Battle of the **bulge**

Audio is an insatiable glutton for storage space. Panicos Georghiades and Gabriel Jacobs recommend putting it on a diet using audio compression.

Audio is important to multimedia, partly because it has a quality which few visual effects possess, especially when presented on a busy screen. It can really grab your attention. Used at the right time and in the right form, the audio element of multimedia can be very effective indeed.

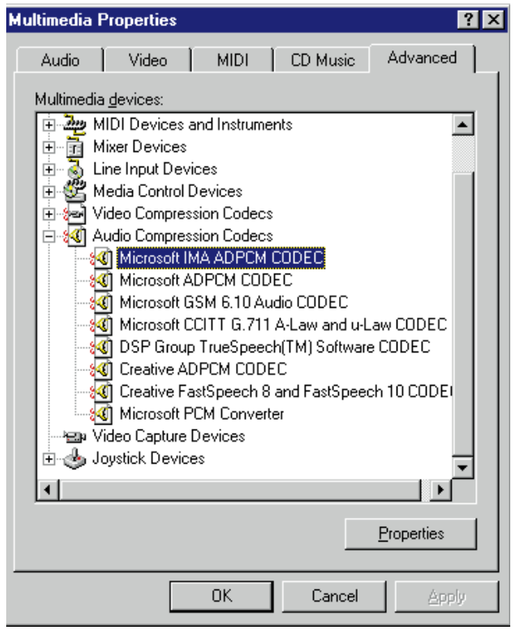
However, one of the problems of using audio is that it takes up a lot of storage space. It's the second most storage-hungry medium after video. And compression, often used with still images (GIF and JPG files) and always used with digital video in multimedia (Cinepak, Indeo, MPEG) hasn't seen such a wide use in audio.

For years we've had to suffer 11kHz 8-bit mono (so called AM-quality sound). We seem to have moved to 22kHz 8-bit stereo for multimedia on CD-ROM, but the internet is forcing a backward step with its 8Kb telephone-quality sound. With multimedia on CD-ROM, however, it's possible to enjoy CD-quality sound and use the same amount of storage space as 22kHz 8-bit sound, with compression. And any machine that can play Video for Windows, can handle it.

Part of the reason for the lack of audio compression in the early days was the use of 386 machines and basic sound cards, but the hardware situation has changed. Most users now have at least a 486, capable of audio decompression in realtime. Compression and decompression drivers have been available for free, and are installed automatically with Video for Windows. They come as standard with Windows 95.

With Windows 95 you get ADPCM, TrueSpeech, GSM 6.10 audio and CCITT G.711 (A-Law and u-Law).

With Windows 3.1 you don't get any of these, but you do have the possibility of adding audio codecs (a CODEC is a COmpressor/DECompressor) and the Video for Windows runtime module includes Microsoft and IMA ADPCM. Individual sound cards may add their own.



The Video for Windows runtime module includes Microsoft and IMA ADPCM

Compression expression

What are these things and what do they do? ADPCM (Adaptive Delta Pulse Code Modulation) comes in two flavours: IMA and Microsoft. Other companies, such as Creative Labs, have their own variations.

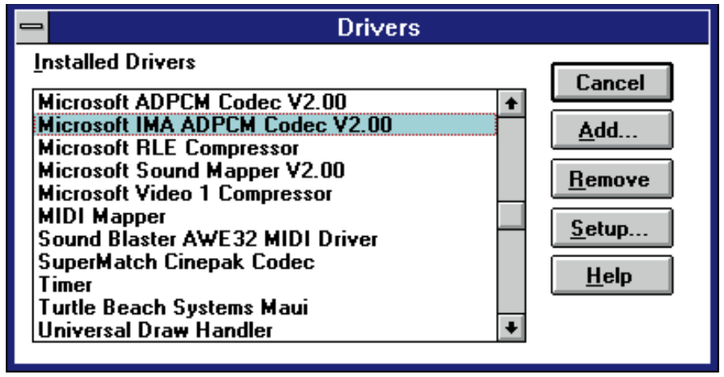
IMA stands for Interactive Multimedia Association. The definition is for multiple hardware platforms and is real-time compression.

Microsoft ADPCM is similar, but offers both real-time and non real-time compression. Non real-time compression using this method can create better-sounding audio files.

This codec is what's used in Microsoft's Encarta encyclopedia. It compresses at 4:1, and works by storing the differences between two subsequent samples rather than the value of each sample — a smaller number which can be stored in four bits instead of 16.

Although low frequencies are fairly faithfully reproduced, high frequencies can sometimes become distorted. You can hear the distortion quite plainly when the sampling rate is 11kHz, and it decreases with higher sampling rates. At 44.1kHz, you can't hear it at all if you have normal hearing. Thus, at high sampling rates, it can be used successfully for classical music, solo instruments, and good-quality speech.

