



Evaluation of Consumer Video Editing Software and DVD Creation Services

Dan Tretter, Yining Deng, Ullas Gargi, Pere Obrador, Peng Wu, Tong Zhang
Imaging Systems Laboratory
HP Laboratories Palo Alto
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In this report, we evaluate nine different consumer-level applications for editing digital video. The report includes brief descriptions and screenshots of each application plus tables detailing the formats supported and features offered by each. Overall, we found that current consumer video editing software is still lacking in ease of use and, in many cases, in software stability. The available features, however, are rapidly approaching those of high-level professional packages. We also include a section discussing three services that offer to convert consumer VHS tapes to DVD. We sent the same tape to all three services and compared the DVDs they produced. Finally, we finish with a few overall conclusions. Please keep in mind that these services and software applications are evolving rapidly, so this report represents a snapshot in time that is current as of early 2002.

Introduction

In this report, we evaluate nine different consumer-level applications for editing digital video. The applications ranged in price from free (Microsoft's MovieMaker and Apple's iMovie are both free with their company's OS) to \$130 for several of the leading PC packages. The report includes brief descriptions and screenshots of each application plus tables detailing the formats supported and features offered by each. Overall, we found that current consumer video editing software is still lacking in ease of use and, in many cases, in software stability. The available features, however, are rapidly approaching those of high-level professional packages. The best application will depend largely on the needs of the user and the intended use, although any of the packages can accomplish basic editing.

The nine applications we evaluated are given in Tables 1a and 1b, along with the cost of each and a comparison of formats and features. The tables are followed by a brief discussion and screenshot of each application individually. Note that all of the applications with the exception of Apple's iMovie run on the Microsoft Windows platform, while iMovie is only available for Apple's OS 9 and OS X.

We then include a section discussing three services that offer to convert consumer VHS tapes to DVD. We sent the same tape to all three services and compared the DVD's they produced.

Finally, we finish with a few overall conclusions. Please keep in mind that these services and software applications are evolving rapidly, so this report represents a snapshot in time that is current as of early 2002.

Consumer Video Editing Software

We tested nine different consumer video editing applications. We selected the most popular applications available, as well as several lesser-known offerings from smaller companies. The applications tested were:

- Apple iMovie 2
- Arcsoft Showbiz
- Magix Video Deluxe
- MainConcept MainActor
- Microsoft Movie Maker
- MGI VideoWave 5
- Pinnacle Studio DV 7
- Sonic Foundry VideoFactory 2.0
- Ulead Video Studio 5.0

We attempted to edit several videos with each software package, mixing video clips, still photos, and audio. We tested a number of features for both audio and video effects, as well as examining the formats supported for input and output. For output, we focussed primarily on MPEG-1 and MPEG-2 formats. Since MPEG-2 is not royalty-free, several applications required a separately-purchased plugin to support this format, and one application (Arcsoft's Showbiz) does not support MPEG-2 at all. Table 1a summarizes the input and output characteristics of each software application, and Table 1b shows the features supported by each. The tables are

followed by a brief discussion of each application individually, accompanied by a screenshot of the application.

Video Editor	Apple iMovie 2	Arcsoft Showbiz	Magix Video Deluxe	MainConcept MainActor	Microsoft Movie Maker	MGI VideoWave 5	Pinnacle Studio DV 7	Sonic Foundry VideoFactory 2	Ulead Video Studio 5
Cost	\$49.00 ¹	\$80.00	\$60.00 ²	\$129.00 ³	\$0 ⁴	\$130.00	\$130.00	\$60.00	\$130.00
File Format (R\W)									
MPEG-1	N \ N	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	N \ Y	Y \ Y	Y \ Y
MPEG-2	N \ Y	N \ N	Y \ Y	Y \ Y	Y \ Y	Y \ Y	N \ Y	Y \ Y	Y \ Y
MPEG-4	N \ N	N \ N	N \ N	N \ N	N \ N	Y \ Y	N \ N	N \ N	N \ N
AVI	N \ N	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y
DV	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ N	Y \ Y	Y \ Y	Y \ Y	Y \ Y
Quicktime	Y \ Y	Y \ Y	Y \ Y	Y \ Y	N \ N	N \ N	N \ N	Y \ Y	Y \ Y
Windows Media	N \ N	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y
Real Media	N \ N	N \ N	Y \ Y	Y \ Y	N \ N	Y \ Y	Y \ Y	Y \ Y	Y \ Y
Audio Only	Y \ N	Y \ N	Y \ Y	Y \ Y	N \ N	Y \ N	N \ Y	Y \ Y	Y \ N
Single Frames	Y \ N	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y	Y \ Y
Input / Output									
Analog Input	N	Y	Y	Y	Y	Y	N	Y	Y
DV Camcorder In	Y	Y	Y	Y	Y	Y	Y	Y	Y
DV Camcorder Out	Y	Y	Y	N	N	Y	Y	Y	Y
Export to Email	N	Y	Y	N	Y	N	N	Y	Y
Export to Web	N	N	Y	N	Y	Y	Y	Y	Y
VCD/DVD Out	N	N	N	N	N	Y	Y	N	Y
SVCD Out	N	N	N	N	N	N	Y	N	Y

