

(Snipped 3/12/07 from Spin Browser™ video explorer reference manual.)

Video and Audio Technical Format Notes for Content Producers (PP)

Preamble:

- ◆ The information below describes the *technical* issues surrounding preparation of content for SB VE use. It does not address content issues in terms of user-experience and aesthetics, cost effective acquisition of appropriate material, or the like. For these latter elements, we strongly encourage you to contact us, as we have much to share based on our years of experience with SB VE installations, both in-house and third-party productions. (At a minimum, please request our SB VE Video Content Information document.)
- ◆ The technical information provided below here is relevant to two groups:
 - Those handling 100% of SB VE installation themselves.
 - Video producers who will hand TF (or a third party) the final content in a form to be loaded into the SB VE for final configuration, creation of an Attract sequence, etc.

1. HD vs. SD:

When considering whether to produce in an HD or SD, we recommend you do not assess simply whether you have HD shot-content available. Rather, think of your composition options in terms of an HD vs. SD "pallet" (the pixel dimensions of the production). An HD pallet allows crisp content windows, clarity of accompanying text, preserves much of the fidelity of high-res stills, etc. For example, we have done HD installations with two SD video clips composed side by side, SD video clips on one side and graphics and text on the other, high-res photos intermingled with video, as well as straight-shot HD video. If budgets allow, we always recommend working in an HD pallet, because even if people initially think they don't need it, by the time they are midway through the project, they frequently end up wanting the high image quality and compositional flexibility HD allows.

2. In final form, SB VE files need to be of the format below:

- a. Quicktime .mov file format. (The QT .mov file needs to be of the "self-contained" variety - i.e., it can't be in the QT linked-file type format.)
- b. Progressive scan - either shot that way initially or properly deinterlaced after the fact. (More detail below.)
- c. MJPEG-A Codec, Single Field. (The "Single Field" comment is basically saying the same thing as b) above. And the "-A" is relevant only if there is a "-B" and or blank option too.)
- d. 24 bit color.
- e. No digital audio Track within the file. (Audio interleaved with video simply takes up disk space, (very slightly) slows down disk reads of image data, and is ignored by the SB VE.)

- f. Pixel dimensions set between 640x480 and 1920x1080¹, depending on the project. 640x480 is the 4:3 aspect ratio format we use for standard def NTSC/PAL/SECAM quality video. 1280x768 is our most common 16:9 aspect ratio HD format. If TF is loading the final video, please speak to us about frame dimensions before finalizing content.

3. MJPEG compression settings:

- a. Normally, with content at 640 x 480, 30fps (29.97fps), we recommend compression rates of around 1.5 - 3.5 megs/second (assumes MJPEG compression!), depending on the content quality and detail level.² This translates to 50K/frame - 117K/frame (which is of course is a framerate-independent way of thinking about things). We recommend around 2.5 megs/second, the middle of this range, for most content.
 - b. For a 1280x768 frame size (increasing the data rate vs. 640x480), if shot at 30fps (29.97fps) this comes out to 4.8 - 11.2 megs/sec. These translate to 160K/frame - 374K/frame, which again is framerate-independent. [If shot at film-similar rate of 23.98 fps (decreasing data rate vs. 30fps), this results in a data rate of 3.8 - 9.0 megs/sec.] For such HD content, we typically recommend around 5-7 megs/second. (This recommendation balances frame update rate with image quality. Please see the chapter *Computer Hardware Notes and Tips for Maximizing Frame Update Rate == Temporal Smoothness* below for additional comments.)
 - c. Often capture and render software/hardware allows for capturing/rendering either at a fixed data rate (good for keeping the load on the computer, and thus SB VE playback smoothness, constant), or a fixed image quality (good for insuring each frame has the same image quality as all others). In most cases, either is fine. If limits are being pushed to the "bleeding edge" in terms of image quality, computer hardware speed, etc., some tests should be done before finalizing things. Note that when choosing a fixed image quality (rather than fixed data rate) - e.g., the "High" quality setting in the MJPEG compression render dialog box - typically frame sizes will vary, being larger for images with lots of detail, and smaller otherwise. The compression figures above should be applied to the average.
 - d. Basically and overall, the goal is to get high enough quality that the images look great and one can see virtually 0 compression artifacts, yet not wildly larger than is needed, which could cause jerky playback in the SB VE (not to mention large amounts of wasted hard drive and/or DVD/CD transfer-medium space).
4. Please also see "*Screen/movie pixel resolution notes*" in the chapter below, regarding pixel mapping your video to your chosen flat screen's native resolution.
5. Deinterlacing:
- a. Deinterlacing refers to the taking of two half-frames ("Fields") - the odd and even horizontal scan lines - and processing them to make a single image. (On a TV, they are shown one after another at 60Hz, twice the total frame rate of 30Hz, and your eye/brain stitches them together temporally.³) For display on computer monitors, and when images are frozen in time such as with the SB VE, the content needs to be "deinterlaced".)
 - b. If deinterlacing is not done, with moving images you will see horizontal "tear" lines in the final content, dramatically reducing image quality and in some cases, making digital files incompatible

¹ A pixel resolution this high may run more sluggishly than you would wish. We recommend not exceeding about 1280 x 768 pixel dimensions. More information on this is available in the following chapter *Computer Hardware Notes and Tips for Maximizing Frame Update Rate == Temporal Smoothness*.

