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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C D-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.

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.

BACKGROUND FOR THE PROJECT

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

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[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

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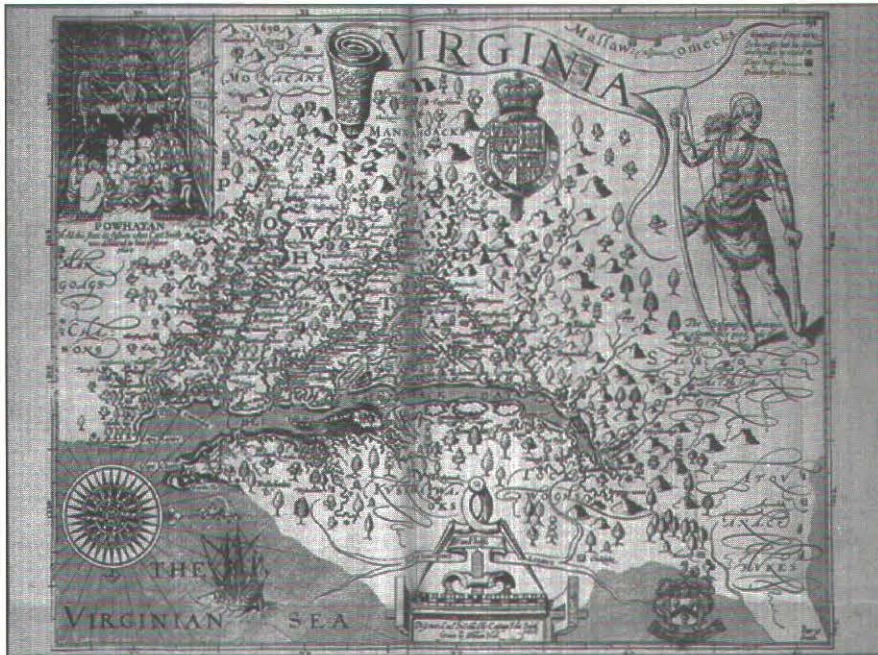
Figure 4. European maps such as this 1612 map of Virginia by John Smith often made extensive use of information provided by Native Americans. These maps are included in the archive to document the significant contribution made by Native Americans to the European mapping of North America.
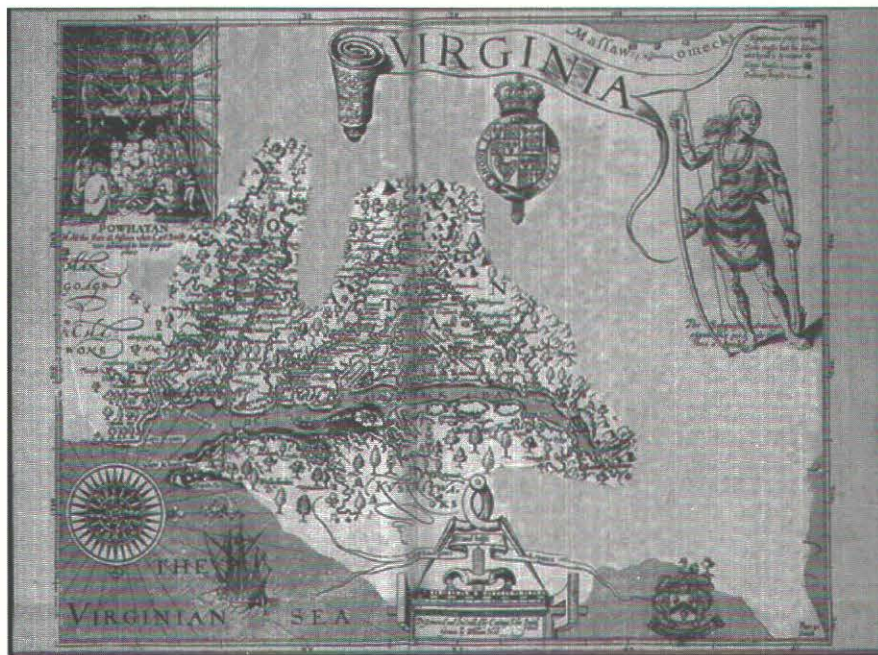

Figure 5. Archive users will be able to visualize the extent of information provided by Native Americans on European maps such as this one by John Smith (see figure 4) by clicking a button that literaly dissolves away the information supplied by Native informants.

