

# Authoring with Hyperlinked Video

A White Paper by Mitsubishi Electric America, Inc.

## Overview

Hyperlinked video is the next generation of multimedia. Until recently, user interaction with desktop video streams required complex, special case software, and video object identification (within video streams) was basically a simulation. No commercial tools previously existed for creating hyperlinked video clips as part of a multimedia authoring process. Now, new products are emerging that let digital media producers create high-quality, interactive hyperlinked video presentations quickly and easily in visual authoring environments.

For example, imagine a video clip on a Web page presenting a car manufacturer's latest model line. As the camera moves through the manufacturer's showroom, a user clicks on a particular vehicle of interest. Based on a link established for that video object (the car), a catalog page appears on the screen that shows the car in much greater detail. Each car is linked to a unique catalog page, which may be further linked to forms allowing users to place orders for cars on-line. Such presentations can be created in several hours by developers properly trained with video hyperlinking tools.

Or suppose the application is a CD-ROM or DVD for a pop music group in which specific video clips are played when users interact at specific *times* and at certain frame positions with the performers in the group. Users could be linked to personal information on their favorite band members, to catalogs on the musical instruments the band is using or to pages for online purchase of band memorabilia and apparel. As noted above, this type of functionality has already enhanced several well-known multimedia products, but at the cost of intricate, low-level code which maps object screen coordinates to elapsed running time. Examples presented later in this document demonstrate the power of creating interactive videos through video hyperlinking even more dramatically.

The technical breakthroughs achieved by hyperlinked video products involve the ability to *automatically* identify and track objects (people, vehicles, buildings, etc.) in digital video clips. Because pattern recognition software has matured dramatically, it is now possible to lock onto video objects and track them in time and space throughout a movie. Multimedia authors can exploit this technology by tagging and linking video objects to other objects in their presentations or video movie — including text, still images, web pages, audio clips and other video sequences (see Figure 1). This white paper explores the potential value and implications of video hyperlinking, and how the technology is being harnessed by products such as Mitsubishi Electric’s VisualSHOCK MOVIE.

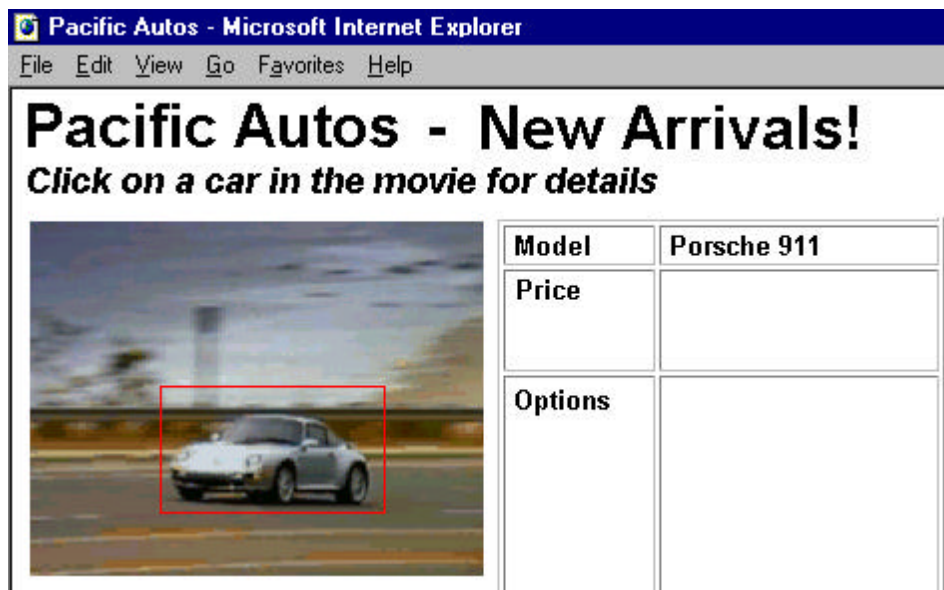


Figure 1. A presentation using a hyperlinked video clip.