Table 1a: Input and output options supported by the various editing packages

¹ Comes free with OS X

² \$50.00 + \$10.00 for MPEG-2 plugin

³ \$99.00 + \$30.00 for MPEG-2 plugin

⁴ Free with Windows ME and XP

HP Restricted

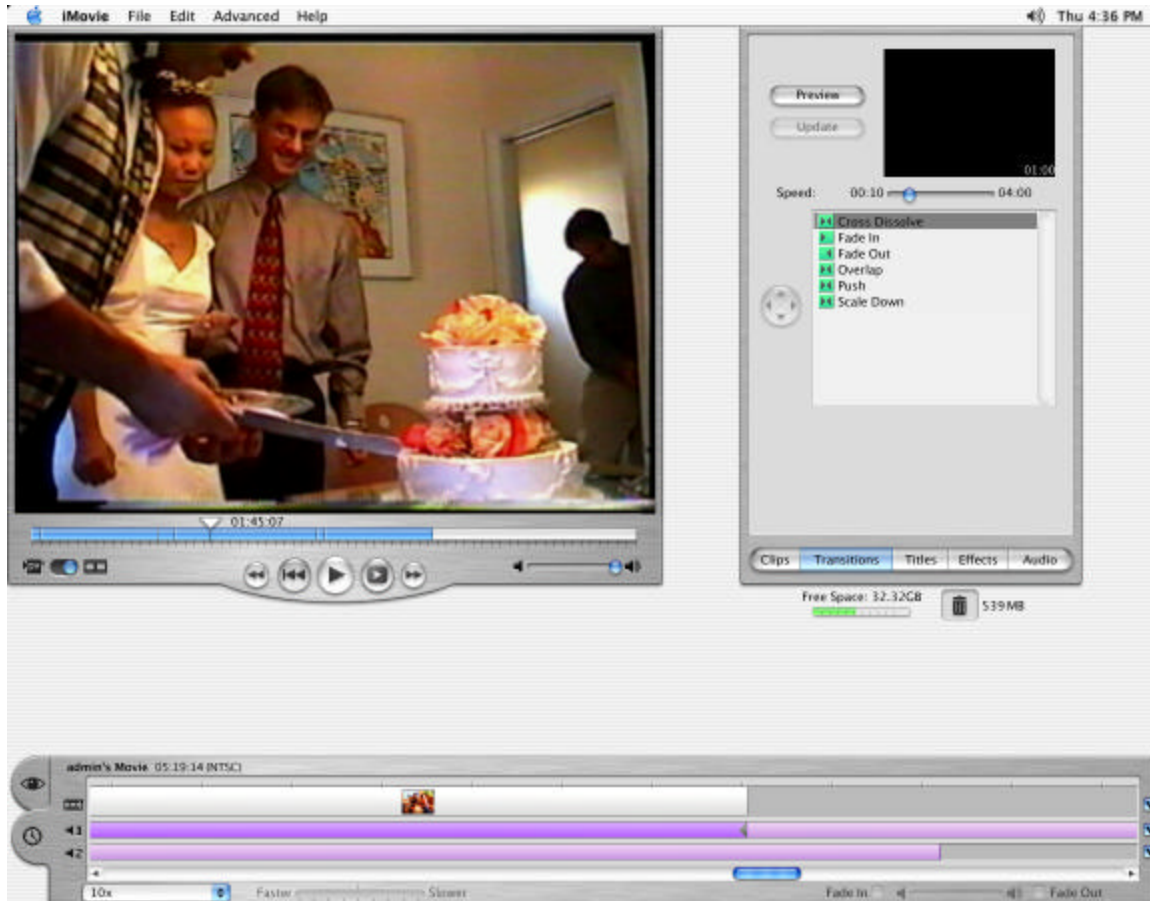
Video Editor	Apple iMovie 2	Arcsoft Showbiz	Magix Video Deluxe	MainConcept MainActor	Microsoft Movie Maker	MGI VideoWave 5	Pinnacle Studio DV 7	Sonic Foundry VideoFactory 2	Ulead Video Studio 5
Features									
Supports Audio Effects	N	N	Y	Y	N	Y	Y	Y	Y
Supports Video Effects	Y	Y	Y	Y	N	Y	Y	Y	Y
Supports Video Transitions	N	Y	Y	Y	Y	Y	Y	Y	Y
Supports Audio Merge	N	Y	Y	Y	N	N	N	Y	Y
Number of Video \ Audio Tracks	1 \ 2	1 \ 2	16 combined	98 \ 98	1 \ 1	2 \ 6	2 \ 3	2 \ 3	1 \ 2
Title effects	Y	Y	Y	Y	N	Y	Y	Y	Y
Auto-scene detection	N	N	Y	N	Y	Y	Y	N	Y
Preview window	Y	Y	Y	Y	Y	Y	Y	Y	Y
Splits A/V streams	Y	Y	Y	Y	N	Y	Y	Y	N
Audio Utilities									
Equalizer	N	N	Y	N	N	N	N	Y	N
Normalizer	N	N	Y	N	N	N	N	N	N
Automatic track damping	Y	N	Y	N	N	N	N	N	N
Set volume	N	Y	Y	Y	Y	Y	Y	Y	Y
Echo / reverb	N	N	Y	Y	N	N	N	Y	N
Time stretch /resample	N	N	Y	N	Y	N	Y	Y	N
Denoising	N	N	Y	N	N	N	N	N	N
Dehissing	N	N	Y	N	N	N	N	N	N
Video utilities									
Video cleaning	N	N	Y	N	N	N	N	N	N
Video trimming	Y	Y	Y	Y	Y	Y	Y	Y	Y
Video rotation	N	N	Y	N	N	N	N	Y	N
Video panning	N	N	N	N	N	N	N	Y	N

Table 1b: Features supported by the various editing packages

Apple iMovie 2

This package is a low end video editor which allows the user to do very basic things within the Apple iMac environment.

The user interface is extremely simple, which means some of the functionality is completely hidden and non-obvious unless you read the documentation. Once you do that the functionality is simple but enough for home video editing, which means no fancy effects unless you acquire some plug-ins they sell separately. A screenshot of the user interface is shown below.



The main disadvantage found in this system is that all the media must be stored as one of the limited formats that Apple supports (namely: AIFF for audio, DV for video, JPEG or PICT for images). In our tests, this was originally done on a PC before transferring the files to the Macintosh, but the iMovie software would still not read any of these files. We had to use Apple Quicktime to read in all of the media objects and export them again with the same format. Then the iMovie application would read them.

The maximum video clip size in iMovie is limited to 2Gbytes (which is not much in DV format). This constraint, which iMovie inherits from MacOS, is a strong limitation of this system when dealing with home movies, which may be very long. If you are inputting from a DV camera,

iMovie will split the input stream into 2Gbyte files, and if you are reading the files from your file system they have to be 2Gbytes at most in size.

Another disadvantage is that the video and associated audio are treated as a single element, and the streams must be split explicitly in order to adjust them separately. Also, iMovie does not use timestamps when editing, which can make it difficult to achieve fine-grained control.