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, DEBABALIZER, 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).

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

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

Le Département de géographie de l'université du Wisconsin à Milwau-
kee 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 Divi-
sion 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
hypermédiatique. 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 discus-
sion de la technologie employée, des échantillons d'images et de
données et une description du fonctionnement de l'interface.

SOMMAIRE

El Departamento de Geografía de la Universidad de Wisconsin-Milwau-
kee 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 Endow-
ment 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.

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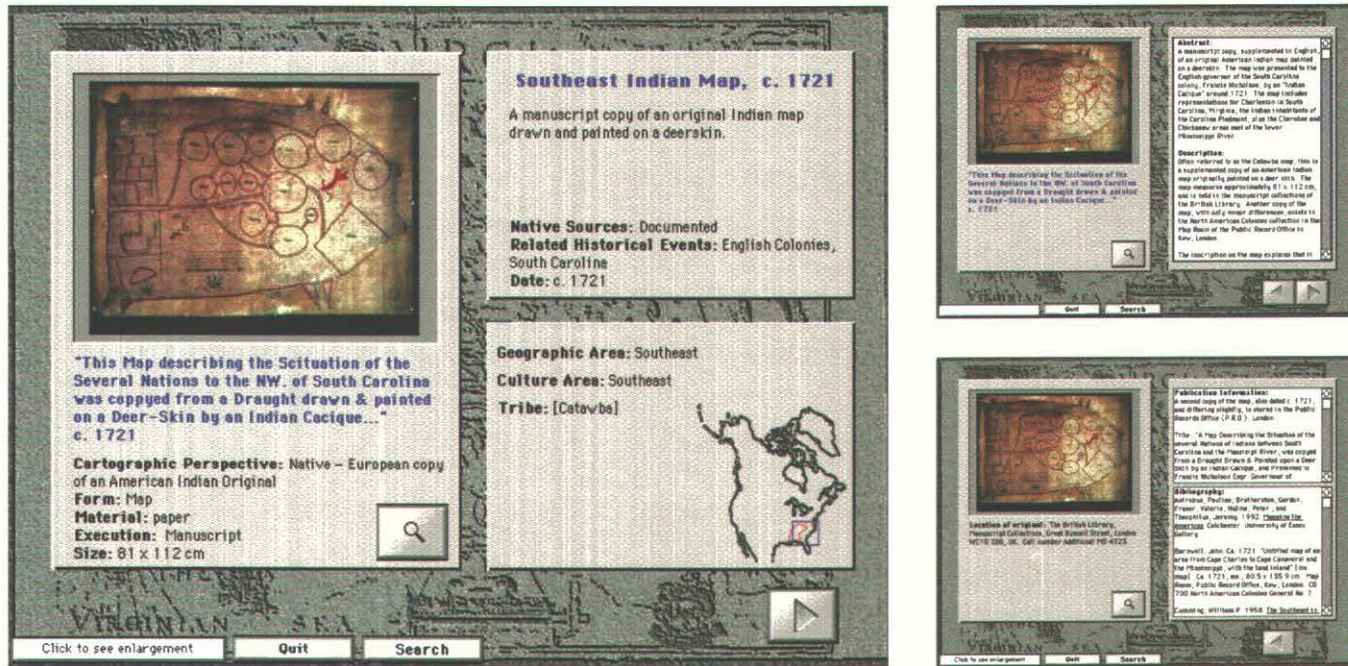*Color figures for "Creating Interactive Media on CD-ROM," pp. 31-36.*