### *Evolving Technology*

Like any next-generation technology, video hyperlinking is dependent on the underlying data types that it incorporates. As it turns out, the video data types most often used in desktop media presentations are mature and relatively standard. Examples of such video data types include AVI, QuickTime and MPEG-1. The leading publishers of hyperlinked video products generally support all of these desktop video standards, as well as the newer

Web-based streaming formats such as RealNetworks' RealVideo and Microsoft's Netshow (ASF).

As desktop video continues its migration to the Web, several principles are becoming clear. First, the Web browser is the ultimate presentation medium. Not only do browsers provide stable, ubiquitous platforms for easily embedding video assets but also the entire browser navigation scheme is based on hyperlinking. Video clips with interactive hyperlinks fit into this environment very well, regardless of whether they are streamed or download from remote Web sites or loaded from local sources (such as CD-ROM or DVD disks). Of course, other types of presentation programs, e.g., Macromedia Director and Microsoft PowerPoint, are also widely used and can be easily complemented with interactive video hyperlinking technology.

A major implication of these principles is that publishers of hyperlinked video development tools need to accommodate both the local and online desktop video models, and tailor their products accordingly. In today's highly competitive markets for multimedia authoring products, tools that can do both from a common user interface have the best chance for success. Mitsubishi Electric understands these issues and has positioned VisualSHOCK MOVIE accordingly. Figure 2 shows the relative positions of the products currently available in this market.

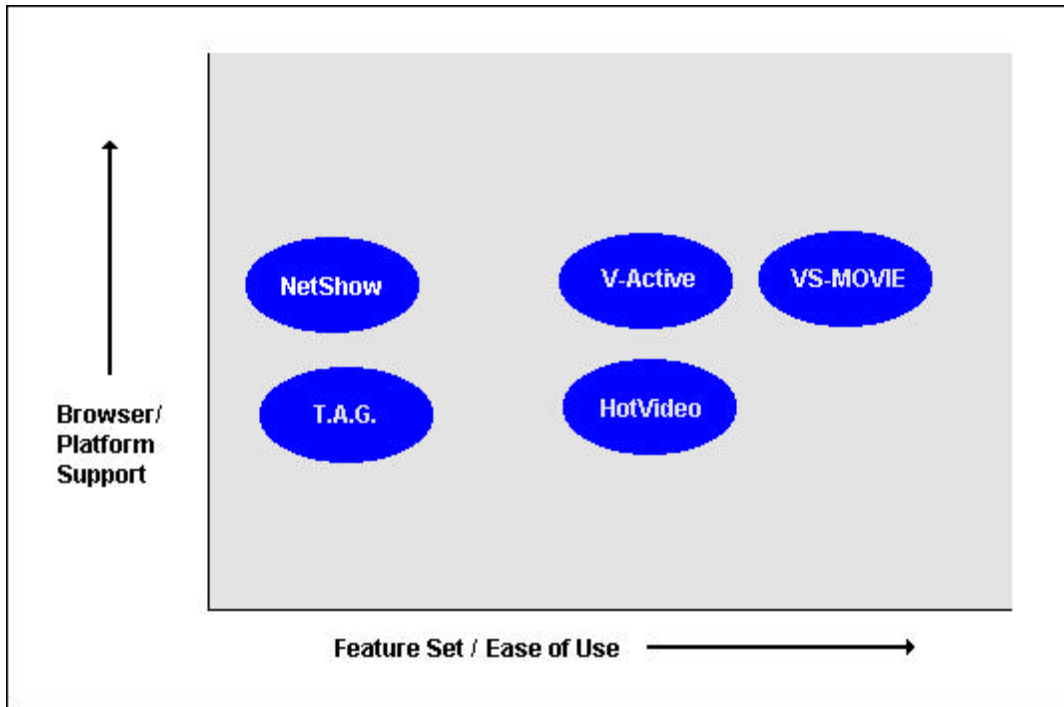


Figure 2. The Hyperlinked Video Market.

