely accessible form. Had more attention been paid to making the information highly accessible and to assuring clarity in the maps and text, this second volume of the *Historical Atlas of Canada* would have been the exemplary contribution its makers strove to achieve. □

ATLAS REVIEW

Atlas of the Pacific Northwest, 8th ed.
Philip L. Jackson and A. Jon Kimerling, editors. Corvallis, Oregon: Oregon State University Press, 1993. 152 pp., maps, diagrams, tables, photographs. \$32.95 cloth (ISBN 0-87071-416-3). \$19.95 paper (ISBN 0-87071-415-5).

*Reviewed by Joseph Poracsky
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This regional atlas of the Pacific Northwest was first produced in 1953 and new editions have been published every four to eight years

since. The edition previous to this 1993 edition was published in 1985. The volume is largely a product of the Department of Geosciences at Oregon State University. Nine of the contributors (including the two editors) are full-time faculty members and three contributors are emeritii of that Department. Other contributors are from the Marine Resources Program at Oregon State University, the Geography Department at the University of Washington, and the Oregon Department of Transportation.

Each chapter was prepared by one or two of the sixteen contributors. The chapters range in length from five to thirteen pages. The first chapter provides a brief introduction and spatial context for the region. Seven chapters cover human geography issues: "Historical Geography," "Population," "Transportation," "Land Use," "Agriculture," "Manufacturing and Industries," and "Recreation Resources and Tourism." Four chapters cover physical environment issues: "Landforms and Geology," "Climate," "Vegetation," and "Soils." Six chapters cover some aspect of resources: "Water," "Energy," "Commercial Timberland," "Ocean Resources," "Minerals and Mining," and "Hunting and Fishing."

The atlas combines text, tables, maps, photographs, and other graphics. There are a total of 159 maps, 31 photographs, 27 tables, 20 graphs, 5 illustrations, and 3 block diagrams. The volume has an 8.5" x 11" page size, and is bound as six signatures in a 32-32-16-16-32-32 page sequence, and utilizes what appears to be a 160 line dot tint. The four 32-page signatures are printed on a bright white un-coated stock in two colors: black and a reddish-brown, reminiscent of the color scheme and appearance frequently found in many textbooks. The middle two 16-page signatures are printed

in four-process color, creating visual variety and a different look in this part of the atlas.

The body text is set in Times Roman, 11/13 and 19 picas wide, creating an uncluttered and inviting appearance. A variety of typefaces are used on the graphics, including Times Roman, Bookman, Futura, and Helvetica and the sizes vary from 4 point to 20 point and are very legible.

A number of map types are used in the atlas to illustrate a variety of distributions. Point, line, and area shading symbols are used to identify cities, highways, parks, dams, major tectonic features, etc. Isoline maps are used to portray the distribution of precipitation, temperature, mean date of last killing frost, and surface runoff. Dot maps present information on population and agricultural production. Graduated pie maps relate patterns of minority population by county, surface water withdrawals by use, and waterfowl harvest. Choropleth maps portray population density, percent of land in farms, percent change in employment, and a variety of other economic and agricultural data.

This new edition states that it has "113 new maps and charts, and several maps have been redesigned for graphic clarity." Although many maps are new, most are simply reprints from earlier editions. This mix results in frequent shifts in style from map to map that reflect the various looks of several editions. This stylistic contrast is especially apparent in variations in line weight hierarchies, shifts in typeface selections, and differences in base map detail. These inconsistencies are particularly noticeable when maps appear side-by-side (as on page 28, where one map uses a red-brown thematic layer on a gray flat tint base and the other map reverses the visual association and uses a black thematic layer on a red-brown

base). This raises a basic issue with regard to atlas design; should a rigid set of design guidelines be followed in an attempt to produce a uniform "look?" Or should the guidelines be allowed to vary in an attempt to make each map distinctive and thereby stand out in the reader's memory? There is unlikely to be a "right" answer to this question.

Other graphic shortcomings of the atlas include poor symbolization choices. This is particularly apparent in the diagram on page 87 and the maps on pages 96, 108, 134-5 and 138-9, where graduated symbols would have been more effective to show different quantities. There are also problems with the photos; all but one or two of them lack captions and their connection to the text (if any) is unclear. There is a sense that the photos are included simply as space filler and to provide visual variety.