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, maker, 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).
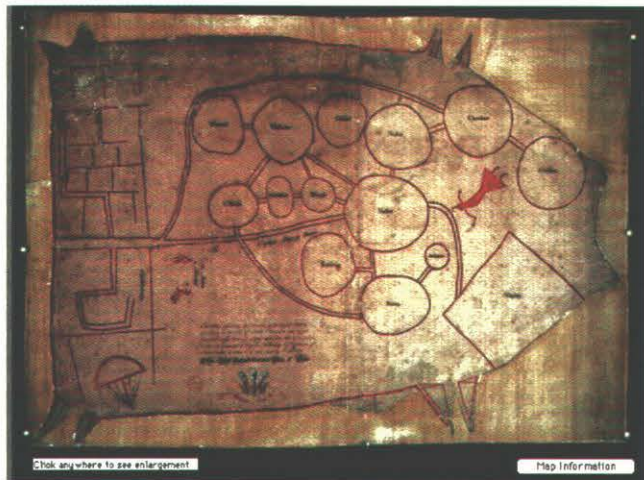
Figure 2. A full screen (640 x 480 ppi) enlargement (shown here at approximately 38% of original size) can be accessed by clicking on the thumbnail image or magnifying glass button available in the screens shown in figure 1. Tiled enlargements of the map can be accessed by placing the mouse pointer over the image and clicking (see figure 3).
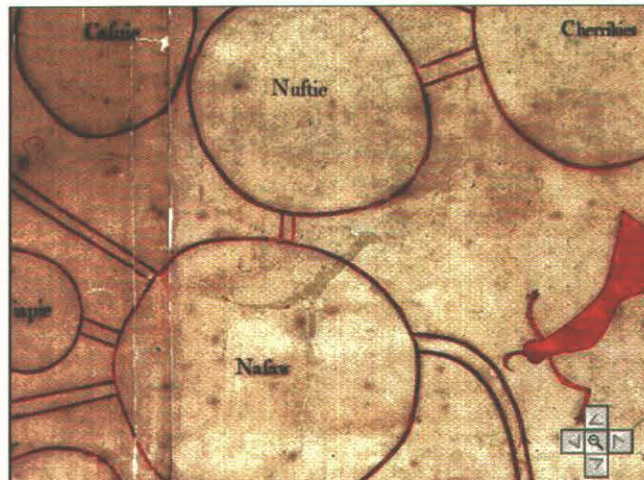
Figure 3. A tiled enlargement (shown here at approximately 38% of original size) of a portion of the Southeast Indian Map (see figure 2). Adjacent tiles can be accessed by using the arrow buttons in the lower right portion of the screen.

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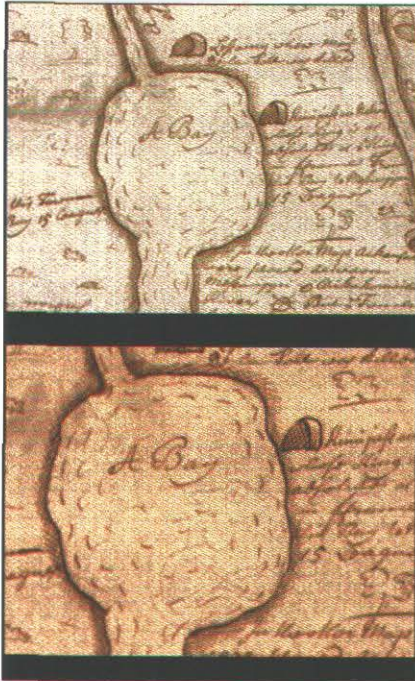