## The Advantages of Hyperlinked Video

The key technology underlying any hyperlinked video product is ease of use through automatic object tracking. Generally speaking, this is the ability to recognize a selected object as it changes size and position from frame-to-frame in a video clip. As long as such recognition is sustained, properties (such as hyperlinks) can be assigned to the object for user interaction at run time. The digital media authoring community has long anticipated such pattern recognition software, and the wait is finally over. The approach taken by VisualSHOCK MOVIE ensures highly accurate video object tracking.

Examples like the on-line automobile show and music performance CD-ROM mentioned earlier only suggest the ways in which video can be fully exploited and transformed into interactive content, both on the Web and in local playback scenarios using off-the-shelf authoring software (as opposed to a browser). Business presentations can be made much more effective by embedding interactive movies in PowerPoint or Astound documents. Training can be fully explained through interactive video. Entertainment videos (music,

education, gaming, etc.) can be enriched through interaction of the audience. In general, user communications can be enhanced with interactive hyperlinked video content.

### *How VisualSHOCK MOVIE works*

VisualSHOCK MOVIE employs a proprietary system of automatic object tracking, enhanced with sophisticated error-correction algorithms. While a precise mathematical model is beyond the scope of this document, the technology can be understood as means of establishing an object *anchor* in terms of start and end frames in a given video sequence, then analyzing intermediate frames to judge whether they also contain the object. If they do, the software assembles a data structure that can be accessed for user interaction via a playback client (ActiveX control, Plug-in, etc.).

Judgment is based on a number of factors, most of which adjust automatically (within assigned parameters) as the tracking process executes (see Figure 3). As noted, once a clip is successfully analyzed, links can be assigned to the object for execution wherever the object is selected in the video sequence at playback time.

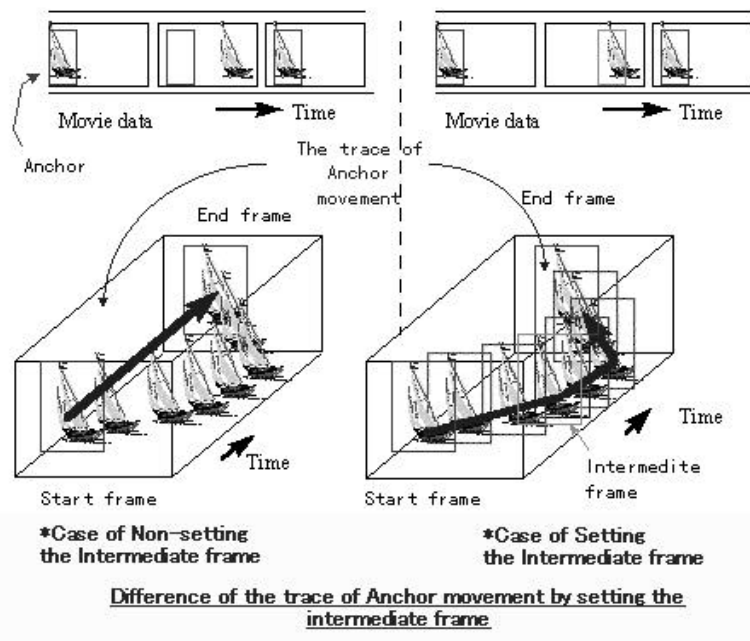


Figure 3. The mechanics of VisualSHOCK MOVIE.

Because such analyses are computationally intensive, the primary goal of any hyperlinked video technology is finding ways to cut down the sheer number of calculations while maintaining a high degree of reliability in the tracking process. Without these economies, the computational overhead would strain most of today's desktop computers. Mitsubishi Electric developers have achieved this goal by implementing a series of innovative approaches based on understanding the low-level architecture of desktop video data types as well as the mechanics of desktop video playback itself.