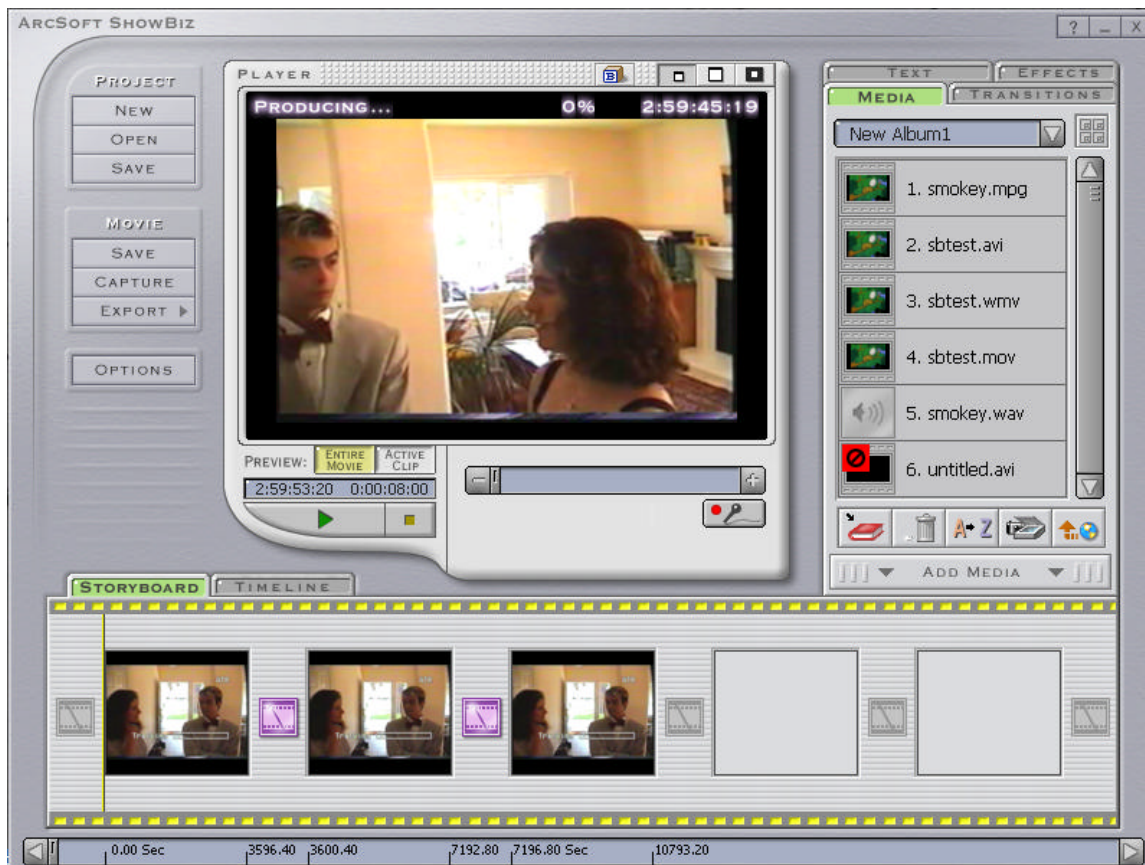
Bottomline is that if you are generating your multimedia collection on a Windows based PC, you will be better off if you stick with the PC for video editing just to avoid all the format translation necessary to use iMovie. On the other hand iMovie is a nice little video editor if you generate your multimedia on a Macintosh.

ArcSoft Showbiz

Showbiz is a fairly nice, basic editing package. It is more suitable than some of the others for beginners, with features similar to those found in Apple's iMovie. Like iMovie, video and associated audio are treated as a single element, and the streams must be split explicitly in order to adjust them separately.

One of the shortcomings of Showbiz is that it has no MPEG-2 support at all, and the MPEG-1 is very basic. To set the MPEG-1 quality, the user must select a quality level between 0 and 100; there is no way to explicitly specify bitrate. In our tests Showbiz also had problems saving MPEG-1 files, with the program hanging before finishing the output generation.

Showbiz does allow the user to easily see the total length of their video, but timestamps are not used for precise editing control. Instead, the user must use the mouse and a slider bar to set edit spots. Keyboard shortcuts "+" and "-" exist for finer control, but these are tedious to use. The user interface can be seen in the screenshot below.



Audio support is also basic, with no audio effects available and only basic volume control. In fact, volume can only be set manually and then only for an entire track (not separately for a

segment). There were some glitches in audio fading, which causes a burst of noise near the end as an audio segment fades out.

We noticed that unlike most of the other applications tested, ShowBiz apparently loads the entire video into memory when editing. It can take several minutes just to load a project before any editing can be performed. This could be a serious drawback on systems with too little RAM.

Despite these drawbacks, basic clipping and fading were easy and fairly intuitive to use. Overall, this is an easy program to use, but it lacks the flexibility and power of some of the other available applications. If MPEG-1 and MPEG-2 output support problems were fixed, this would be a good alternative for basic editing on the PC, although more powerful applications can be purchased for the same price.

MAGIX Video deLuxe

This is a pretty powerful package for video editing, with plenty of functionality for editing, transitions and special effects. It also has some drawbacks, including pretty bad technical support, probably due to the small size of the company.

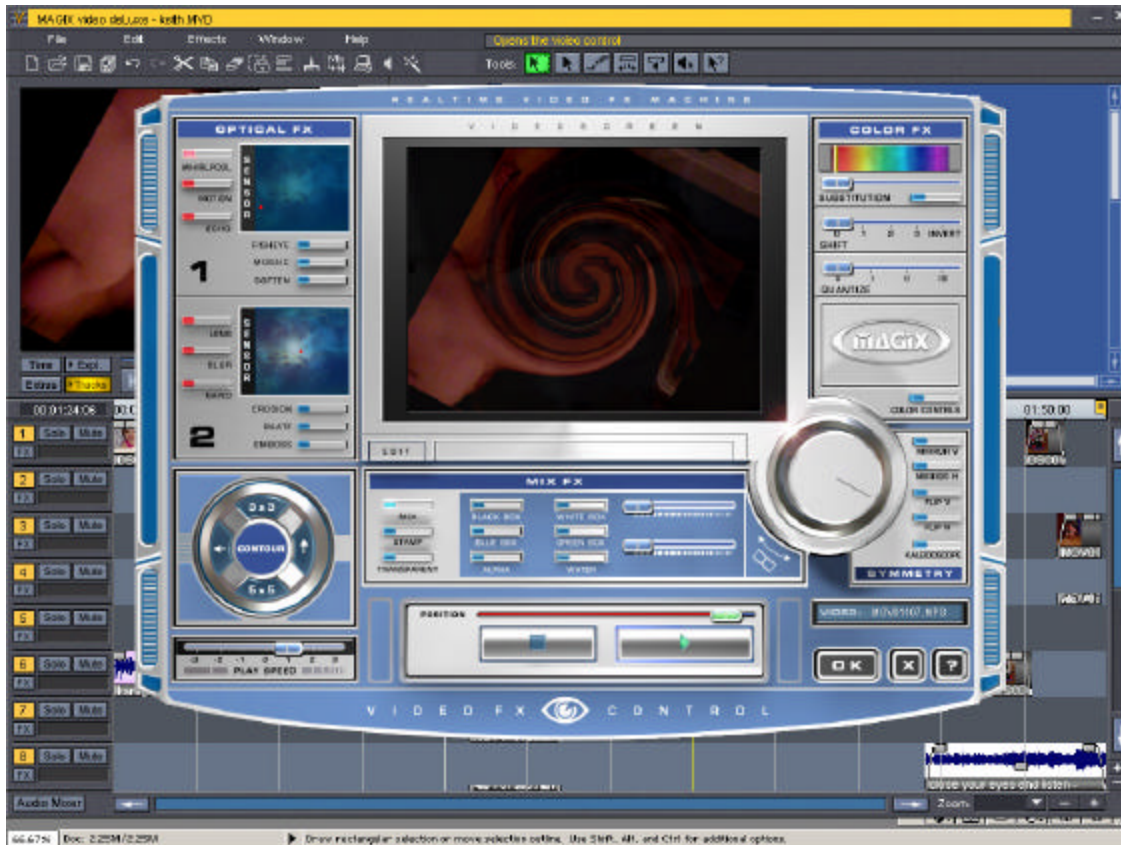
This package allows 16 tracks overall, which may be devoted to either video or audio. This provides great flexibility when editing as you may drag and drop objects anywhere you want regardless of their type.

