EXHIBIT 30

DEMYSTIFYING MULTIMEDIA

A Guide for Multimedia Developers from Apple Computer, Inc.

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vidual basis. The level of quality that is possible given the data rates and the decompression times is another consideration.

Compression Characteristics

Compression schemes can be either lossy or lossless. **Lossless** compression preserves all of the original data. These schemes are appropriate for situations where data integrity is a primary importance. Software instructions and text data are examples where all information must be preserved. **Lossy** compression drops data or degrades the quality according to the compression setting. With lossy compression, data is actually lost and cannot be recovered but the compression ratios are usually far greater than lossless schemes. Lossy schemes attempt to remove information the viewer is apt not to notice (dropping visual information before audio), but if the compression settings are too restrictive, the picture quality may become too poor.

There are four main characteristics by which you can judge compression algorithms—**compression ratio**, **image quality**, **compression/decompression speed**, and **spatial/temporal compression**.

The **compression ratio** is a comparison of the storage space for the compressed data with that of the uncompressed data. This ratio gives an indication of how much compression is achieved for a particular image, sound, or video clip. Most compression algorithms allow a range of compression ratios with the exact ratio depending on the complexity of the content. For example, a highly detailed image of a crowd at a football game may yield a very small compression ratio, whereas an image of a pure blue sky may yield a very high compression ratio.

The compression ratio typically affects the **image quality**. Generally, the higher the compression ratio, the poorer the quality of the resulting image. This trade-off between compression ratio and picture quality is an important consideration.

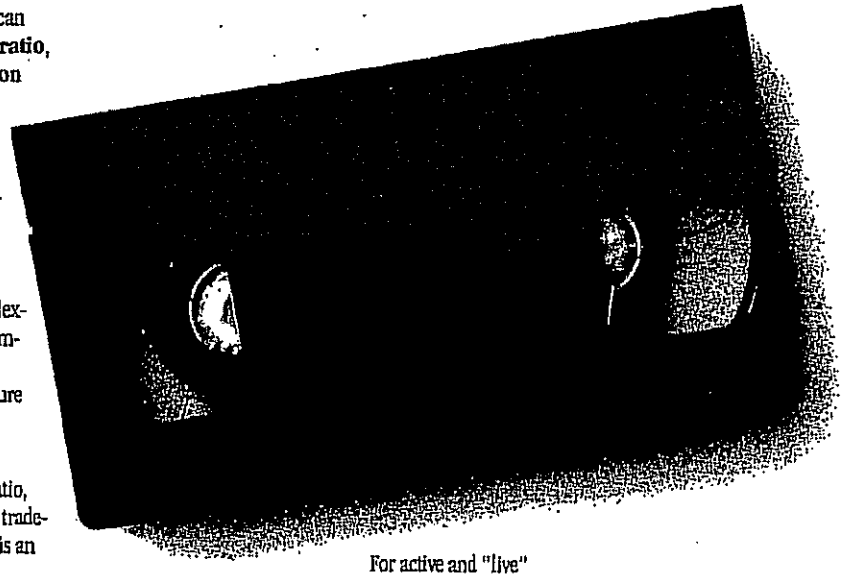
Compression and **decompression speed** represent the times required to encode and decode data, respectively. Compression/decompression speed depends on the efficiency and speed of the compression/decompression algorithm, or **codec**. Some codecs take a long time to compress even a little data. This will affect how fast the production team can work, so consider this when planning the production for a project. Some codecs are **symmetric**, which means that it takes the same amount of time to compress as to decompress. Other codecs are **asymmetric**. This means that compression and decompression times are not the same. Asymmetric codecs may take a very long time to compress data but they decompress and "play" much more quickly.

Spatial compression is used to remove information from within a single frame of picture or video. The frame is analyzed and compressed independently of the other frames. **Temporal compression**, however, analyzes the changes between one frame and the next and only records the changes. For video with little detail or movement, the changes between individual frames is low and the compression ratio can be very high. But for video with lots of minute changes throughout the frame, compression may make little difference.

Compression Limits

Finely detailed video or high fidelity audio may perform poorly on lower-end computers. Such performance may not permit the kind of fluid presentation that is required for some uses.

Each transition has its own data rate associated with it when in a digital video format. Cuts, for example, use less data than a cross-dissolve. Data-intensive transitions may be a problem in movies made for less-powerful computers. If a computer cannot process the frames fast enough, it will drop some out, which may degrade the quality of the movie. It may be better to redesign the edits to use less intensive transitions. Prototyping should determine the appropriate transition styles to use.



For active and "live" multimedia, like a teleconference or videophone, the compression and decompression times may stifle real-time interaction and destroy any sense of spontaneity. When using decompressed imagery, avoid finely timed interactions because the performance of the playback equipment may not be able to deliver the elements within the time expected. Again, test all elements before finalizing production specifications.

Older CD-ROMs have a minimum data transfer rate of 150KB/sec while newer ones can handle 300 KB/sec.