Figure 3. A portion of a map scanned at the highest Photo CD resolution (2230 ppi) compared with the same area from a 3175 ppi scan on a Nikon LS-3510AF.
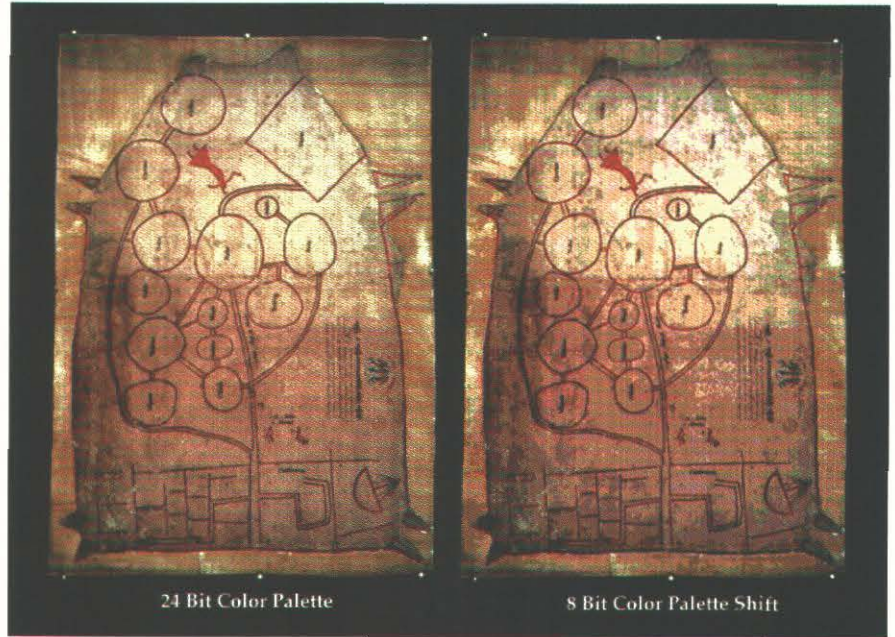

24 Bit Color Palette   8 Bit Color Palette Shift

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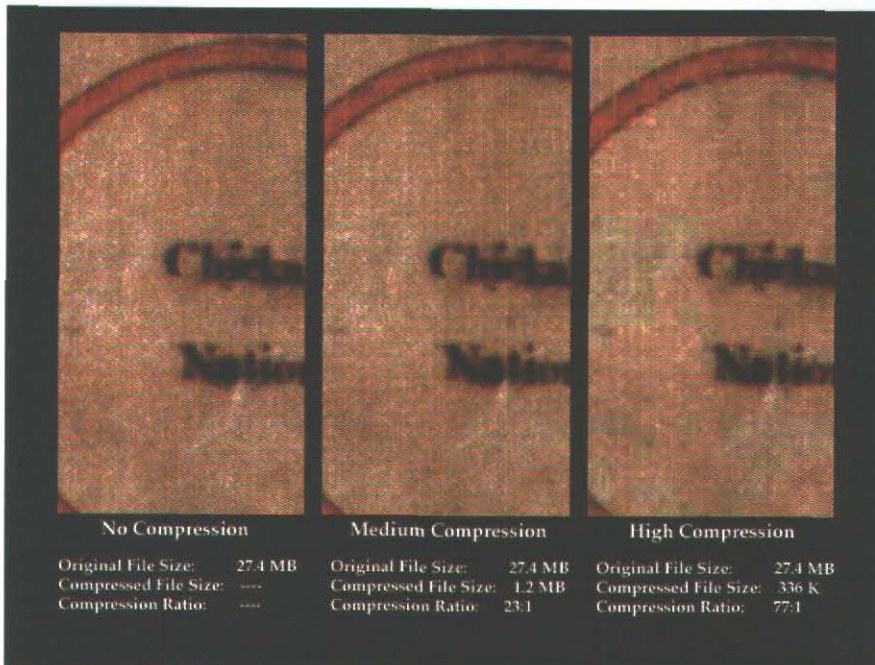

No Compression   Medium Compression   High Compression

Original File Size: 27.4 MB	Original File Size: 27.4 MB	Original File Size: 27.4 MB
Compressed File Size: ----	Compressed File Size: 1.2 MB	Compressed File Size: 336 K
Compression Ratio: ----	Compression Ratio: 23:1	Compression Ratio: 77:1