The most interesting feature of this package is the amount of effects it has built in:

- 48 built in video effects
- 45 built in Audio effects
- 25 Overlay text effects
- 100+ Transition Effects

Each of these effects plays a small demo (3 seconds) so that the user knows exactly what this effect is (by the name itself this is usually impossible). All in all this allows for great opportunities for the creative user. On top of that it comes with an Audio Processing Effects Console and a Video Processing Effects Console, where the user may fine tune any effect by hand. See snapshots below:





Video Cleaning is another interesting feature which allows the user to modify the contrast/brightness/colorBalance/etc to a whole video clip (similar to the way image editors like Adobe Photoshop allow users to adjust individual images). Scene detection based on a threshold is also a powerful tool, and audio denoising and dehisssing are built in as well.

One problem we encountered is that vertical video clips (which have been rotated outside of this package), do not playback correctly; they are stretched to the maximum width, generating a distorted output. But this might be a problem with the encoded bitstream generated by that particular rotation software, because when it is rotated withing the Real Time Video FX Machine (see picture above) it works well except for the fact that some part of the video is cropped.

Another interesting feature is the number of output formats available. But in this aspect our experience has shown that the application has some problems. The application claims to support MPEG-1 and MPEG-2 output (MPEG-2 is just a trial version, and you need to purchase the upgrade), but in one of the 2 projects that were built there was no way of outputting either, even with technical support sending 2 new software patches.

One disadvantage is that all snapshots default to the same time length for a slideshow, and there is no way of grouping them and modifying this feature in a batch mode.

Overall, this would be a great package if they fix their bugs with MPEG exporting.

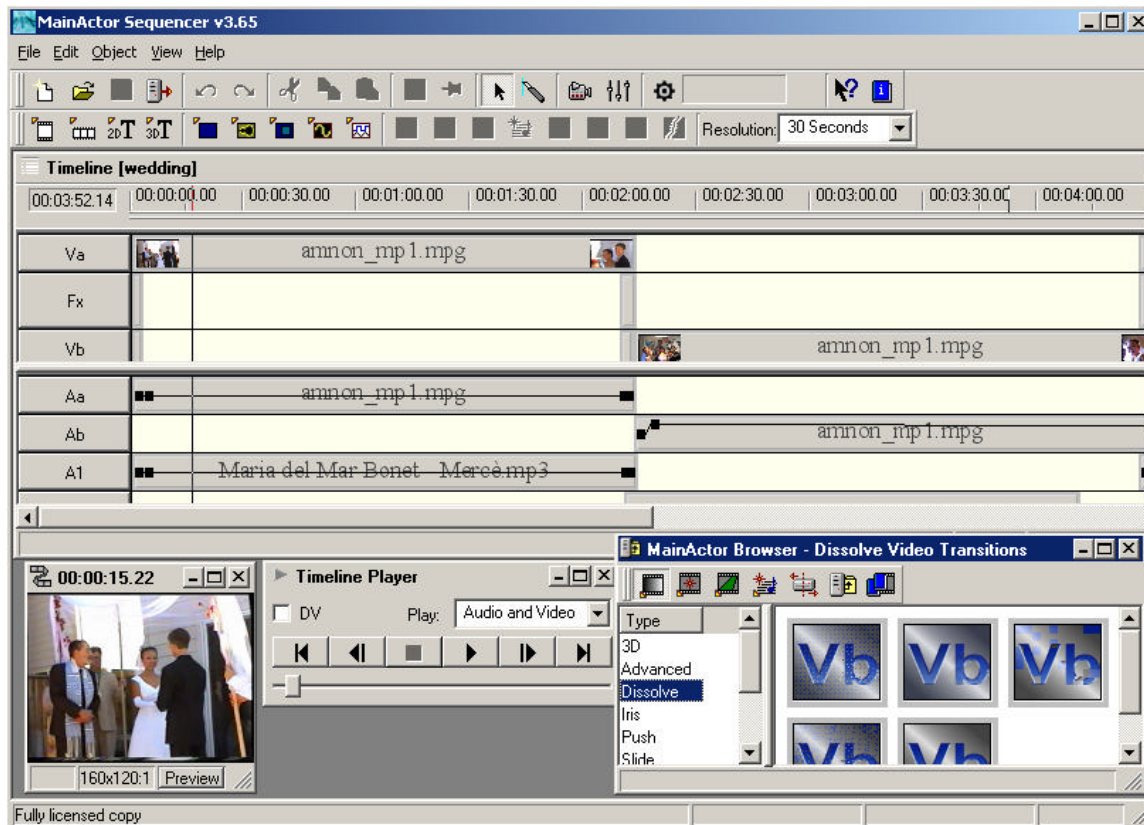
MainConcept MainActor

MainActor is a mid-level editing package with some interesting features. The application does tend to crash periodically, and sometimes freezes up temporarily when working to carry out commands. It seems to have an especially hard time with still images. MainActor also stretches still images to fill the project frame, distorting the pictures.

However, MainActor does have some interesting features. It supports a broad range of output formats, and it accepts an almost unlimited number of video and audio overlay tracks.

MainActor supports extensive 3D text options as well as 2D text. If the extra MPEG plugin is purchased, this program has a very extensive number of options for configuring the output. The user can select a number of coding parameters to optimize performance. In fact, the options are somewhat overwhelming for a typical user, but this could be a nice feature for more advanced users.

In general, the program is designed for manual editing. It has no automated scene detections, and although transitions are easy to add, they must be added by hand. There is no slideshow mode to create video from still images easily. Each image duration and transition must be added by hand. Timecodes cannot be entered directly, but the timeline resolution can be set to be as fine as 1 frame, allowing mouse-driven editing and cuts on a frame-by-frame basis. The user interface is shown in the screenshot below.