### *Working with the VisualSHOCK MOVIE MapEditor*

The VisualSHOCK MOVIE authoring tool is the *Movie MapEditor*, shown in Figure 4. The following sequence of steps illustrates the basic process of identifying and creating a hyperlink for an object in a standard video clip.

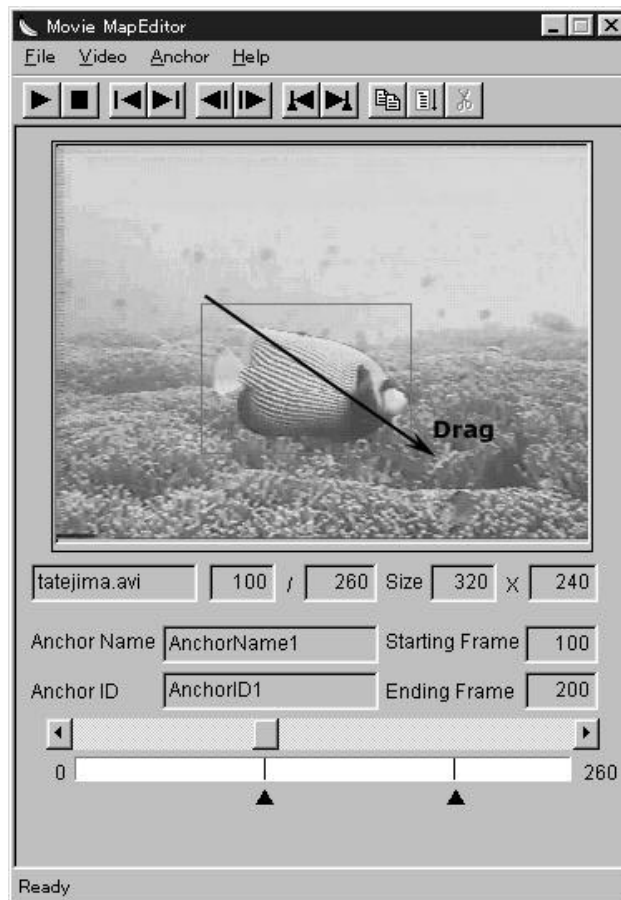
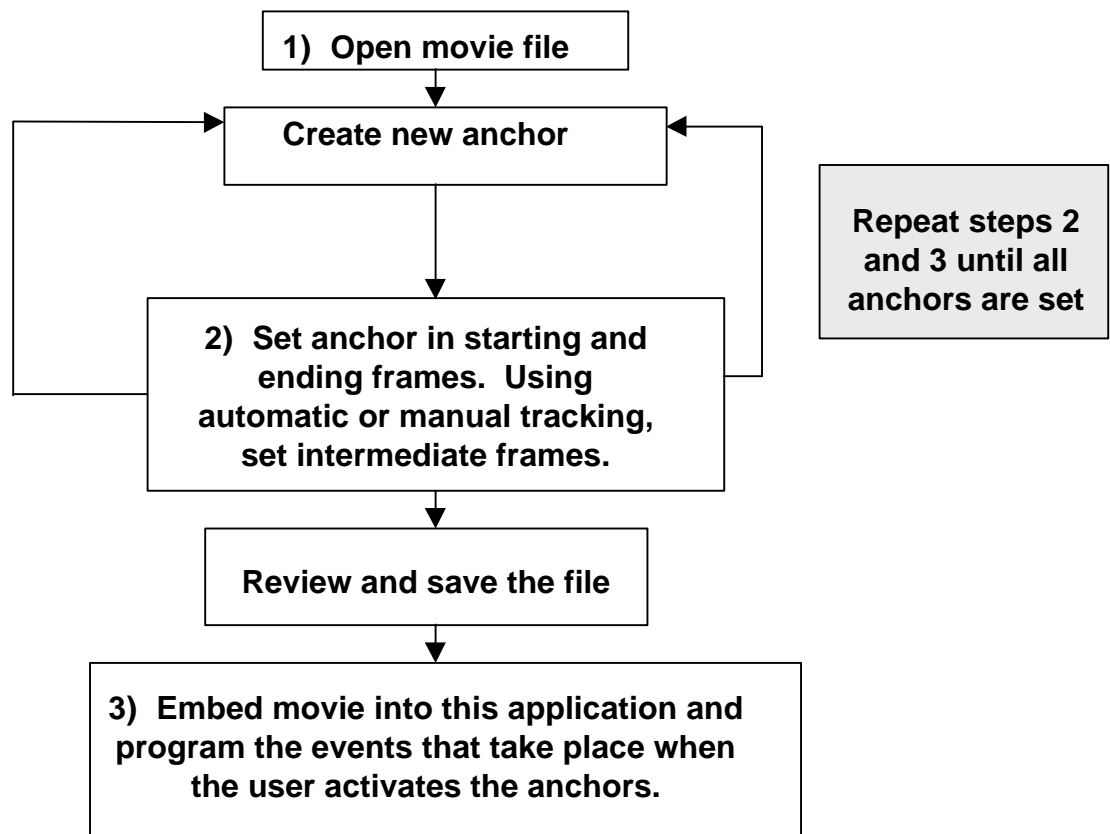


