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 problematical 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 many 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 DIREC-TOR 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

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LINKWAY LIVE: An Authoring Tool for DOS and Windows

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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.   ❏

MOSAIC AND THE WORLD WIDE WEB

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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