² Note that in the upper end of the suggested range, you should see *no* visual degradation of the image. If you do, something is odd and we strongly suggest you call us to consult. And even at the lower range, the compression artifacts should be quite modest.

³ It is possible screen phosphor persistence may also help here.

with the SB VE software altogether. (For great information about deinterlacing in general, please see www.100fps.com.)

- c. If images can be shot in what is called "Progressive Scan" to start with (and at *full* frame rates⁴, which lots of prosumer camcorder progressive scan modes do NOT typically allow), that is great and will result in the best final image. But often, particularly with older cameras, lower cost cameras, or previously existing content, that is not an option. (Also, it is possible to accidentally take footage that was originally shot in progressive scan mode, and when re-rendering it on the computer, convert it back to an interlaced form that may be incompatible with the SB VE...)
- d. Deinterlacing properly, both in general and for the SB VE in particular, can be a surprisingly tricky business and many different algorithms and settings exist for performing the task. Programs such as Adobe After Effects, Adobe Premiere, AVID, Apple's Final Cut Pro/Express, Quicktime Pro, and several fancier software utilities/plugin-ins (for example www.revisionfx.com (<<recommended) and www.alparysoft.com, to name just a couple) and hardware devices, can all do this. However, quality achieved between different methods can vary quite dramatically - from wonderful to virtually unusable (with blurring, superimposed ghost images, etc.). And the number of settings that all must be correct is, in many cases, quite numerous. (For example, in Premiere 6.5 it was around 4, spread throughout various places, and where the settings that did the best at stitching horizontal tear lines, often made overlaid text virtually unreadable...) And if you are performing multiple layers of editing, incorrect workflows can result in certain clips being deinterlaced more than once, which can in certain circumstances greatly decrease quality.
- e. If content is provided to TF in interlaced mode, it can be deinterlaced here. That is an acceptable solution, so long as the source content is of proper format with both fields of high quality and intact, and it is understood that such deinterlacing here may be redundant, with the effects of slightly increasing overall project cost, and possibly degrading quality slightly due to multiple compressions. It is generally better, therefore, that all deinterlacing be done (properly) ahead of time.
- f. It is **STRONGLY** recommended that a small deinterlaced file be tested within the SB VE system before rendering the entire content. This test can be performed by you if you are the one loading and configuring the entire system, or by TF if we are doing it (it is sufficient to simply email us a small file of just a few frames in length).

6. Head-to-Tail Transition:

Recall that the SB VE is typically configured to loop seamlessly "head-to-tail", so please remember to add whatever you want to happen (if anything) between the end and start of the video. In other words, you might want a fade from the end frame to the start frame, or just to black, or to an intro/credit screen,... or you might just want a simple head-tail connection with no transition at all.

7. For maximum flexibility, render several smaller movie files, rather than a single large one:

- a. Note that the rate of progression through a movie, as a function of dial rotation, is set in the configuration on a *file-by-file* basis.
- b. Because of this fact, it is strongly recommended to save different types/lengths of content as separate files, in order to be able to adjust traversal parameters independently. For example, best dial parameters for a 1 hour point-of-view river flyover are typically quite different than for a 10 second clip of beetle walking. Particularly if such a short clip immediately follows such a long one in an installation, the need for independently adjustable parameters is significant.
- c. In a similar manner, whenever creating transitions or intro screens, please consider making them separate movies, in order that their relative progression time can be adjusted independently of the core movie sequences.

⁴ By "full frame rate", I mean 30fps. [Some might claim 60fps, the Field update frequency, is the more appropriate figure to use (the issue has to do with human perception questions, not overall mathematical bandwidth), but in any event, virtually everyone would agree that 15fps, what many prosumer camcorders allow in progressive scan mode, is *not* sufficient.]

- d. Relatedly, when thinking about how many frames to put in such a transition (and your production overall), do not think of time (which is pretty meaningless with the SB VE), but rather, the visual "jerk" between sequential frames (which you want to minimize).
- e. Note that from the user perspective, transition from one movie file to the next is seamless, so there is little downside to rendering several small files rather than one big one. Plus, with several smaller files, if you may a mistake in one, you don't have to re-render the entire sequence.