Figure 4. The Movie MapEditor user interface.

*Step 1.* Run the MapEditor (VSMEDIT.EXE) and open a new movie from the File menu. Valid formats include AVI, MPEG1 and QuickTime. Information about the movie (such as the movie name, first and last frame numbers, and movie window size) is filled in automatically at the bottom of the MapEditor user interface.

*Step 2.* Create a new anchor by defining an anchor name and an anchor ID. Once defined, these values also appear in the bottom part of the interface.



*Step 3a.* When *automatically* tracking an object, determine the start and ending frames of the object you wish to track, then draw an anchor around the object with your mouse in both of these frames. The anchors appear as colored rectangles on the video frames. Next, select the Automatic Setting from the Anchor menu. This sets the internal auto-tracking path for the object. Wait a moment for the program to perform the necessary calculations, then play the movie and check that the newly created intermediate anchors are correctly positioned. If necessary, you can perform manual adjustments on the

intermediate anchors with your mouse. As noted earlier, this type of automatic object tracking is one of the main technical breakthroughs achieved by VisualSHOCK MOVIE. Automatic tracking only works for AVI and QuickTime movies, not MPEG-1. For MPEG-1 you must use the manual tracking method.

*Step 3b.* The manual tracking method can be used for MPEG-1 movies and for fine tuning the automatic generated tracking. When *manually* tracking a defined object, first select the starting frame for the anchor then draw an anchor around the object with your mouse. Advance the movie to the next frame where the linear progression ends and do the same. Again, changing the anchor position in any frame by moving the anchor rectangle displayed on the frame with your mouse, or by changing the size of the anchor rectangle (by dragging on one of its edges). Continue this process until you are finished. Manual tracking works for all supported movie types (AVI, QuickTime and MPEG-1).

*Step 4.* After the attributes of the anchors are set, select Save from the File menu to save the anchor information. To see all of the anchors defined for a movie, click the View Anchor List from the Anchor menu.

*Step 5.* The movie for which you just created the anchor(s) is now ready to be embedded on a Web page or in a Windows application for user interaction via the VisualSHOCK MOVIE ActiveX control or Netscape plug-in.