The most serious criticism of this atlas relates to the documentation of information and data. The atlas has no index—a situation that might be excused by the topical nature of the chapters and the relative ease of finding subjects within such a structure. However, there is no bibliography either. Only one map and a handful of the tables in the atlas cite their data sources. Perhaps the most glaring example of this problem occurs on page 137, where the text discusses a recent analysis "undertaken by Swanson" and a map is presented based on that analysis, but nowhere is there a bibliographic citation of the Swanson source. Three chapters do end with lists identified as "Further Reading," "Sources," or "References." However, the omission of a proper bibliography leaves the reader with no springboard to explore issues further.

Overall, a good job was done in editing the atlas and few errors were detected. The registration is

generally good, with only a few distracting miscues (e.g., maps on pages 22, 31 and 104). Despite its shortcomings, the *Atlas of the Pacific Northwest* does contain a great deal of information. In general, information is presented clearly and effectively and the maps presented provide a useful introduction to a large and varied region. In short, this edition of the atlas succeeds in packing a great diversity of themes into a slim volume and carries on the tradition that was started forty years ago, maintaining its place as an indispensable reference work on the Pacific Northwest (at least until the ninth edition appears in a few years). □

BOOK REVIEW

Maps are Territories: Science is an Atlas

David Turnbull, with a contribution by Helen Watson with the Yolngu Community at Yirrkala. Chicago: The University of Chicago Press, 1993. 66 + vi pp., 14 maps in color, 43 in black and white, and 15 additional illustrations, further reading, acknowledgments. \$12.95 paper. (ISBN 0-266-81705-9).

*Reviewed by Mark Warhus
Department of Geography
University of Wisconsin - Milwaukee*

David Turnbull's book, *Maps are Territories: Science is an Atlas: A portfolio of exhibits*, examines questions about the nature, content, and meaning of maps through a series of museum exhibits. Like an annotated gallery guide, the book presents and comments upon a wealth of images in an effort to show how all maps function as a metaphor for

knowledge and as a means of knowledge representation.

The book was first published in 1989 by Deakin University Press in Geelong, Australia. It was written in response to a review and critique of the cross-cultural content of course material used in Deakin University's Social Studies of Science. It includes examples of maps from Asian, Native American, and Aboriginal-Australian cultures, along with a selection of western maps from various time periods and countries. Although written as one of six "Portfolios" for use in the course, the book stands alone as a thought-provoking introduction to issues of cartographic conceptions and practices.

The preface explains that the book "is conceived and structured not as a linear verbal narrative but as a progression of museum or gallery exhibits designed to exercise the skills of visualization and visual analysis, so essential to any understanding of the basic theoretical issues of perception and cognition." In keeping with this museum motif, the book's contents are arranged in eleven exhibits rather than chapters. These exhibits include reproductions of maps, explanatory illustrations, quotations from relevant books, and short essays. The exhibit topics cover "Maps and Theories," "The Conventional Nature of Maps," "Maps and Pictures," "Aboriginal-Australian Maps," "The Function of Maps," "Maps—A Way of Ordering Knowledge," "Maps—A Way of Ordering Our Environment," and "Maps and Power." These exhibits are actually illustrated discussions of the concepts and ontological arguments Turnbull is presenting. Within each essays, he draws upon authorities as diverse as Arthur H. Robinson and Ludwig Wittgenstein to explain or question some of the basic concepts of what maps are and how they work.

The first exhibit "Maps and Theories" sets the stage for the rest of the book. In examining the "theory as map metaphor," the author cites T. S. Kuhn's *Structure of Scientific Revolutions* to note that paradigms that embody theories "provide scientists not only with a map but also with some of the directions essential for map-making. In learning the paradigm, the scientist acquires theory, methods, and standards together, usually in an inextricable mixture." This statement of the ties between how we think of space (the theory) and how we portray it (the map) is extended beyond the western cartographic tradition to include all forms of map making. Turnbull contends that the role of space in ordering knowledge and experience is a fundamental construct in all cultures. He cites Malcolm Lewis's contention that "cognitive maps"—the ability to apply names, symbols, and spatial relationships to things—"may have been a major factor in the intellectual development of hominids." At the same time, Turnbull speculates that the perception of relative location "may constitute one of the variables that differentiate the way cultures experience the world." In other words, while spatial cognition is a universal phenomenon, it is only expressed in culturally relative systems. Having thus shown "the Western world view" to be one of many possible ethnocentric means of understanding the perceived world, Turnbull goes on to identify two characteristics of all maps. First, he argues that maps are selective, meaning that they are incapable of displaying all there is to know about any given piece of the environment. Second, he asserts that to be a map they must represent at least some aspect of the landscape, albeit a landscape which embraces the full extent of J. B. Harley's and David Woodward's definition of a map as a representation of the spatial

understanding of "things, concepts, conditions, processes, or events in the human world."