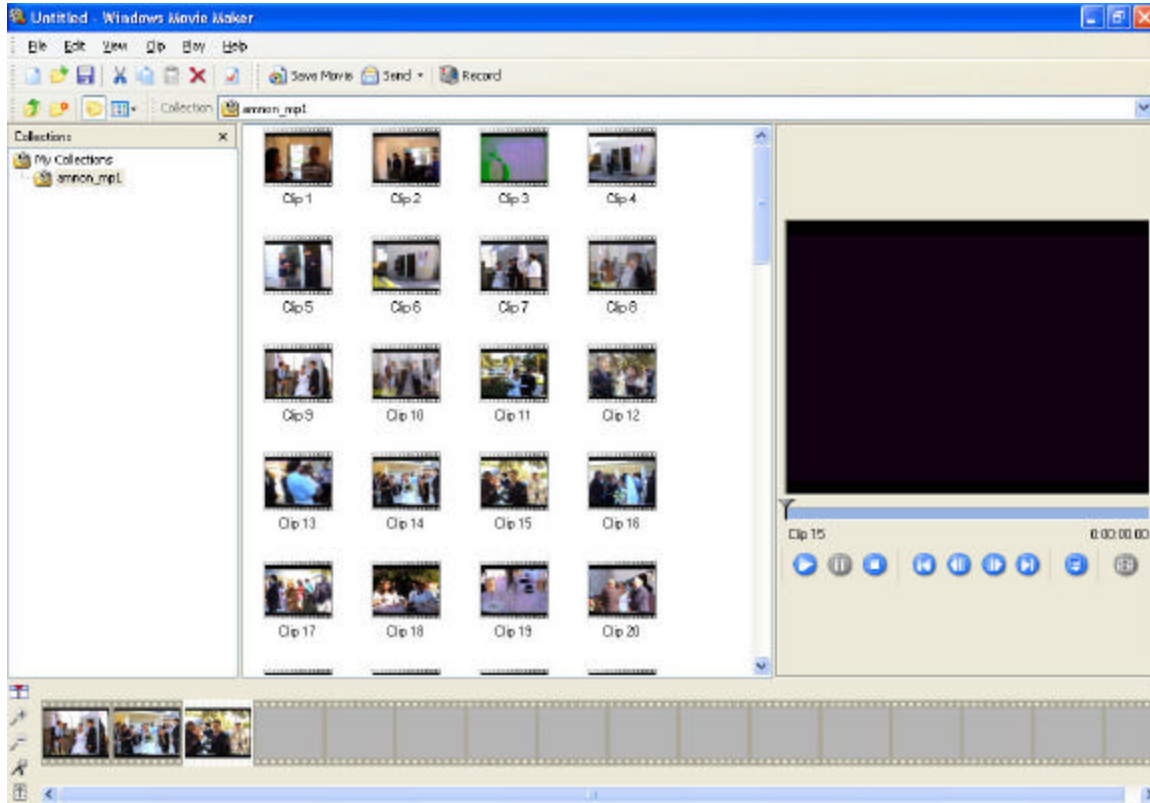
Audio editing is also limited. Each audio segment has 4 edit points to set the volume envelope, which must be set by hand using the mouse.

Like several of the other packages, MainActor does not display the total project runtime until the user selects the export option. Instead, the user must zoom out the timeline to see the total project runtime.

The help on this application was quite poor in spots, mentioning features without revealing how to access them. One bug that we noted is that the project resolution must match the output resolution when in MPEG-2 mode. Otherwise, the video gets corrupted.

Microsoft Windows Movie Maker

Overall, Windows Movie Maker is a primitive video editing and publishing application. It provides limited file format support (no Real or QuickTime support). Editing and publishing supports are quite limited too. For example, text overlay is not supported. Publishing to VCD, DVD, or VCR is not supported. But for what it supports, it works very well. The documentation is well written and the interface is comparatively cleaner, partially due to the fact that it supports fewer features compared with other applications. The user interface is shown below.



Movie Maker uses the term “Collection” to organize the digital content to be edited and produced. Several input video formats are supported. It can also take the input from VCR and DV. When a video is inserted, scene detection can be turned on to segment the video into clips. The publishing support is quite limited. It mainly supports writing the edited content to files but not other medias (VCD, DVD, etc.)

Movie Maker can use both the “timeline” and “storyline” models as the container to organize the digital content to be published. A piece of video (“clip”) can be trimmed, but no special effects are supported. Transition between clips is supported, but there is only one default mode for the transition. No text overlay is supported. The audio editing support is limited to adjusting the volume and supporting the default transition of audio only. One uncommon feature offered by Movie Maker is speech narration. The user can use a microphone to create an additional narration track for the video.

MGI VideoWave 5.0

Overall, VideoWave seems to be a very well-thought-out video editing and publishing application. It provides robust support of most of common video/audio editing functions and output formats (VCD, DVD, VCR and Web). The interface design is comparative clean, though the user may need to spend a few hours to get used to the terminologies and switching between different modes. The documentation provides a good guide for this purpose. A snapshot of the user interface is shown below.



