

cartographic techniques

Mapping for the Internet with Macromedia Director

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Publishing maps on the Internet presents today's cartographers with a new set of challenges. The Internet allows anyone, anywhere, anytime to view maps. Cartographers must now decide how to make them available, which format to use, which technology, and what map reading features to include.

The most basic issue that impacts the effectiveness of maps on the computer is *display resolution*. A screen's display resolution for today's computers ranges between 72 and 96 pixels per inch, while modern maps are printed using many times that resolution. It is as if cartography is stepping back into the days of wood-block prints. This loss of resolution can be mitigated using several techniques.

Today, many of the maps on the Internet are static. They are low-resolution images with poor data-ink (colored pixels) ratios. Better techniques must be used to increase the computer screen's ability to convey cartographic information. These techniques yield maps that are more interactive or animated, in other words, more informative. Users can query and explore maps; movement and sound can also be introduced to reinforce the user's experiences. To provide this sort of rich content, cartographers will need to use the right tools to make and publish their map. One such tool is Macromedia Director. This article will focus on techniques for creating rich map content for the Internet using Director.

Macromedia Director

Macromedia Director is a raster-based multimedia presentation tool distantly akin to Microsoft's Power-Point or the old Apple HyperCard environment. Historically Director was targeted towards the creation of kiosk presentations and interactive CD-ROMs but over the past few years it has been revamped for the web.

Once a project has been created in Director, it can be saved as a Shockwave movie that can be played by a plug-in for web browser such as Netscape Navigator or Internet Explorer. Most modern computers now have these plug-ins installed by default and Macromedia estimates that 65% of Internet users have it enabled (December 2001).

Example Project: Annual Precipitation in California

The following project, which contains several maps are taken from a recent NACIS Web Mapping Contest entry. This project was completed at Humboldt State University with the assistance of Dr. Margaret Pierce during an Advanced Cartography semester in 2000. You can view and should refer to this project and its source files while reading this article at: www.nacis.org/contest.html

The project has an interactive, animated, and sound-enhanced interface detailing recent precipitation data for the state of California. The maps were designed in Adobe Illustrator and then exported to Macromedia Director for composition and sequencing.

Director Basics

While Director provides a useful environment for arranging and sequencing, it is not useful for creating or designing map or interface content. The program can, however, import most raster image formats

including GIF and JPEG, which are the most commonly used formats for the web. For Adobe users, versions 9 and 10 of Illustrator now include ImageReady, which is quite handy for optimizing web graphics.

When images are imported into Director they become cast members, available to use within Director's layout and sequencing environment. Director is modeled after the Hollywood format of movie production. Each movie has a cast of characters called "sprites", is orchestrated with a "time line" and takes place on a "stage."

Adding Motion to the Display

It is important to create a user experience where the map elements are clearly arranged and logical interaction is not only facilitated but also encouraged. For cartographers, thinking of a map or maps in terms of potential sequential experiences is new, but hardly foreign. Director provides a useful architecture for defining navigation and interaction parallel to the display of the maps.

Director uses a timeline metaphor for arranging action on the stage. The timeline consists of a sequence of frames in which any of several channels (similar to the layers found in cartographic design packages) exist. These channels can have their visibility toggled on and off in any frame. [Figure 1]

The timeline allows a movie to be planned out in a linear progression, left to right. However, a movie need not be set for linear viewing; a frame or group of frames can act independently of the other frames allowing the movie to be manipulated by the viewer as it plays. It may be helpful to conceptualize each section of the movie as the chapters found on a DVD.

Director is useful for animating sequences of maps. Each map can be placed in a frame and Director will play through a series of frames until a "stop on frame" com-

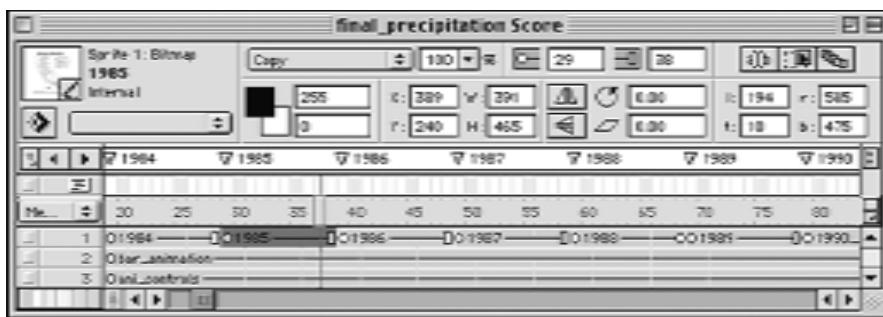


Figure 1. The score shows the movie is currently on Frame 37, Channel 1 has the map for 1985 displayed, Channel 2 has the user-interface navigation bar displayed, and Channel 3 contains the animation controls (pause, backwards, forwards). The top portion of the score window displays information about the selected object; where it is positioned on the stage and how long it is on the stage (1984 is on the stage in Frames 29 through 38).



Figure 2. This script is associated with a specific frame and is accessed via **Modify > Frame > Script**. The script is called when the movie plays through that frame (exits the frame) and keeps the movie on that frame (keeps cycling through that frame).