As can be seen from this synopsis of the three pages that make up the book's first exhibit, *Maps are Territories* can be a little heavy going. However, once he has established the philosophical underpinnings of the work, Turnbull presents the rest of his exhibits in a more straightforward fashion. Throughout the book, he applies concise and well-informed reasoning to the examination of particular aspects of maps. For example, Exhibit 2, "The Conventional Nature of Maps," explores the roles of both the human agents who produce maps and of the various conventions (e.g. symbols, icons, tools, and methods) that are arbitrarily applied in the representation of the environment. The interaction between a convention's functional adaptations (e.g. map projections and the interests they serve) is seen as one aspect of the power inherent in maps. Turnbull points out that in Western society this power is enhanced by the value placed on "artless" maps – those that are perceived as simple renditions of the landscape providing objective "real world information." He also points out the similarities between this western view of maps and western scientific discourse in which the representation of the phenomenal world is, like maps, laden with conventions.

Rather than defending these western cartographic and scientific claims to "objectivity," Turnbull advocates a constructivist approach. He suggests that we consider our representations of the world as active constructions in which "our experience of the world and our representations of it are mutually interdependent, so there is a sense in which the two are inseparable. Or, to put it in its most contentious form, 'the map is the territory'." Having made his

thesis statement, Turnbull continues with exhibits that examine related aspects of maps. In doing so he often uses non-western maps as examples or demonstrates how, on closer inspection, these "primitive" maps have the same functional characteristics usually thought to be the sole preserve of "accurate," i. e. western, maps.

In Exhibit 4, "Bringing the World Back Home," Turnbull discusses the quality of "indexicality," meaning that maps are dependent upon their context for their truth. Indexicality is often cited as a shortcoming of so called "primitive" maps. Turnbull points out that this can be just as easily said of Western maps, though he admits that the context for western maps is sometimes based on a much larger scale (as in the cartographic convention created by the 1884 international agreement which established the location of the prime meridian). In exhibit after exhibit, the author shows how the distinguishing characteristics of maps—those qualities which make them so basic to the human experience of the world—are universal characteristics. He also makes it clear that all societies imbue their maps with the power to order knowledge and pass it on to succeeding generations.

The principle that culturally relative perceptions are represented in constructs (maps) that have unique universal characteristics raises interesting questions about the nature of human experience and our attempts to express it in functional forms. If, as Turnbull contends, "our experience of the world and our representations of it are mutually interdependent," then the "theories" or concepts that we use to explain and organize this experience represent what Turnbull calls "shared examples of practice" or "science." In this context, Turnbull makes his corollary statement that "science is

an atlas"—a compendium of theories which allow a society to hold its varied and selective experiences together in a coherent and functional image of the world.

Throughout the essays, Turnbull makes well-documented, if at times esoteric, arguments. The many cross-references to the book's maps and illustrations begins to achieve a museum-like quality, providing a visual as well as a textual experience for the reader. This is a fortunate synergy, as the text alone would be a daunting read for any but the most philosophically inclined and it is hard to imagine a long queue forming at the entrance to an exhibition which begins with framed quotations from Jorge Luis Borges and Brian Harley. Luckily, the rich array of images makes the mental aspects of understanding "the basic theoretical issues of perception and cognition" a little less arid. Furthermore, the concepts which Turnbull presents do need to be understood and internalized by anyone involved with thinking about, producing, and reading maps. The book, despite its difficulty, makes a good complement to any serious study of cartography.