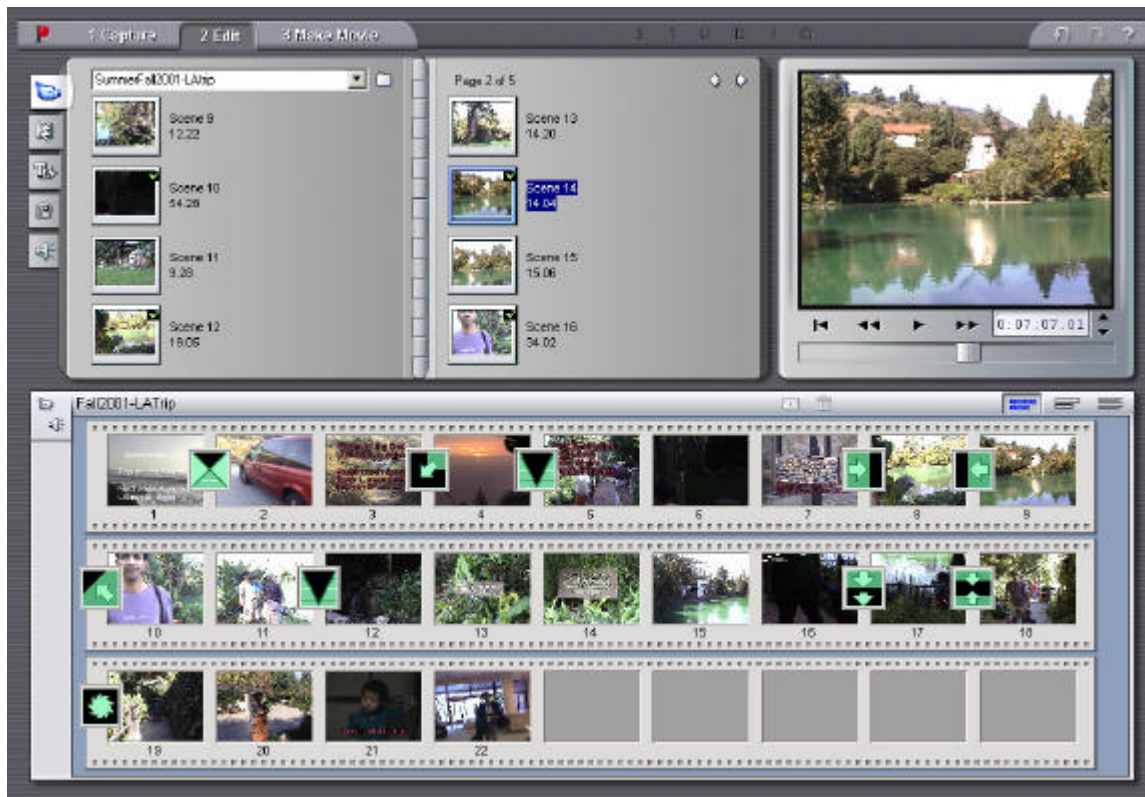
VideoWave uses the term “library” to organize the digital content to be edited and produced. Various common video/audio formats are supported to be put into the library. The input from DV or VCR is also supported. When a video is inserted into the library, scene detection can be turned on to segment the video into clips. The edited content (video and/or audio) can be published to VCD, DVD, VCR or to the Web.

VideoWave uses “storyline” as the basic container to organize the digital content to be published. Each piece of digital content from the library will first be edited and then added to the storyline. A piece of video can be trimmed, text overlaid, modified by changing the color and adding in special effects. A piece of audio can be cut or stretched and synchronized with video. The user can specify a desired transition when joining video clips together.

Pinnacle Studio DV 7

Pinnacle Studio DV version 7 is a fairly good mid-range video editing package. It differs from other packages in its class in that it comes with a FireWire (IEEE 1394) PCI capture board for around the same price. For users needing such a board, StudioDV is a good value.

Studio has 3 operating modes: Capture Mode, Edit Mode and Make Movie Mode. These are not selected from the top level menubar but by tabs in the window in the middle of the screen. Thus opening a video file does not happen from the top menu but from a folder button in Edit Mode, which can be counter-intuitive if one is used to a "Open File" menu item. The operating window cannot be resized, so a high resolution screen can end up with a lot of unused gray real estate, which could have been used by the package. A screenshot of the user interface is shown below.



The package is supposed to support MPEG-2 but had problems when we tried to use this feature. Attempts to perform scene detection on an MPEG-2 bitstream resulted in a loaded CPU and non-responsive application for some minutes. The scene detection itself works but not spectacularly. Detected scenes can also be sub-divided at any time using either date/time information, video content (i.e. shot detection), or with fixed time intervals (e.g. every 30 seconds). Either the audio or video track can be locked and the other deleted. However, the audio will be saved as a system MPEG file, not MP3. The application supports title overlays but only at the beginning of a clip (scene clip), not at arbitrary points. One interesting option is to export an edited video to Pinnacle's website for sharing with others. This feature was unique to Studio DV among the applications we tested.

Editing View can be either storyboard, timeline or text view. The storyboard view is good, with an interval bar under each clip showing the progress of playback within the clip when playing the movie. The text view is just a text listing of the clip filenames and durations. The timeline view has no zooming feature, which makes it difficult to place objects, for example sound effects, precisely. The sound effects library provided with the application is also just passable. The transition library is good with around 74 types of standard transitions and many more using Alpha Magic or Hollywood FX for studio libraries (some of which are upgrades to be purchased).

The playback window shows the currently selected clip if you click on a clip or the current playback position. If the currently selected clip in the storyboard is not also being played back (e.g., the playback window has been fast forwarded), then the Split Clip and Combine Clip menu items are grayed out, making it possible to split or combine a clip only if it is also currently being viewed. Also combining clips is only possible if the two clips are consecutive shots . These are unnecessary restrictions and should be removed.

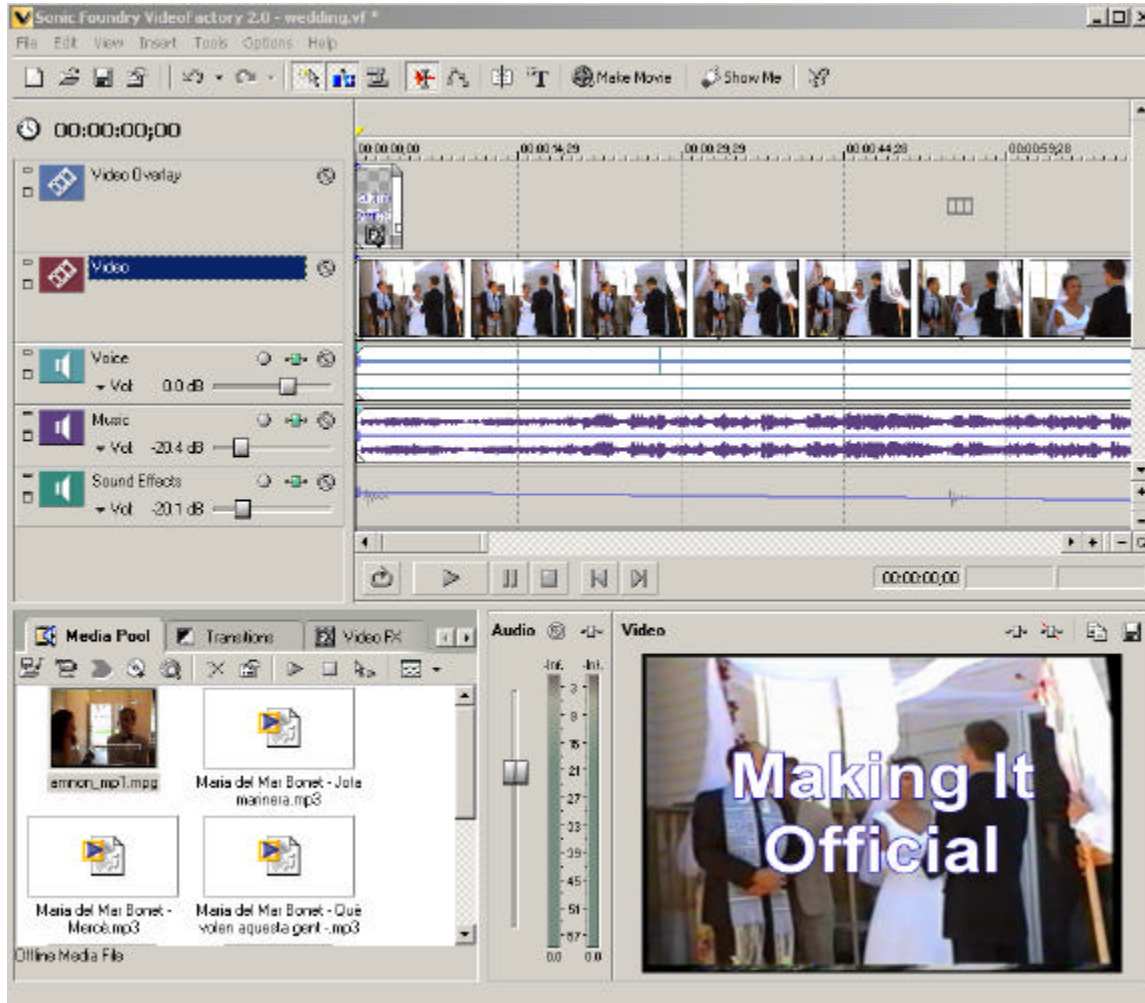
Studio comes with a Video Toolbox that allows adjustment of color, black and white, sepia rendering, brightness and contrast adjustment, set clip end points and set playback speed (from 0.1 X to 5 X).