CCITT G.711 A-Law and u-Law are codecs which give compatibility between telephony standards in Europe and North America. CCITT stands for Consultative Committee for International Telephone and Telegraph: it's an international organisation which creates and approves communications protocols. Its G.711 codec offers a 2:1 compression ratio by moving from 16 bits to 8 bits per sample. We don't recommend using it for multimedia.



Audio compression drivers that come with Windows 95

TrueSpeech has been developed by the DSP Group. It offers good compression (about 16:1) and is fine for certain voice applications, but it's not a good option for music, as you'll hear in our example on the CD-ROM. It doesn't give you real-time compression, but it does offer real-time *decompression* and is a viable alternative for use with modems and networks. It can certainly be used in multimedia for narration if you have too much sound and too little space.

GSM 6.10 is a good real-time compression system, if your hardware is fast enough to handle it. It's a useful codec for recording voice with the Windows Sound Recorder when you want to store sound embedded in documents, and it conforms with a standard set down by ETSI (the European Telecommunications Standards Institute).

For now, we'll leave you with these brief explanations and will return to the subject in more detail at a later date. Meanwhile, we've included various versions of an audio sample on this month's cover-mounted CD-ROM, which has been compressed using these methods, so do have a listen to it.

Not a clear picture

Another reader has sent us an interesting query to which there is no clear answer: *"Much interest is being shown in electronic still-image cameras at present. I have seen the advertisements concerning inexpensive video capture cards but I've heard that they only work for a composite signal and not for the higher-quality S-Video signal, although this may be incorrect.*

"Could you please advise how an S-Video source can be used with its higher resolution as a source for putting video clips onto the hard disk? More importantly for me, please explain the process for still electronic images. I would then try to print them at 720dpi onto special paper on an Epson Stylus Color.

"I think an answer to this question, including a comparison of the degree of resolution obtainable from an S-Video signal, vis-a-vis that obtainable from the new electronic image cameras, would be of interest to many. It might even stop the mythical estate agent rushing out to buy the new cameras if he already has a Hi-8 video camera."

James Jenkin
<jenkin@itl.net>

You're right about being wrong in what you've heard about the S-Video capabilities of capture boards. Ninety-nine percent of video capture boards on the market include an S-Video input. Also, most of them can capture stills (or single frames) and move video. So yes, as you have deduced, it's possible to get very good results from using a video camera and a capture board. However, before dismissing the usefulness of still digital cameras, there are a number of things to consider.

Most capture boards nowadays, costing £300 to £1,000, will capture a full PAL signal (most of the visible horizontal lines). The information in each line is normally digitised up to 736 times, usually using Y:U:V 4:2:2. This results in a 24-bit true colour picture. So you can end up with a captured photo-realistic image which is 736 wide x 560 high.

However, this comes from the power of the capture board and doesn't depend on whether or not you connect the camera to it

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using S-Video or composite video.

Most domestic camcorders have an estimated horizontal resolution of about 500 lines on a live signal, but still compare well with the resolution of some of the cheaper cameras working at up to 400 lines only. But when you record a camcorder signal onto tape and then play back and capture, the recording process puts on its own limitation of an estimated 400 lines (for Hi-8, S-VHS, or S-VHSC).

You also have tape-related deterioration like drop-out, noise and colour changes. In addition, the PAL signal from a camcorder is interlaced — the odd lines are not drawn at the same time as the even lines. This creates further problems often visible on stills captured while the subject is moving. Digital cameras, on the other hand, have low shutter speeds (the Casio QV10 can go as low as 1/4000 of a second). There can be synchronisation problems between the camcorder (playing a tape) and the capture board.

These are the disadvantages of using a camcorder plus capture board combination. But there are advantages. For example, the lenses and zoom facilities on most camcorders are better than those you find on cheaper digital cameras. A video tape can hold many more images than any digital-camera's floppy disk or RAM. And if you're capturing things in motion, you don't have problems with people shutting their eyes just when you click.

The main advantage of digital cameras over capture boards is not in their resolution.

Fig 1

Casio QV10	320 x 240	96 images in 2Mb RAM
Kodak DC20	493 x 373	8 images in 1Mb RAM
	320 x 240	16 images in 1Mb RAM

You can see that these resolutions are similar to those of camcorders.