Perhaps the most successful aspect of the book is its frequent use of non-western maps. Examples of Native American, Pacific Islander, Chinese, prehistoric, and Aboriginal-Australian maps are shown side by side with western maps and examined with the same careful analysis. Their very presence helps to give these maps some of the validity that the book effectively argues they deserve. Exhibit 5 on Aboriginal-Australian Maps, contributed by Helen Watson and the Yolngu community at Yirrkala, is perhaps the best example of Turnbull's theses in action. Watson and the Yolngu provide an in-depth analysis of the background, functionality, and cultural appropriateness of several

aboriginal bark paintings which have been interpreted as maps. The book carefully examines these "dhulan," explaining how they relate to "the Dreamtime" and represent the "footprints of the Ancestors" who named the landscape. The exhibit effectively demonstrates how these concepts help form the conventions that shape and define the Aborigines' space and how their cartography, which includes an extensive oral component, has enabled Aboriginal culture to flourish and maintain itself. Set within the concepts, arguments, and examples of Turnbull's other exhibits, this examination of the Aboriginal bark paintings is possibly as good an explanation of the nature of maps as western philosophy, history, and anthropology can provide. What it left me hoping for is to someday read an equally cogent Australian Aborigine's analysis of the "forms of life" and "primitive conventions" to be found in the western mapping tradition. □

BOOK REVIEW

Mapmakers of the Sixteenth Century and Their Maps. Bio-Bibliographies of the Cartographers of Abraham Ortelius, 1570
Robert W. Karrow, Jr. Chicago: The Newberry Library, 1993. 846 pp., maps, index. \$110 cloth plus \$6.00 shipping and handling. (ISBN: 0-932757-05-7).

*Reviewed by Clinton R. Edwards
Department of Geography
University of Wisconsin-Milwaukee*

This work had its origin in a catalog by Abraham Ortelius containing a list of cartographers and their known works from the latter part of the fifteenth and sixteenth centuries up to 1570. The

catalog, titled *Catalogus Auctorum*, has undergone several permutations including a printing by A. E. Nordenskiöld (1889) and an edition by Leo Bagrow that added biographical sketches and descriptions of the maps as well as of many other maps based on them. Karrow initially began with a proposed English translation of Bagrow's *A. Ortelii Catalogus Cartographorum* (1928-30), but soon realized that, due to the loss of many maps during World War II and the discovery of many more maps in the interim, a complete rewriting was in order. The result is not only a rewriting, but a very significant expansion of the individual biographies and the number of maps identified with their cartographers. Over 90% of the works treated were examined personally by Karrow, and although the basis was Bagrow's expansion of the *Catalogus Auctorum*, Karrow's claim that his contribution "... represents [his] own research and emphases ... [and] differs from the earlier work in many respects" is well founded.

The first biography in the book is that of Ortelius. The remaining biographies are arranged alphabetically, with the biographical texts interspersed chronologically with titles of maps, extensive commentary, and references to pertinent literature. Many familiar names appear throughout the text (Mercator, Sebastian Cabot, Münster, Waldseemüller), but many others will be recognized only by the more knowledgeable practitioners of the history of cartography. The limit of cartographers known to Ortelius will be disappointing to those who do not note the subtitle and expect to find the great early-sixteenth-century "discovery maps" and their authors represented. The names and maps range widely among the German, Flemish, and Dutch, with a smattering of French and Italian. However, the Portuguese and

Spanish maps of the Columbian and immediately post-Columbian years, as well as their Italian, German and other derivatives, are almost absent. Curiously, Ortelius seems to have known few of the "pioneers," who in the first few decades after Columbus attempted to include the Americas in their views of the world. Hence, one must turn to works like Kenneth Nebenzahl's *Atlas of Columbus and the Great Discoveries* to complement the list of sixteenth-century cartographers who attempted to represent an imperfectly known world. There are found the likes of Juan de la Cosa, "Cantino," Caveri, Ruysch, Homem, and Ribeiro.

This aside, Karrow presents a rich panoply of European cartographic accomplishment in meticulous, scholarly detail. He has also included bibliographic references to and often exhaustive treatment of the cartographers' works in other disciplines; this range includes fields such as astronomy and astrology, mathematics, medicine, the arts, history, and even ephemeral broadsides and pamphlets. The bibliography occupies sixty-one pages with over 2,000 entries, reflecting the great diligence with which Karrow has searched not only for the works of the cartographers but also for works about them and their maps. There is an index to place and date of publication of the maps that is then usefully reversed to date and place of publication. The general index is truly analytical. For example, among all the maps represented in the work, one can see at a glance a list of those of the British Isles in chronological order with their authors. Or, one finds a list, in alphabetical order of place, of the maps produced by a particular cartographer. Countries, regions, provinces, islands, and cities are interspersed with the personal names, and there are even entries on such esoterica as a map on which ice fishing is shown

or a world map in the shape of a lily.