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.
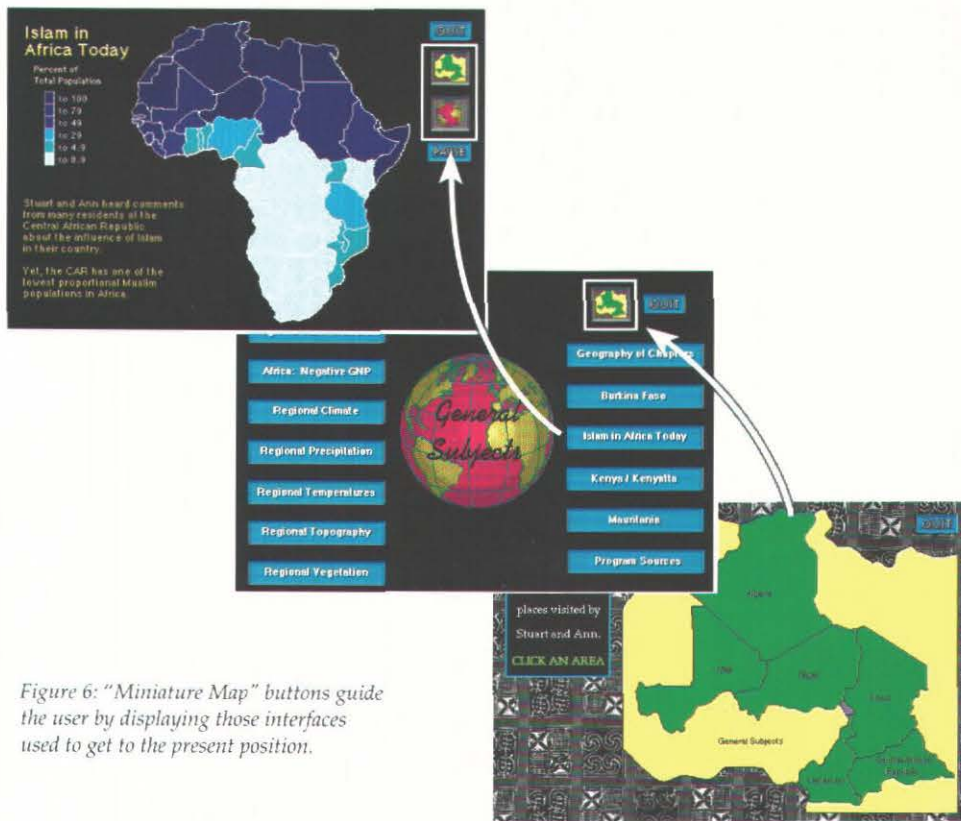
Figure 6: "Miniature Map" buttons guide the user by displaying those interfaces used to get to the present position.
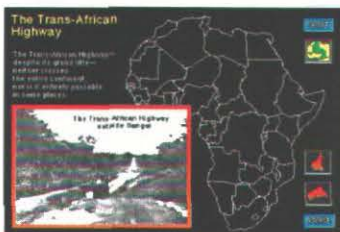
Figure 4: Upon clicking Cameroon, for instance, the user will find her/himself at a secondary menu with several different subject "buttons." A click on any of these initiates an animated multimedia event, exemplified by the Trans-African Highway sequence. The user is returned to the sequence's subject menu after the event has finished playing.

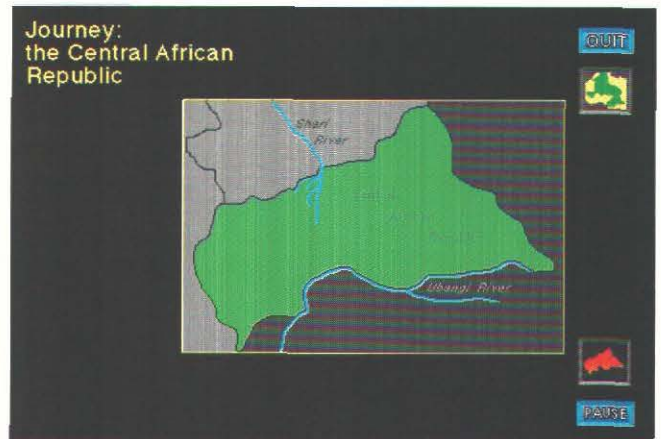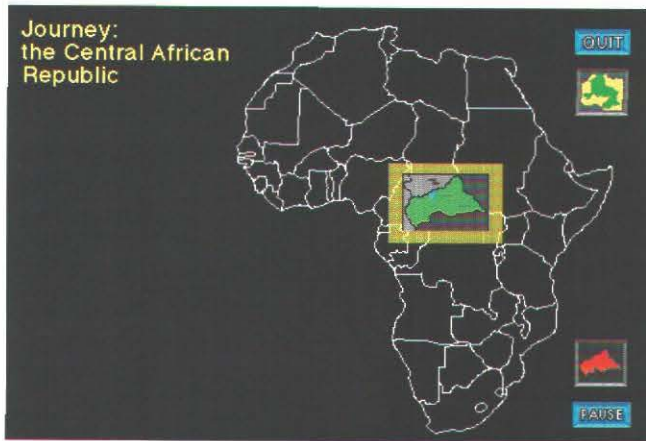*Color figures for "The Armchair Traveler Plugs In," pp. 20-25.*