### *Working with the VisualSHOCK ActiveX Control*

For playback of a movie with hyperlinks (anchors), the VisualSHOCK MOVIE ActiveX Control or Netscape Plug-in is employed. Generally speaking, the VisualSHOCK MOVIE ActiveX Control is used to execute anchors created using the Movie MapEditor. This technique can be implemented in almost all ActiveX-compliant applications. Such applications include Microsoft and Netscape Web browsers, as well as Microsoft Office productivity applications. A code fragment of the VisualSHOCK MOVIE ActiveX Control implemented in an HTML object tag is shown below.



```

<object id="Movie1" width="160" height="152"
  classid="clsid:5A3CC0C8-3292-11D1-AD92-0040053B8A04"
  codebase="http://www.visualshock.com/download/vsmovie.cab">
  <param name="_Version" value="131072">
  <param name="_ExtentX" value="5644">
  <param name="_ExtentY" value="7303">
  <param name="_StockProps" value="0">
  <param name="AutoRepeat" value="-1">
  <param name="MovieFile" value="http://www.visualshock.com/
    vs-gallery/movie1.avi">
  <param name="SelectionEnd" value="167">
  <param name="ShowAnchor" value="-1">
</object>

```

User interaction with the VisualSHOCK MOVIE ActiveX control can be handled with standard Visual Basic Script, as follows:

```

<script language="VBScript">
<!--
Sub Movie1_OnActivateAnchor(AnchorID)
  select case AnchorID
    case "AncID1"
      parent.notes.location.href="page1.htm"
    case "AncID2"
      parent.notes.location.href="page2.htm"
    case else
  end select
end sub
-->
</script>

```

### *Working with the Image Map Converter for RealMedia*

The VisualSHOCK MOVIE Image Map Converter (VSMIMC) utility creates an image map file for integrating movies created in RealNetworks' video streaming format. This is essentially a two-step process. The user can set all actions that take place on each anchor from a pull-down menu:

*Step 1.* Load the image map file that VisualSHOCK MOVIE created, displaying the anchor (hotspot) list. Define actions for the hotspots when played back using the RealVideo file. The VSMIMC utility then creates a text formatted image map file to be used with the RealNetworks RMMERGE tool. This is a standard utility provided by RealNetworks for integrating triggers and other special data types in RealMedia streams.

*Step 2.* Using the RealNetworks tools, you can then create RealVideo files from supported video files and merge the image map file created with VSMIMC into the streaming RealVideo (.RM) file.

## **The Future of Hyperlinked Video**

Just as hyperlinking of static media sparked the first wave of multimedia production tools, video hyperlinking promises to push the industry to another plateau of user interactivity. Armed with tools like VisualSHOCK MOVIE, developers can create high-quality presentations using interactive video on short production schedules without special programming. Consumers will enjoy receiving visual information in a much more direct and compact manner than with previous delivery mechanisms (such as hyperlinked pictures or non-interactive video clips). Corporate users will leverage the power of VisualSHOCK MOVIE to sell business ideas quickly and efficiently, and to provide more focused training.

This white paper's goal was to identify and examine the issues surrounding the advent of video hyperlinking technology on the desktop. New media producers have long anticipated this technology, and it is finally available due to breakthrough software development by companies like Mitsubishi Electric in the area of pattern recognition in digital video streams.

As demonstrated, there is now a race to capture the authoring market with products incorporating video hyperlinking, and several of the established multimedia players have already introduced tools which seek to bring that market home. Mitsubishi Electric's

VisualSHOCK MOVIE is especially positioned for success because of its superior object tracking capabilities and its suitability for both Web-based and local playback applications.

## **Background of Current Players and Technologies**

Despite the relative youth of the hyperlinked video industry, several companies are already distinguishing themselves. The following capsules describe the current competitors, their strengths and weaknesses, and their current positions in the market.