The author's purpose, to expand on Bagrow's work and to present as fully as possible the work of the cartographers known to Ortelius, has been accomplished admirably. It makes one greedy for more. Most welcome would be collation and similar analysis in one work of the mapmakers and their maps most closely attuned to the early era of European overseas discoveries. This would enhance the many recent Columbian studies and the many others to come as we continue to observe the quincentenaries of voyages, expeditions, invasions, and foundings during the early decades of European expansion. □

announcements

MIRCOIMAGES MAP AND IMAGE PROCESSING SYSTEM USED IN 56 NATIONS

MicroImages' Map and Image Processing System (TNT mips, formerly MIPS) is actively used in fifty-six nations and in April of this year MicroImages announced shipment of version 4.6. The flexibility of this integrated GIS, image processing, CAD, and desktop mapping system has generated steady growth, expanding its use from Australia to Russia and China to South Africa.

TNTmips provides support for eleven different computer platforms with versions for PCs using Microsoft Windows 3.1 and NT; Macintosh; and workstations including IBM, Sun, DEC, Silicon Graphics, Hewlett Packard, and Data General. TNTmips features include integrated raster, vector, CAD display, editing, and

interconversion; pin mapping (symbolic map overlays from database query); symbol, line and fill pattern design tools; automated map legend generation; wide support for X-Y digitizers, scanners, plotters, and printers (laser, thermal transfer, ink jet, sublimation); database query for selection and styling of points, lines, and polygons; 3-D display; video capture; mosaicking; georeferencing and warping to many map projections; elevation mapping and orthoimage creation; classification and interpretation; statistical measurements; smart line-following; buffer zone creation; polygon fitting; watershed and viewshed analysis; screen and page layout including scale bars, map grids, and legends; outline annotation fonts and tools; and customization with Spatial Manipulation Language. Rapid, individualized technical support via phone or FAX without cost is also a contributing factor in the wide geographic spread of TNTmips. TNTmips maintains a quarterly upgrade schedule for timely delivery of product improvements.

For more information contact: MicroImages, Inc., 201 North 8th Street, Lincoln, Nebraska, 68508-1347 USA; Telephone: (402) 477-9554; FAX (402)477-9559. □

USGS OFFERS DIGITAL LINE GRAPH-3 (DLG-3) DATA IN THE SPATIAL DATA TRANSFER STANDARD (SDTS)

The U.S. Geological Survey (USGS) is distributing digital line graph-3 (DLG-3) data in the spatial data transfer standard (SDTS) format. The SDTS, approved as Federal Information Processing Standard (FIPS) 173, was developed to allow the exchange of spatial data between dissimilar databases and

processing systems. The availability of USGS data in SDTS format is regarded by the USGS as a major step toward successful use of the SDTS.

The SDTS specifies an exchange format, including structure and content, for spatially referenced vector and raster data. The SDTS is the national spatial data transfer mechanism for Federal agencies, and will be available for use by State and local governments and the private sector. This means increased access to and sharing of spatial data, the reduction of information loss in data exchange, less duplication in data acquisition, and increased quality of spatial data. The USGS, as the SDTS maintenance authority, conducts various activities to promote acceptance of the SDTS and demonstrates examples of prototype uses of the standard implementations. Initially, only 1:24,000-scale and 1:100,000-scale DLG-3 data will be available in SDTS format, but additional data sets will become available later.

For more information on the SDTS, contact the SDTS Task Force, U.S. Geological Survey, 526 National Center, Reston, VA 22092 or e-mail to sdts@usgs.gov. For information about the distribution of DLG-3 in the SDTS format, contact any Earth Science Information Center (ESIC) or call 1-800-USA-MAPS. □

SPACE SHUTTLE EARTH OBSERVATION PHOTOGRAPHY

For more than 30 years (beginning with the Mercury missions in the early 1960s), earth-views have been photographed by astronauts using hand-held cameras. More than 100,000 of these are now available for purchase. Most of the

Continued on page 57


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**cartographic
perspectives
Back Issues**

The first issue of Cartographic Perspectives was published in March 1989. Back issues (for all issues) are now available at a cost of \$20 per issue (\$10 for members). Please specify the issue numbers (1-18) when ordering. Makes checks or purchase orders payable to NACIS. Send your back issue requests to:

Edward Hall, Treasurer
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NACIS Board Meeting August 9, 1994 Ottawa, Ontario

The following members of the Board were present: C. Harrington, H. Castner, E. Hall, C. Remington, J. Patton, R. Bolton, B. Fine, D. Tilton, D. Schenstrom and P. Chalk. Vice President Elect Keith Rice was also present. The meeting was called to order at 3:10 and the minutes of the April 16, 1994 meeting were approved after minor changes.