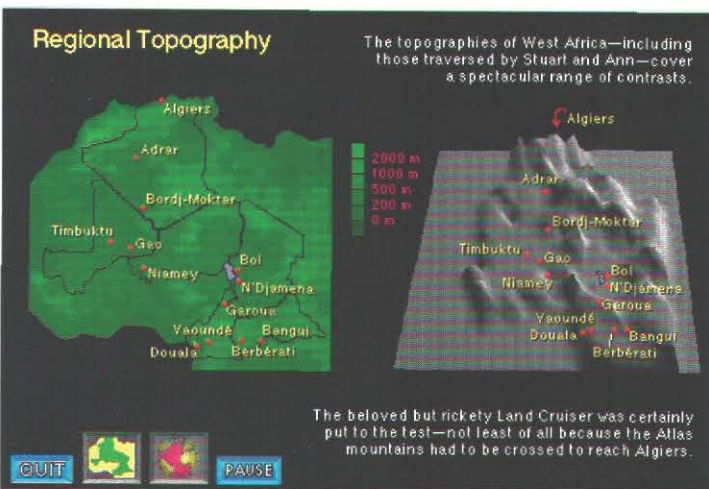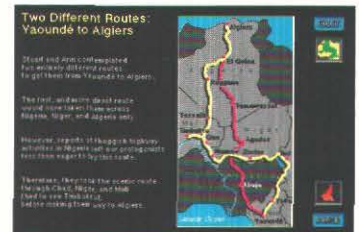
Figure 7: "Growing Maps" put map excerpts into context.

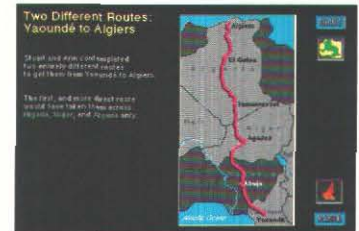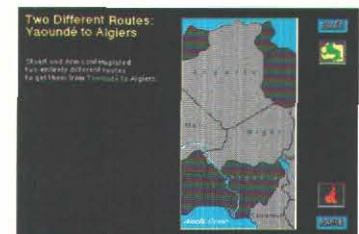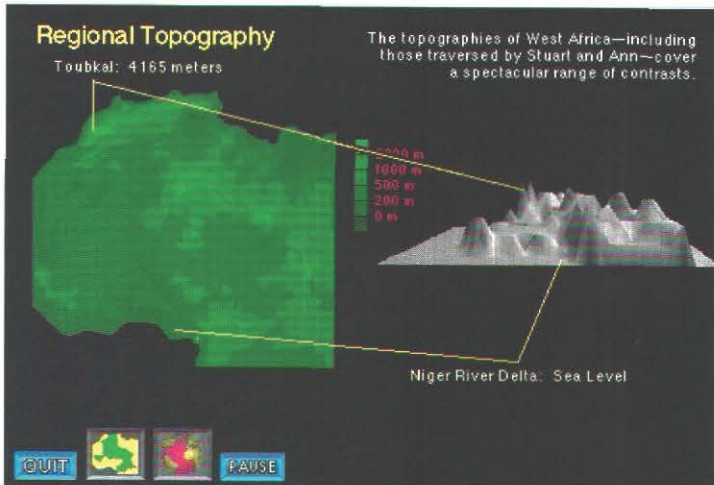Figure 5: Sequential animated overlays make the simplest map rich in information.

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