8. Audio:

If audio accompanies the video, it should be saved as a separate .wav file, uncompressed (integer big endian), at one of the standard sample frequencies in the 32-48Khz range, typically 16 bit stereo.

9. Notes regarding media delivered to TF, should you be providing us with content to install and configure:

- a. Regarding digital files (our much preferred content delivery format):
 - i. Files can, depending on size, be delivered on CD-ROM, DVD-ROM, or external Firewire or USB hard drive (and these days, even 4Gig+ USB Flash Thumb drives).
 - ii. Generally, we can read both PC and Mac format (we are PC-based but have a software utility for reading Mac format disks that usually works) CD-ROM -R, DVD-ROM -R, and DVD-ROM +R.
 - iii. For up to about 1 Gig of content, FTP Internet transfer of files is an excellent method assuming you have a high speed upload link.
 - iv. It is strongly encouraged that, before rendering your entire project at significant time and expense, you:
 - 1. FTP or email us a 5 frame movie file to test.
 - 2. Double check to be sure your final render settings match, in all regards, the settings you used when you sent us the test files!
 - 3. (Optional) Send us a clip on the media you plan to provide (DVD-ROM -R, etc.) to be sure we can read said media.
- b. Regarding tape formats:
 - i. In house, we can read MiniDV, Hi-8, and VHS tapes.
 - ii. Other formats, such as BetaSP and high-end formats such as DigiBeta, will require outside conversion services which will be charged at cost plus our time to coordinate the transfer.
- c. Regarding DVD movie disks⁵:
 - i. We certainly can read these, but note that DVD movies are compressed using MPEG 2. As mentioned below, MPEG is not the greatest codec choice for stop-frame review; however, for many types of content it will likely be fine.

10. Misc. Issues:

- a. Sometime conversions between different frame rates, as occur when going from PAL or film to NTSC, can also create problems if not done properly. Be sure to examine the final content for "ghosting" etc.
- b. Overall, to achieve maximum image quality, conversions from one format to another should be minimized.

⁵ As contrasted with DVD-ROM data disks.

- c. Be sure that content has had all unwanted black/distorted borders around the edge of the image removed. Unlike a TV which cuts off peripheral scan lines, computer screens in general, and the SB VE in particular, do not.⁶
- d. Avoid going through any intermediate compression algorithm - such as MPEG (particularly MPEG 1) and many others - that introduces distortions during high-speed motion changes. Such changes may be virtually unnoticeable to most viewers when playing the video at normal speed, but will be highly objectionable to all when viewed in stop frame on the SB VE.
- e. For SD content, if there is any way to get source material higher than VHS quality (both BetaSP and MiniDV are much better), it will enhance the final exhibit experience.

1. SCREEN/MOVIE PIXEL RESOLUTION NOTES

- a. When using a flat LCD or Plasma hard-pixel-wired screen⁷, producing movie content whose pixel resolution exactly matches that of the screen results in by far the best image quality.
- b. Where this issue arises most frequently and most importantly is when using a large display (e.g., 42") and HD content. For example, the native screen resolution might be 1280x768. In that case, it is by far best to produce movie content *exactly* 1280x768 in size.
Where the above does *not* apply is if:
 - i. The video content is SD (such as 640x480), as you cannot purchase a flat screen display with a native pixel resolution so low.
 - ii. The screen resolution is so high (for example, 2000+ x 2000+), that producing a video of the native resolution will result in too low a frame rate.
- c. In general, when producing video we recommend not exceeding about 1280 x 1024 pixel dimensions which, properly configured on a fast machine, should update at around 30fps. However, note that the frame update rate is determined not only by the pixel dimensions, but also by the size of each JPEG frame. Thus, a highly-compressed movie of 1280 x 1024 pixel dimensions, might potentially run faster than a very uncompressed 800x600 one. Therefore, when you are pushing current computer hardware to the limit, you should experiment with the MJPEG compression factor (this latter being equivalent to the frame size in kilobytes which in turn is equivalent to the movie data rate in megabytes/second), in order to determine the best compromise between frame update rate and individual frame image quality. Note that this balance is affected not just by hard technical details, but also by the video subject matter and the human perceptual system. Specifically, if you are doing something like viewing the blooming of a flower, even 15fps would look fine, whereas if you are performing a horizontal pan, 30 or even 60fps may not appear as smooth as you would wish.
- d. For setting non-standard screen resolutions that your graphics card does not natively support, we recommend using the program Powerstrip from www.entechtaiwan.net.

If there are any questions or comments, do not hesitate to contact us!

⁶ Again, if TF is performing final install, we can re-render content to remove said black borders, but that has the same issues as discussed above regarding deinterlacing, in terms of slight increased cost and the need for recompression.

⁷ Which all flat screens are - we are contrasting here to CRT-based conventional screens.