Election Results

D. Tilton reported the results of the 1994-95 NACIS Board and Officer Election as follows: Vice President- Keith Rice; Treasurer- Ed Hall; Board of Directors- Patricia Gilmartin and Carolyn C. Weiss.

Treasurer's Report

E. Hall reported a total balance of \$21,002.80 for all NACIS accounts. Hall discussed the poor rate of interest returned on the Society's money market account. He suggested the reinvestment of some of this money into certificates of deposit. It was decided that \$5,000 should be invested in a short term C.D. of 6 months and that an additional \$5,000 be invested in a longer term C.D. of at least 15 months.

NACIS XIV

H. Castner reported on a few minor changes in the program. He finds that attendance for this meeting is down from previous years. Despite the lower attendance, the use of the University of Ottawa's facilities have kept the costs of the meeting down. A final financial accounting of the meeting will be available in the early fall.

NACIS XV

J. Patton reported that a contract had been secured with the Hilton

Hotel in Wilmington, North Carolina for our annual meeting. Dates of the meeting are October 25-29, 1995. Room rates are \$70.00 per night. 140 room nights are required in the contract and members of the Society are encouraged to mention their affiliation with NACIS when making reservations.

Future Meeting Sites

P. Chalk reported on her review of potential sites in San Antonio, Texas. The Board preferred a downtown location at a room rate of \$65 to \$80 between Oct. 1 and Nov. 7. The Board offered suggestions on local contacts as arrangements for this meeting site become more definitive.

Cartographic Perspectives

D. Tilton circulated a written report from Sona Andrews and himself addressing pertinent issues. Highlights of this report include the following: 1) abstracts accompanying articles will be translated into both Spanish and French; 2) future issues will arrive in polybags allowing for the use of inserts; 3) there is a need to reestablish the "non-profit" status of the Society with the post office to save on mailing costs; 4) there will continue to be one color issue per year and; 5) a call for the submission of more manuscripts for review.

Other Business

R. Bolton and B. Fine will be mailing letters to solicit new memberships. Thanks were offered to Jeff, Ron and Hull for their service to the Board. The meeting was adjourned at 5:15 p.m.

*Submitted,
Craig Remington
NACIS Secretary*

NACIS Business Meeting August 11, 1994 Ottawa, Ontario

The meeting began at 6:33 p.m. with the announcement of election results. Thanks were given to those members leaving the Board. Ed Hall circulated a statement reviewing the balances of all NACIS accounts as a part of his Treasurers report. Sona Andrews spoke to issues involving Cartographic Perspectives. A color issue will be mailed in September. She asked for the submission of more manuscripts, especially from map librarians. About 50 new members have resulted from the flyer circulated in the A.A.G. Cartographic Specialty Group newsletter. There was broad agreement that advertising should not be placed in C.P. Barbara Fine suggested that a list of benefactors be printed, in lieu of ads. Sona spoke to the problem of forwarding bulk mailed copies of C.P. Other business included the appointment of Dan Seldon as our representative to the Cartographic Users Advisory Council.

Henry Castner brought before the membership an invitation to NACIS to participate in a mini-conference in San Jose, Costa Rica. A discussion of this matter brought forth the issues of costs, the makeup of the Costa Rican organization, and our past efforts to make contact with interested parties in Latin America. Henry raised questions over the content of the program. Dave Tilton pointed out that the opportunity to participate should be open to all NACIS members, not just those who fill a program niche. With many questions yet to be answered, Jeff Patton offered a motion that the Board proceed with a positive response to the invitation with the support of the

membership. The motion was seconded and passed. The final matter of business was Charles Harrington's request that members consider running for office. The meeting adjourned at 7:40 p.m.