The Audio Toolbox allows 3 tracks - original, sound effects and music, with individual volume levels. You can also add voice-over narration and add music from an audio CD.

Overall, the program is good, and except for the MPEG-2 file reading problem mentioned, works quickly and reliably, with all the features that are most likely to be needed by home users.

Sonic Foundry VideoFactory 2.0

This application works quite well overall, with many of the functions being fairly intuitive. It is designed for manual editing only, with almost no help on the automatic analysis front (no scene detection, for example). Imported media is added to a “Media Pool”, from which it can be added to the timeline. The media pool loads very fast, even for extremely large files. When adding to the timeline, the audio is analyzed to generate a visible waveform for the timeline. The user interface is shown in the screenshot below.



Some of the functions are very poorly documented. “Ripple edit”, for example, is one of the buttons that is not well explained. This function automatically eliminates the dead space resulting from cutting out a section of video. Also, the software can save individual frames as images, but the procedure is not documented in any of the help screens. We had to visit the discussion section of the company’s website to find out how this function (displayed prominently on the software box) works.

Sonic Foundry has recently switched MPEG encoder providers from Ligos to MainConcept. This has caused some difficulties since the documentation does not match the software. Also,

the entire MPEG support was missing for several weeks until a fix was made available for download.

VideoFactory has many powerful, easy to use transitions. However, automatic crossfade should be set before attempting to use the transitions. This step is not obvious. Also, adjacent video segments must be overlapped in advance to enable transitions. When previewing, transitions and effects can look jerky, but no time is necessary for pre-rendering.

VideoFactory does not include a general audio editor (Sonic Foundry sells those separately). Volume control only exists on a track basis, not event by event. The audio envelope used for adjusting volume along the track is not very intuitive to use, and the software gives no help in adjusting audio volumes. Audio cropping and crossfades are relatively simple, but audio effects can only be added on a track basis.

Text overlays were easy to add, and the transition tool was the same as for video segment transitions.

For a long video, the audio and video portions can lose synchronization. Our 1 hour video ended up with the audio segment ending about 1 second before the video. Also, the peak generation for the audio portion did not work properly (the audio waveform was not visible after processing).

Timecodes can be used to determine begin and endpoints for editing and positioning. This is a very useful way to position the cursor. For rougher edits, click and drag also works.

For MPEG-2 rendering, we could only select between a few pre-defined options, like SVCD or DVD. No customization is supported without purchasing an add-on option.

Still images default to 5 seconds on the timeline. We could not find a way to change this default. Each image duration must be set by hand, which can get tedious, especially for a longer slideshow. Also the overlap and transition must be set for each segment boundary by hand. Timeline specifications and snapping can speed this process, but it is still manual. Since the preview is generated realtime, crossfades don't always appear in the preview window. Finally, a couple of output clips were rendered badly, with black "flashes" visible in the video. Both of the bad clips are vertically oriented videos.

Ulead Video Studio 5.0

Ulead Video Studio is a stable application that provides reasonable basic editing functions, but we found its speed and features to be lacking for more advanced users. The user interface is not very intuitive, so the user may need to refer to the software guide frequently. In general, this application is suitable for simple tasks, although it can be slow (such as when running on a laptop). It does include a VCD/DVD plug-in that is pretty convenient, although, like the rest of the application, it can be quite slow. Overall, Video Studio is a somewhat clumsy tool, but it is stable and provides many of the most common editing functions and may work for some consumers. Below is a screenshot of this application.



We have tested this software's functions for editing long video clips, making slide shows of photos (may be mixed with small video clips), and producing basic DVD's and VCD's.

Video Studio can automatically detect shot boundaries from a DV video stream by using time codes in the video clip. It also offers dozens of transition effects for merging clips into a longer video. However, we were unable to figure out how to apply a simple fade-in and fade-out between clips, and the application is not able to split the audio and video apart in a clip. Text overlays can be added at any point in the video, and video filtering effects can be added to clips. The application also supports slideshows consisting of still images and short clips combined. Audio annotation and background music can be added to the slideshow if desired.

The DVD/VCD plug-in for Ulead Video Studio can automatically (if time codes are available) or manually (otherwise) select scenes, up to 99 scenes for the DVD; and the user can choose to add or remove scenes. The user can also select a background image for the DVD menu. The plug-in will then generate DVD/VCD/SVCD files and burn them to DVD or CD discs. However, it only works with one video file (i.e. burn one file at a time), and the file has to be saved in DVD/VCD/SVCD compliant format.

The Video Studio user interface uses a timeline view with four tracks: video, text overlays, voice annotation, and music. The original sound track of the video is stored together with the video part in the video track (i.e. AV can not be split). The volume of voice annotation and music background can be adjusted, and fade in/out effects can be applied to them. These are the only audio functions provided.

The interface also shows a storyboard with a frame of every video ever loaded as part of the project, even if the video does not exist in that directory anymore. We found it annoying that there is no way to remove the frame from the interface, but if a frame is clicked, an error message will appear if the application can not find the corresponding video in the directory. It is the same with images and audios.