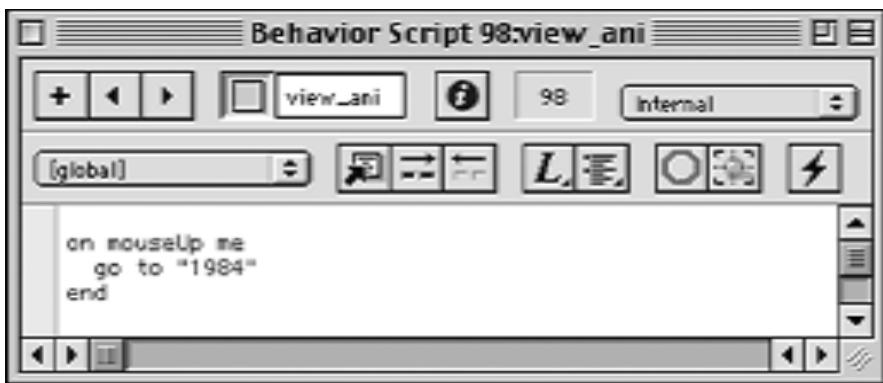


Figure 3. This script is run when the user releases their mouse button on the movie button. The instruction is for the movie to go to the frame marked by the "1984" label and start playing there.

mand is encountered [Figure 2]. The movie can jump to a different series of frames while playing and the content of those frames can be changed on the fly with more advanced programming techniques.

These techniques were used when constructing the sample project. The maps representing each water year were placed in separate frames. The map presentation's interface allows the user to

step through the maps one-by-one or in an animated series.

Because of Director's timeline, the program is well suited for mapping projects that emphasize motion or change in the dimensions of time and space. It is also useful for orchestrating interactivity.

Designing a Button

Version 8 of Macromedia Director does not anti-alias text. Therefore, use a graphics package or other software that can produce a professional appearance. Export this interface element just like the map images.

Procedure:

1. Create a button in your preferred graphics software package.
2. Export the button as a raster image. (**File > Export**, File Type: JPG or GIF)
3. Import the image into the Director Cast as a Sprite. (**File > Import**)
4. Place on Stage by dragging the Sprite from the cast to the Stage.
5. Set up a Script for the button; for example, go to Frame Number or Marker in the timeline [Figure 3]. (**Modify > Sprite > Script**)

Introducing Sound

Sound can provide feedback for data exploration, provide background music, be a confirmation soundtrack for actions undertaken (button clicked > sound of bell rung), or provide narration.

Introducing voice-overs can serve to grab the user's attention and this narrative technique can hold the visuals together and provide the viewer with an explanation of what they are seeing, as they see it. These words must be planned and integrated with the map presentation *before* recording the voice-over.

There are many different types of voices; some sound warm,

others cold. A voice can make the listener edgy or make them feel at home. When recording narration voice-overs it is important to select an appropriate tone of voice for the material at hand.



Figure 4. Examples of feedback user interfaces. When using the first, try to keep your voice in the middle, with peaks in the orange and valleys near, but not at the left edge. The second shows the volume wave form—this example is good because it has a range of peaks and valleys, i.e., a dynamic engaging set of voice content—hopefully the map is equally dynamic and engaging.

Record the voice-over in a quite room and use your recording software's feedback facilities. Figure 4 shows two kinds of interfaces for letting you know to speak up or back away from the microphone.

Digital sound can be recorded with a modern computer using programs like Peak LE for the Mac or SoundForge XP for Windows (those programs are included with Director). Once they are digitized, save them in a format compatible with Director (WAV, AVI, sound, or Quicktime at 22,050Hz, 16-bit, and mono) and import them into your cast (**File > Import**). The sound (now a sprite) can now be placed into your timeline to occupy a frame in one of the two sound channels. As the movie plays through the score it will automatically

play any sound clip found in a frame. For instance, in the example project voice-over narration is used to audibly introduce each section of the animation.

Director's ability to integrate sound into the map presentation allows cartographers to make use of several senses to deliver more information to the user. The voice-over technique allows the user to interpret the map animation in real-time as the movie plays and the narrator gives viewing pointers.

John Krygier provides basic terms and concepts for using "Sound and Geographic Visualization" in the volume *Visualization in Modern Cartography* edited by Alan MacEachern (1994). At the recent NACIS 2001 meeting in Portland, Oregon the father & son team of Keith and Steven Rice (University of Wisconsin at Stony Point) presented the first of their three papers, "Scoring and Scripting Music for Animated Maps," on using sound in cartographic products and their next two are highly anticipated.

Publishing to the Web with Director

To publish your Director project to the Web it needs to be saved as a Shockwave Movie.

1. Preview your movie (**File > Preview**)
2. Export your finished movie (**File > Save as Shockwave Movie**)

Once the movie is exported and copied to a location on a web server it can be linked to a normal HTML web page that introduces the movie, its topic, and viewing requirements (plug-in information).

Conclusion

Macromedia Director is just one way of creating content-rich Internet maps. The learning curve for Director is moderate to steep so keep your map presentation simple and do as much of the map design in a graphics package.

