# **Sound** principles

**Eleanor Turton-Hill explains how to make the most of the sound-making capabilities of your PC.**

These days, most PCs come with a sound card pre-installed but very few people fully exploit the sound capability of their machines.

Sound cards don't only make games and multimedia applications sound great but with the right software you can also compose, edit and print your own music as well as learn to play the piano, record and edit digital audio, and play audio CDs from your desktop.

Before you start fiddling with your recording software, however, it helps to understand some of the underlying principles of sound generation on PCs. Here, I've given a brief summary of the most important technical concepts relating to sound.

### Why does a PC need a sound card?

Sound is a relatively new capability for PCs because no-one really thought about it when the PC was first designed. The original IBM-compatible PC was designed as a business tool, not as a multimedia machine, so it's hardly surprising that nobody thought of including a dedicated sound chip in its architecture. Computers, after all, were seen as calculating machines; the only kind of sound necessary was the beep that served as a warning signal.

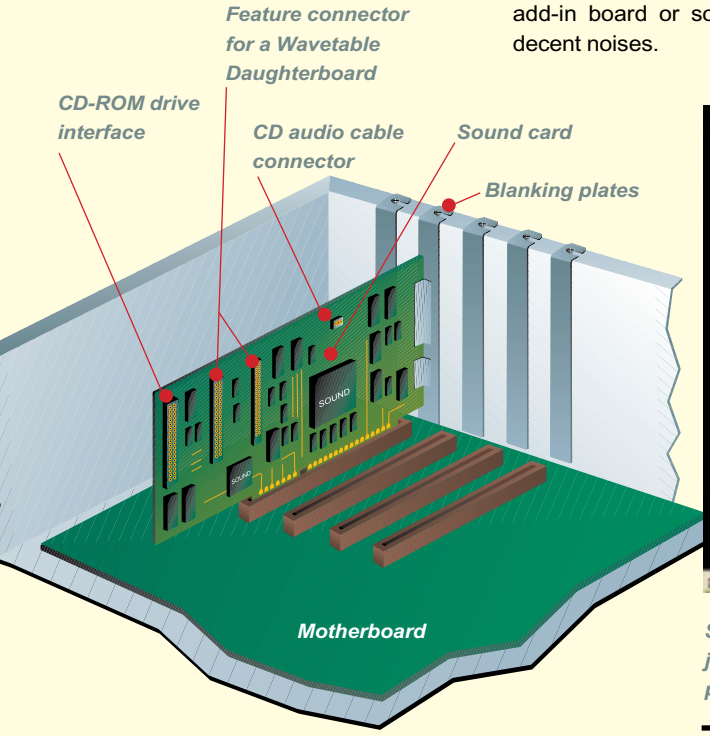
For years, the Macintosh has had built-in sound capabilities far beyond the realms of beeps and clicks, but PCs with integrated sound are still few and far between. That's why PCs continue to require an add-in board or sound card to produce decent noises.

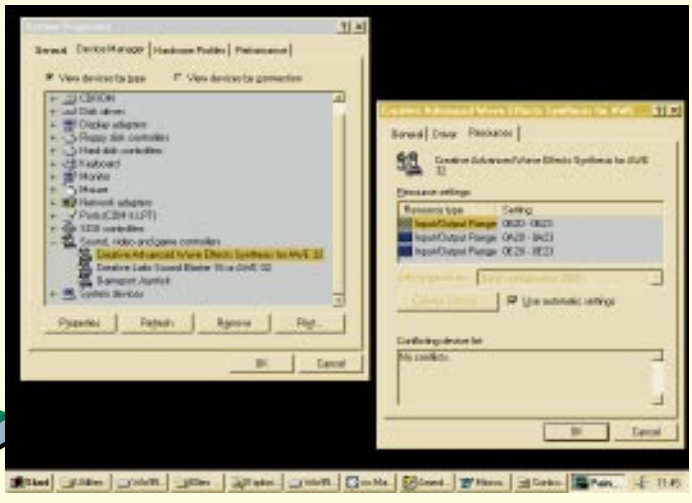
The popularity of multimedia applications over the past few years has accelerated the development of the sound card, and the increased competition between manufacturers has led to these devices becoming cheaper and more sophisticated.

Sound cards can cost from as little as £30 to as much as £300. Most modern boards now use WaveTable technology which uses sampled sounds of real instruments. WaveTable has greatly improved the quality of sound available on a PC compared to the synthesised sounds of a few years ago. Digital Signal Processing (DSP) technology is becoming more widespread on sound cards and this allows reverb, delay, and other digital effects to be applied to instruments or samples.

### What is Plug and Play?

Plug and Play is a standard introduced by Microsoft in its latest operating system, Windows 95. Essentially, Plug and Play was introduced to make the installation of new devices easier by automating the whole process. Windows 95 includes drivers for a large number of sound cards and should automatically detect Plug and Play cards when they are installed.