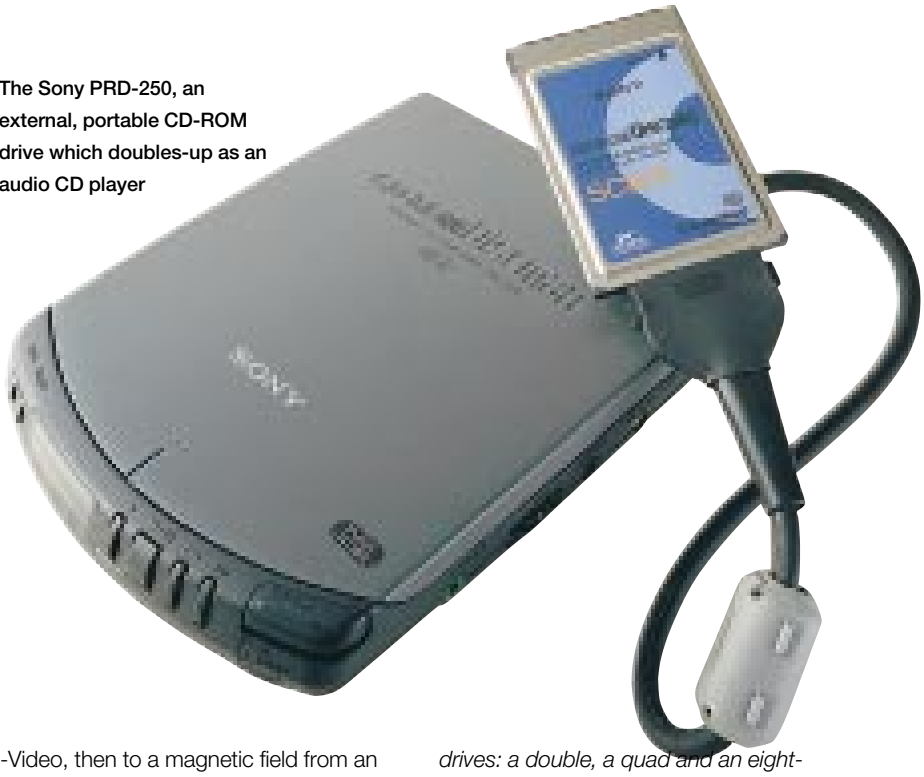
It's true that the expensive ones (£8,000-plus) can go to high resolutions, some comparable to film. But the cheaper ones (£400 to £1,000) don't have high resolutions. The table in Fig 1 illustrates the point.

Where digital cameras differ is that the signal has a shorter path (thus less processing) and is therefore truer. A signal that simply gets digitised and stored to a disk or RAM is likely to be truer to the original than one which gets converted to S-Video, then to a magnetic field from an analogue electric signal, then back to S-Video, and is then digitised by the capture board within a noisy PC environment.

As a result, images from digital cameras tend to have less spillage of colour from one pixel to another, and less noise. They give a clearer image, even if the resolution is less than that which you may get with a camcorder.

If you can avoid recording a signal onto tape when using a video camera and capture board, and you can capture from a live signal, the results obtained can be comparable, and even sometimes better than, what you can get with a cheap digital camera. This is fine, but now you have lost the portability aspect. You can now see why there's no straight answer to your question.

It's worth mentioning that the lighting on the object you're digitising will play a far greater role in the quality of the results than whether you use a digital camera or a capture board, or whether you use S-Video or composite video connections. Note also that the situation is likely to change, in favour of the camcorder and capture board combination, with the new digital camcorders now becoming available.



The Sony PRD-250, an external, portable CD-ROM drive which doubles-up as an audio CD player

CD-ROM drives and hi-fi

Reader, Lawrence Lo, writes to ask whether he can use one of his CD-ROM drives as an audio CD player. *"I have three CD-ROM drives: a double, a quad and an eight-speed. I want to take out the double-speed drive, which is a Creative Labs CDR-563. I was wondering whether it is possible to use it as an audio CD player for the hi-fi? I'm sure many other people have, like me, upgraded their CD-ROM drives. Some may still even have their old single-speed drives. Can they be used for audio?"*

Lawrence Lo
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You're not the first to have this idea, Lawrence. In fact, it's the most obvious use for an old CD-ROM drive. However, unless you have an old computer (even an 8086 with only 640Kb RAM, no hard disk, running under DOS) and an appropriate interface card (an old 8-bit SoundBlaster with a CD-ROM interface will do), you can't do it with your particular drive. This is because even though you can connect its audio output to your hi-fi, and maybe even power it externally, you'll have no control over its transport mechanism.

This is not the case with all CD-ROM drives. Some external drives, especially most of the portable ones like the new Sony PRD-250, are designed to double-up as CD players.

•PCW Contacts

If you have any multimedia-related problems, queries, hints, tips, or suggestions, write to us c/o *PCW* at the usual address, or email

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