There are other tools for creating Internet compatible maps. For instance, Macromedia's Flash product enables vector graphics to be used. If you want users of your map to be able to print at high resolution then Flash is a good alternative.

A relatively new format for web vectors is the World Wide Web Consortium's SVG or Scalable Vector Graphics format. Carto.net, based in Switzerland, has online tutorials and information on this emerging technology: <http://www.carto.net/papers/svg>.

In general, if you want high quality printed maps, use a vector-based format such as SVG or Flash. If you only need high quality on-screen maps use Director or traditional HTML.

Content-rich maps on the Web have the potential for negative side effects. Often these content-rich maps require more bandwidth and modern multimedia capable computers with specialized software for viewing and getting information from the maps.

Modern cartography can embrace this change in medium using new delivery techniques that meet the demands of increasingly multimedia literate and expectant map users. The opportunities that these new Internet-based technologies bring are well worth the effort.

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FURTHER READING

USER INTERFACE and ANIMATION

Edward R. Tufte. *Visual Explanations: Images and Quantities, Evidence and Narrative*. Graphics Press. Cheshire, Connecticut. 1997.

SOUND

John Krygier's chapter "Sound and Geographic Visualization", pages 149-166. *Visualization in Modern Cartography, Volume 2*. Edited by Alan MacEachren and D.R. Fraser Taylor (1994). New York: Pergamon.

Keith and Steven Rice (University of Wisconsin at Stony Point). NACIS 2001 meeting. "Scoring and Scripting Music for Animated Maps".

book reviews**The Grammar of Graphics**

By Leland Wilkinson
New York: Springer-Verlag, 1999.
ISBN 0-387-98774-6, hardcover,
\$69.95, xvii, 408 pp., tables, 248
illustrations (169 full color), references, index.

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Some books defy simple classification. This volume is at once a text and a philosophical treatise, and to some may seem to be an advertisement for a companion statistical software program. Moreover, given its title, many cartographers and geographers might miss its considerable relevance to their work. That would be unfortunate, for there is much of interest to be found within its pages.

The book's title at once promises more and less than the text delivers. Leland Wilkinson, the book's author, is a legendary figure in the field of statistical software, having been an academic, a programmer, and an entrepreneur who wrote and marketed the SYSTAT program and is now senior vice

president for SYSTAT products at SPSS, Inc. Wilkinson has spent an entire career thinking about how to array, visualize, analyze, and interpret data, and this book summarizes his current thinking on the subject. While much of his work may seem theoretical, Wilkinson is a very practical man who has also developed a data graphics software package designed around the grammar described here.

The heart of this book is a series of chapters describing the concepts and structure of Wilkinson's understanding of the grammar of graphics. The grammar consists of verbs, nouns, and adjectives, and processes from the input noun "data" through the successive steps "dataset," "varset," and "graph," to the output noun "graphic." Along the way, the verbs "dataview," "varmap," "grapher," and "aesthetic" transform the data as it is shaped into a graphic, modified by the adjectives "reference," "algebra," and "coordinate." Each of these steps and modifications is described in general terms in a series of ten chapters, with illustrations of the application of most concepts discussed. Cartographic examples appear throughout, although Wilkinson takes pains to remind the reader that his grammar does not create or emulate a geographic information system.

Wilkinson's purpose is to identify the general rules that govern the creation and presentation of data graphics, and to set forward a structure within which these rules might be operationalized most efficiently. If the grammar is successful, it should be possible to reduce any data visualization problem into a graphic utilizing the rules outlined. Wilkinson is the first to admit that this structure is only one of many that might be constructed while following these rules, and that the purpose of the book is to further the scientific understanding of the display of quan-

titative data in graphical forms. To this end, Wilkinson builds on, and in some instance criticizes, the work of Tufte, MacEachren, Bertin, Cleveland, Tobler, and many others who have contributed to this field over the past fifty years.

The final chapter pulls together the elements of the grammar of graphics by attempting to graph complex problems solely through the rules proposed. To demonstrate the versatility of his grammar of graphics, Wilkinson shows how it might be applied to generate a replica of Minard's well-publicized "Figurative map of the successive losses of men in the French army during the Russian campaign, 1812-13" (Tufte 1983), and a complex dataset concerning the annual northward migration of the Monarch butterfly across North America.

Among its many strengths, this book is very methodical, at times obsessively so. It is also very well illustrated, with numerous charts and graphics, a lengthy and comprehensive bibliography and index. For this reviewer, the most significant weakness is that it is difficult to grasp many of the nuances of the proposed grammar without the opportunity for a hands-on experience. A companion CD-ROM including the examples in the book, so that readers can experiment with the various functions and elements of the grammar of graphics, would greatly enhance the text.

This book is not for the faint of heart, and certainly not for the novice reader. It would not be recommended reading for those without several courses in statistics; geographers who lack training in cartographic methods may also find the book difficult. However, those who read the book cover to cover and take some time to ponder the concepts and proposed theoretical structure for data graphics will find the experience worthwhile. All geography and