VHS to DVD Conversion Services

Ever wonder what you are going to do with your old home videos if you decide to migrate completely from your analog VCR to a digital DVD player and personal video recorder? Well, a number of companies are offering to help you make that transition by converting your VHS tapes to DVDs for you. All you need to do is send them your VHS tapes, and they will create and send you a DVD of the same content. We have recently tested three companies that offer the VHS to DVD conversion service: YesVideo, which is partly owned by Kodak; LifeClips, which is partly funded by Sarnoff; and ImageStation, which is owned by Sony.

Test Material

Our test VHS tape contains 90 minutes of unedited wedding video. It includes footage of the entire event, including scenes of guests mingling prior to the wedding, the wedding ceremony, the cake cutting, the reception, and the opening of gifts. The camcorder was turned on and off a number of times during content capture, with shots ranging from only a few seconds in duration to about 20 minutes for the shot of the ceremony.

Procedures and Fees

For YesVideo, we dropped off the VHS tape at one of the participating photo stores and returned to pick up the DVD a couple of weeks later. For LifeClips and ImageStation, you can request the service online and they will send you packaging materials for sending your VHS tapes via UPS and FEDEX. You will still have to go to a UPS or FEDEX drop-off station, so the ordering process is similar in terms of convenience. It takes about a week or so to get your VHS tape back with the newly created DVD. Since the DVD is mailed to the customer, LifeClips and ImageStation do not require a second trip to get the finished product. For a 2-hour video tape, the prices for these companies are as follows:

- YesVideo: \$40
- LifeClips: \$30 + \$10 shipping
- ImageStation: \$40 + \$10 shipping

Video Quality

We have not noticed any significant difference in terms of video quality among the three companies. The quality of the DVDs is about the same as that of the original VHS. In general, DVDs have better resolution than VHS, so this is not surprising.

DVD Layout and UI

All three services provide a 3-button main menu DVD layout. The first button directly starts playing your video just like VHS. The second button links to another menu that lets the user select scenes in the video and jump to a particular location. A key frame thumbnail is used as the menu button for each scene, where the scenes are arranged in chronological order as DVD chapters. The third button links to company information. The navigation of the LifeClips DVD

is somewhat more awkward than the ImageStation and YesVideo DVDs. Normally, the “menu” button on a DVD player will take you back to the previous menu, while the “top” button will take you to the main menu. On the LifeClips DVD, both buttons link directly to the main menu, so the user cannot go from viewing a scene back to the scene selection menu directly. Instead, they must go through the 3-button main menu again.

Scene Cuts and Key Frame Selection

Although all three services offer a scene selection menu, they each divide the video into scenes differently and use different keyframes to represent the scenes. ImageStation simply divides your video into 5-minute scenes, and the first frame from each scene is chosen to be the keyframe. This procedure requires no analysis of the video data, which makes it simpler than the procedures used by LifeClips and YesVideo. However, it is also the least useful of the three.

Both YesVideo and LifeClips do some video processing. YesVideo prints all keyframes on the cover of the DVD case. The case is large enough to hold 54 keyframes, which is exactly the number of scenes detected for our video. We suspect this number of scenes, is fixed for all DVDs. A number of scene cuts chosen by YesVideo correspond to video shot boundaries, so Yesvideo must use an algorithm for video shot detection in their scene segmentation. We have also found that scenes seem to be limited to a 45-second minimum and 5-minute maximum. Some short-duration shots are merged into longer scenes and long-duration shots are cut at 5 minutes. Keyframes from YesVideo usually appear in the first few seconds of their corresponding scenes. One guess is that the first stable frame with little motion is chosen to be the keyframe.

LifeClips also does video shot detection and divides our test video into 70 scenes. LifeClips does not seem to set duration length limits for each scene. For our video, the scene durations range from 15 seconds to 35 minutes. Also, the DVD contains many very short-duration scenes (20 scenes in 11 minutes). The first frame in each scene is chosen as the keyframe.

Conclusions

The video editing packages can all be used to accomplish basic editing operations, but they vary widely in features offered, ease of use, and application stability. Microsoft's Movie Maker is probably the least powerful of the applications tested (but of course it's free). It can serve as a reasonable introduction to video editing for consumers, but regular users will probably outgrow the limited feature set relatively quickly.

Apple's iMovie and Arcsoft's Showbiz are basic editing packages that offer enough power for many casual users. Like Microsoft's Movie Maker, these packages are fairly intuitive, and new users can figure out the basic editing commands without too much trouble. For Apple users, iMovie 2 will probably suffice for many consumer video editing needs. Windows users who need more features than Movie Maker offers but who value ease-of-use over feature richness may want to consider Showbiz. However, Showbiz does not support MPEG-2 output, and other software packages for Windows offer significantly richer feature sets for similar (in some cases less) cost.

Magix and Sonic Foundry both produce credible video editing packages for about half what competitive applications sell for. Both companies are primarily known for their audio processing applications, so the video editors are not their main product. Magix produces a very powerful, feature-rich application, but they are currently on the first generation of their product, and it has stability problems. Overall, this is an application to watch, but users may want to wait for future product generations before considering a purchase. Sonic Foundry's product, although not as well known as some of the others, is actually quite nice. Their main drawback is the limited on-screen help menus and some ease-of-use issues. Users may want to consider this product if cost is an issue and they are willing to spend a little time learning the application.

MainConcept, like Magix, is a small German company that is attempting to break into the emerging North American market for video editing software. The MainActor application is interesting, but suffers from stability problems. Users may want to wait for a more stable release before trying this product unless it is important to them to have maximum flexibility when setting MPEG-2 options for rendering.

MGI, Pinnacle, and Ulead produce what are probably the three best-selling consumer video editing packages for Windows. All three sell for the same price, although Pinnacle's Studio DV comes with a firewire card while the others do not. Windows PC's that ship with a video editing package (other than Microsoft Movie Maker) probably come with a light version of one of these three products. All three products also support DVD and VCD output, although MGI VideoWave does not support SVCD. Ulead's Video Studio does not split the audio and video portions of a clip, unlike the other two applications. Overall, though, any one of these applications could serve quite well for most users. All of them are stable with reasonable documentation and a good mix of features.

The VHS to DVD conversion services were all similar in their results, although ImageStation was somewhat more primitive in its processing than the other two. The browsing functionality is quite nice, although the number of DVD chapters produced by LifeClips and YesVideo were

both a bit too large for easy browsing. Overall, all of these services performed similarly, with user preference probably being the deciding factor (plus the fact that Sony's service is more expensive).