### *Authoring Tools/Applications*

#### **VisualSHOCK MOVIE**

Launched in 1998, VisualSHOCK MOVIE Version 1.0 from the New Business Development Group of Mitsubishi Electric America, Inc. is focused on both the Web and the local playback markets for hyperlinked video authoring tools. The product provides a separate facility for creating and modifying hotspots within a video clip (the *Movie MapEditor*) using a proprietary motion recognition system. An ActiveX Control and Netscape Plug-in are provided for movie retrieval and playback, as well as the Image Map Converter (IMC) tool for converting the video hotspot information into a format compatible with RealNetworks video streaming environments. For Macromedia Director developers, a VisualSHOCK Xtra has been developed by g/matter using the VisualSHOCK technology. Supported video types include MPEG-1, AVI and QuickTime. A detailed discussion of the VisualSHOCK MOVIE technology is presented earlier in this document. Supported platforms: Windows 95 and NT. Supported browsers: Netscape Navigator and Microsoft Internet Explorer. Supported applications: ActiveX compliant, e.g., PowerPoint, Front Page, etc.

#### **V-Active**

V-Active from Veon (formerly known as Ephyx) debuted in 1997. Currently in Version 2.0, it also targets Web and local playback developers. A visual-editing tool facilitates content creation and an ActiveX Control handles playback. V-Active supports MPEG-1, AVI and QuickTime, as well as RealVideo and Microsoft ASF video formats. Supported

platforms: Windows 95 and NT. Supported browsers: Netscape Navigator and Microsoft Internet Explorer.

### **HotVideo**

HotVideo from the alphaWorks division of IBM entered the market in early 1998 after several years in development. Media types supported originally included just QuickTime, but the new Version 2.0 handles AVI, MPEG, MOV and RealVideo. Streaming ASF format is not yet integrated. It remains to be seen how well IBM will market this tool to multimedia developers. Supported platforms: Windows 95 and certain non-Windows Java-enabled systems. Supported browsers: Netscape Navigator and Microsoft Internet Explorer.

### **T.A.G.**

Digital Renaissance's T.A.G. offers a way to make video streams embedded in Web pages as interactive as possible, but the product does not have true object tracking like Visual ShockMOVIE, V-Active and HotVideo. It is included in this roster of tools only to provide market context. Supported platforms: Windows 95 and NT. Supported browsers: Netscape Navigator and Microsoft Internet Explorer.

Each of the products profiled above has an opportunity for long term success. V-Active was first to market with a good user interface and support for RealVideo and NetShow. HotVideo is backed by IBM. Microsoft NetShow (noted below) continues to improve as the underlying technology (DirectShow and the ASF file format) undergoes constant upgrading. VisualSHOCK MOVIE is backed by Mitsubishi Electric and features a straightforward user interface along with very reliable object tracking technology. As most developers of digital media creation tools have learned over the last five years, usability and support are the key factors for long-term success in any authoring product. These factors were given top priority in the design of VisualSHOCK MOVIE.

*Note: It is important to remember that none of the hyperlinked video solutions discussed so far competes directly with products like Macromedia Director or AimTech's*

*IconAuthor. Movies with hyperlinks are meant to be embedded within presentations created by full-blown authoring environments (such as Director).*

## ***Internet Video Streaming Technologies***

### **Microsoft NetShow**

While Microsoft NetShow 3.0 does not include automatic tracking of objects in video streams, it does have a facility for tying images at specific movie frame coordinates to elapsed movie time. The effect is that a user can click on a specified area of a movie frame at a certain duration point in a NetShow clip, which triggers a specified hyperlinked event (such as displaying an image or launching another movie). NetShow is mentioned here only to provide context for the true video hyperlinking solutions such as VisualSHOCK MOVIE. Supported platforms: Windows 95 and NT. Supported browsers: Netscape Navigator and Microsoft Internet Explorer.

### **RealNetworks RealMedia**

Like NetShow, RealMedia provides a suite of tools that provide a limited form of user interaction with objects in desktop video clips, but no pattern recognition and object tracking technology is employed in the most recent released version (5.0). Supported platforms: Windows 95 and NT. Supported browsers: Netscape Navigator and Microsoft Internet Explorer.

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