*Submitted,
Craig Remington
NACIS Secretary*

NACIS Board Meeting August 13, 1994 Ottawa, Ontario

The following members of the Board were present: H. Castner, E. Hall, C. Remington, C. Harrington, P. Chalk, B. Fine, D. Schenstrom,

C. Rice, D. Tilton, and C. Weiss. Former Board member R. Bolton was also present. The meeting was called to order at 9:05 a.m.

The meeting began with the welcoming of Carolyn Weiss to the Board and a review of the election results.

The vast majority of the time spent at the meeting involved a discussion of invitation from Costa Rica and the procedural steps NACIS should follow in exploring this idea. As a result, Henry will exchange letters with Professor Ucles Nunez in an attempt to develop a program that is compatible with their desires and is representative of the Society's broad interests. Henry will also

mail a letter to the membership appraising them of the status of this opportunity. The Board will hold a conference call meeting in late September or early October to evaluate our progress and plan further steps. At this time a decision for a 1995 or 1996 meeting would be made.

Final matters included the necessity to reestablish the non profit mailing status of C.P. The Board supported not allowing advertising in the publication. A mention of donations from benefactors to C.P. was deemed acceptable. The meeting adjourned at 10:15 a.m.

*Submitted,
Craig Remington
NACIS Secretary* □

Announcements continued from page 54

photographs are in natural color, however, color infrared film has also been used on some missions, and a small amount of black-and-white film has been used with polarizing filters.

Five lenses (40-mm, 50-mm, 100-mm, 250-mm, and 500-mm) on a Hasselblad camera and two lenses (90-mm and 250-mm) on a Linhof camera offer a wide variety of both areal coverage and spatial resolution. For most Shuttle missions, the orbital track covers the tropical and temperate regions of the Earth between 28 degree N and 28 degree S latitude, but about a fourth of the missions have flown up to 57 degree N and 57 degree S latitude. Repeat coverage of an area is obtained by acquiring photographs on several missions and by taking photographs from different viewing angles during a single mission. As a result of the Earth's rotation and the duration of the Shuttle's orbit (approximately 90 minutes), an area may be photographed at different Sun

angles during a single mission. Stereoscopic coverage is available for a number of areas.

Prints, slides, and transparencies of Space Shuttle Earth-looking photographs are distributed through three agencies (listed in the column to the left).

A user may contact these agencies for ordering assistance, price lists, and order forms. To order a picture, submit the Space Transportation System (STS) mission number, the film roll number, and the frame number. If your interest lies in a specific area, you can search the electronic data base yourself or obtain a listing of available photographs through the EROS Data Center. Submit the geographic name (i.e. country, island chain, ocean, or sea) and the latitude and longitude coordinates for the area of interest. The Space Shuttle Earth Observations Project recommends that you view the photograph you are considering either on microfilm or laser videodisc before ordering. □

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

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

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

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

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

Cartographica. A quarterly journal endorsed by the Canadian Cartographic Association/ Association Canadienne de Cartographie that features articles, reviews and monographs. 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 a list of recent cartographic literature. Contact: Hon. Secretary, Charles Beattie, 13 Sheldrake Gardens, Hordle, Lympington, Hants, SO4 10FJ, England.

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

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

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

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

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

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

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.

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

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

FEATURED PAPERS

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

REVIEWS

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

TECHNICAL GUIDELINES FOR SUBMISSION

Literature cited should conform to the Chicago Manual of Style, 13th ed., University of Chicago Press, Chapter 16, style "B." Examples of the correct citation form appear in the feature articles of this issue. Authors of Featured Papers should submit four printed copies of their manuscript for review directly to Dr. Michael Peterson, Chair of the *CP* Editorial Board, Department of Geography, University of

Nebraska - Omaha, Omaha, Nebraska 68182. Manuscripts are reviewed by a minimum of two referees. The recommendations of the reviewers and the Chair of the *CP* Editorial Board are sent to the Editor of *CP*. The Editor will contact all authors to notify them if their paper has been accepted for publication and if revisions are necessary prior to publication. The following technical guidelines should be followed for all accepted manuscripts (these guidelines also apply to book, map, and software reviews).

Material 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*, *MS Word*, and *MacWrite* are preferred, as well as documents generated on IBM PCs and compatibles using *WordPerfect* or *MS Word*. ASCII text files are also acceptable.

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

Materials should be sent to: Dr. Sona Karentz Andrews, Editor- *Cartographic Perspectives*, Department of Geography, 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.

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

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

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

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

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

§ to influence government policy on cartographic information.

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

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