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 carto-graphic challenges GeoSystems faced in condensing these complex events into brief (4-5 minute) animations.

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INTRODUCTION

T he *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).

"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 competi-tive 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 anima-tions. 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.

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

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

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

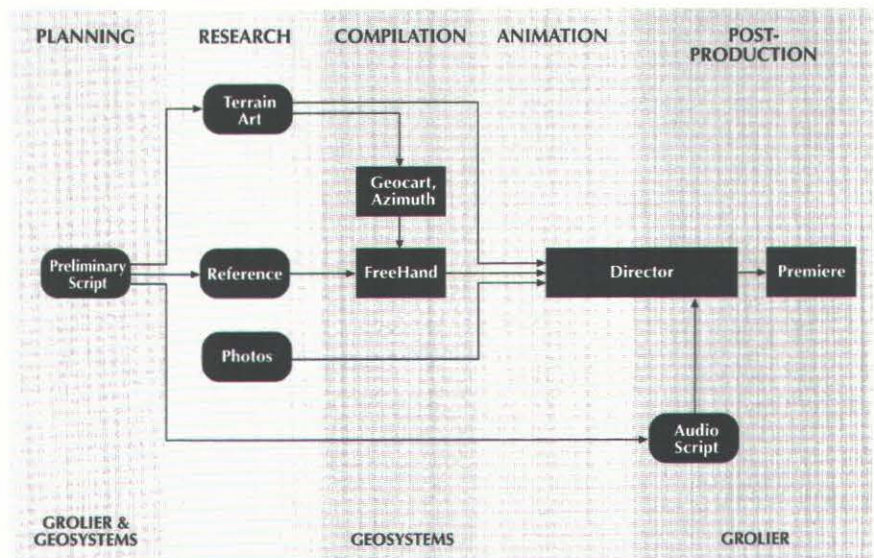USING MACROMEDIA DIRECTOR

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.

ACKNOWLEDGMENTS

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

EDITOR'S NOTE

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 Naútico 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.

RESUMEN

Entre janvier et juin 1994, GeoSystems - une société R. R. Donneley & 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.

SOMMAIRE

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