MIDI vs. Digital Audio

In contrast to MIDI data, digital audio data is the actual representation of a sound, stored in the form of thousands of individual numbers *(samples).* The digital data represents the instantaneous amplitude (or loudness) of a sound at discrete slices of time.

MIDI data is to digital audio data what vector or drawn graphics are to bitmapped graphics.

MIDI data is device dependent; digital data is not. Just as the appearance of vector graphics differs depending on the printer device or display screen, the sounds produced by MIDI music files depend on the particular MIDI device used for playback.

Example : A roll of perforated player-piano score played on a concert grand would sound different than if played on a honkytonk piano. Digital data, on the other hand, produces sounds that are more or less identical regardless of the playback system.

The MIDI standard lets instruments communicate in a well-understood language.

MIDI has several advantages over digital audio and two huge disadvantages.

First, the advantages:

- MIDI files are much more compact than digital audio files, and the size of a MIDI file is completely independent of playback quality. In general, MIDI files will be 200 to 1,000 times smaller than CD-quality digital audio files. Because MIDI files are small, they don't take up as much memory, disk space, or bandwidth.

- Because they are small, MIDI files embedded in web pages load and play more quickly than their digital equivalents.

- In some cases, if the MIDI sound source you are using is of high quality, MIDI files may sound better than digital audio files. You can change the length of a MIDI file (by varying its tempo) without changing the pitch of the music or degrading the audio quality.

- MIDI data is completely editable—right down to the level of an individual note. You can manipulate the smallest detail of a MIDI composition (often with submillisecond accuracy) in ways that are impossible with digital audio.

- Because they represent the pitch and length of notes, MIDI files can generally be converted to musical notation, and vice versa. This is useful when you need a printed score; in reverse, you can scan a printed score and convert it to MIDI for tweaking and editing.

MIDI's disadvantages:

- Because MIDI data does not represent sound but musical instruments, you can be certain that playback will be accurate only if the MIDI playback device is identical to the device used for production. Imagine the emotional humming chorus from *Madame Butterfly* sung by a chorus of Budweiser frogs—the sound of a MIDI instrument varies according to the electronics of the playback device and the sound generation method it uses.

- Also, MIDI cannot easily be used to play back spoken dialog, although expensive and technically tricky digital samplers are available. In general, use MIDI in the following circumstances:

- Digital audio won't work because you don't have enough memory or bandwidth.

- You have a high-quality MIDI sound source.
- You have complete control over the machines on which your program will be delivered, so you know that your users will have high-quality MIDI playback hardware.

- You don't need spoken dialog.

The most important advantage of digital audio is its consistent playback quality, but this is where MIDI is the least reliable! With digital audio you can be more confident that the audio track for your multimedia project will sound as good in the end as it did in the beginning when you created it. For this reason, it's no surprise that digital audio is used far more frequently than MIDI data for multimedia sound delivery. There are two additional and often more compelling reasons to work with digital audio:

- A wider selection of application software and system support for digital audio is available for both the Macintosh and Windows platforms.
- The preparation and programming required for creating digital audio do not demand knowledge of music theory, while working with MIDI data usually does require a modicum of familiarity with musical scores, keyboards, and notation, as well as audio production.

In general, use digital audio in the following circumstances:

- You don't have control over the playback hardware.
- You have the computing resources and bandwidth to handle digital files.
- You need spoken dialog.

Chapter 5

ANIMATION

Animation makes static presentations come alive. It is visual change over time and can add great power to your multimedia projects and web pages. Many multimedia applications for both Macintosh and Windows provide animation tools.

The Power of Motion

- You can animate your whole project, or you can animate here and there, accenting and adding spice.

- For a brief product demonstration with little user interaction, it might make sense to design the entire project as a video and keep the presentation always in motion.

- For speaker support, you can animate bulleted text or fly it onto the screen, or you can use charts with quantities that grow or dwindle; then, give the speaker control of these eye-catchers.

- In a parts-assembly training manual, you might show components exploding into an expanded view.

- Visual effects such as wipes, fades, zooms, and dissolves are available in most multimedia authoring packages, and some of these can be used for primitive animation.

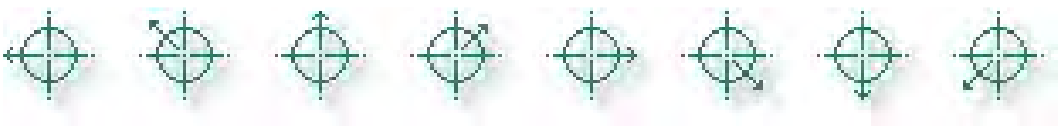
For example, you can slide images onto the screen with a wipe, or you can make an object implode with an iris/close effect. But animation is more than wipes, fades, and zooms.

Animation is an object actually moving across or *into* or *out of* the screen; a spinning globe of our earth; a car driving along a line-art highway; a bug crawling out from under a stack of papers, with a screaming voice from the speaker telling you to "Shoot it, now!"

Principles of Animation

Animation is possible because of a biological phenomenon known as **persistence of vision** and a psychological phenomenon called **phi**.

An object seen by the human eye remains chemically mapped on the eye's retina for a brief time after viewing. Combined with the human mind's need to conceptually complete a perceived action, this makes it possible for a series of images that are changed very slightly and very rapidly, one after the other, to seemingly blend together into a visual illusion of movement. The illustration shows a few cels, or frames, of a rotating logo. When the images are progressively and rapidly changed, the arrow of the compass is perceived to be spinning.



- Digital television video builds 24, 30, or 60 entire frames or pictures every second, depending upon settings; the speed with which each frame is replaced by the next one makes the images appear to blend smoothly into movement.

- Movies on film are typically shot at a shutter rate of 24 frames per second, but using projection tricks (the projector's shutter flashes light through each image twice), the flicker rate is increased to 48 times per second, and the human eye thus sees a motion picture.

- On some film projectors, each frame is shown three times before the pull-down claw moves to the next frame, for a total of 72 flickers per second, which helps to eliminate the flicker effect: the more interruptions per second, the more continuous the beam of light appears.

- Quickly changing the viewed image is the principle of an animatic, a flip-book, or a zoetrope. To make an object travel across the screen while it changes its shape, just change the shape and also move, or **translate**, it a few pixels for each frame. Then, when you play the frames back at a faster speed, the changes blend together andyou have motion and animation. It's the same magic as when the hand is quicker than the eye, and you don't see the pea moving in the blur of the gypsy's cups.

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