*Sound cards which conform to the Plug and Play standard have only just started to appear on the market. Those which live up to their promises should install automatically and report no conflicts*

## WaveTable daughterboards

If you're thinking of improving the sound capability of your PC, check your existing sound card first to see if it has a feature connector. If it does, then you could save some money by upgrading the card with a WaveTable daughterboard.

WaveTable daughterboards are compatible with any 16-bit sound card that has a feature connector. The connector is easy to find and will be located at the bottom left-hand side of the card near to the blanking plate. It looks similar to a CD-ROM interface, only smaller. Some cards, including the Value edition of the SoundBlaster 16, may not have this connector, so check first.

Installing a WaveTable daughterboard couldn't be easier. Simply remove your sound card and "sit" the daughterboard on top, making sure the connectors are firmly attached. Three plastic spacers will also be provided which prevent the two cards from damaging each other.

The most interesting thing about this type of upgrade is that you don't have to install any software for it to work and there are no dip switches to configure. If you want the daughterboard to be the default synthesiser in Windows, which is likely, you will need to edit the MIDI mapper, or MIDI output port if you're using Windows 95. This is straightforward and is explained in the accompanying manuals.

The quality of the instruments on each WaveTable daughterboard vary significantly. This is usually determined by how much ROM the card has. Most cards contain between 1Mb and 4Mb of samples and offer digital effects which include reverb, chorus and delay. Reverb gives the impression that the instruments are being played in large halls or churches, which is great for when you're playing Doom. When chorus is applied, the sound is similar to many instruments playing at once when only one is actually being used. Delay is just a posh word for echo.

The operating system reads your Config.sys and System.ini files and scans for existing drivers on installation. If the card's drivers are pre-bundled with the operating system, they'll be installed and configured for you. If not, you'll be prompted for an installation disk.

Sound cards which aren't Plug and Play-compatible must be installed manually using the Add New Hardware Wizard in Windows 95. As with many new Plug and Play devices, the "seamless integration" concept does not always work in practice; often, cards which claim to conform to the Plug and Play standard don't install smoothly.

### WaveTable synthesis

WaveTable cards play back pre-recorded samples of real instruments. A WaveTable ROM, therefore, is an electronic table of waveforms. Whereas one FM sound card will sound much the same as the next, WaveTable cards differ significantly in quality. The quality of a card's instruments is determined by several factors: the quality of the original recording of each instrument; the sampling rate, or frequency, of the recordings; the number of samples used to reproduce each instrument; and the compression methods used to store the samples.

By using high ratio compression techniques, more samples (or instruments) can be "squeezed" into small amounts of ROM. There is a trade off with quality, however, as compression often results in loss of dynamic range and quality.

Every instrument produces subtly different timbres depending on how it is played. For example, when a piano is played softly, you don't hear the hammers hitting the strings. When it's played harder, not only does this become more apparent, but there are also changes in tone.

Many samples and variations have to be recorded for each instrument to recreate this range of sound accurately with a synthesiser. Inevitably, more samples require more ROM. A typical sound card may contain up to 700 instrument samples within 4Mb ROM. To accurately reproduce a piano sound alone, however, you're looking at between 6Mb and 10Mb of data. This is why there is no comparison between the synthesised sound and the real thing.

### Digital signal processors

Digital effects can dramatically improve the overall quality of sound cards. Digital Signal Processors (DSPs) use complex algorithms to add reverb and other effects to give the impression that instruments are being played in large concert halls. Other popular effects include stereo choruses and delays.

Adding a stereo delay to a guitar part can "thicken" the texture and give it a spacious stereo presence. Chorus is also used to thicken instruments and gives the impression that many instruments are playing when, in fact, only one is being used.

### What is MIDI?

MIDI stands for Musical Instrument Digital Interface. It was developed as a communications protocol so musical instruments could "talk" to each other. MIDI was first developed to allow keyboard players to "layer" the sounds produced by several synthesisers, although today MIDI is used mainly for sequencing. A sequencer is a piece of software that records and plays back MIDI information. It allows complex musical arrangements to be built up that would otherwise be impossible for one person alone to play.

MIDI doesn't transmit any sound, just simple binary information. The ones and zeros that are sent down the cables contain very specific instructions. The most common instructions tell the receiving instrument to play a particular note for a duration of time — a note-on message followed by a note-off message. The same instructions contain details of how loud to play that note.

The synthesiser knows which sound to play using a simple program change message. This message tells the synthesiser to select sound number 67, for example, which in the General MIDI specification is a saxophone. Before General MIDI came into effect, sequences containing program change messages were meaningless if played back on an instrument other than the one on which it was recorded. This was because program 3 on the original synthesiser may have been a piano, while on another synthesiser it may have been a trombone. The result is a tune that sounds nothing like the composer intended.

In much the same way as you can have seven SCSI devices in a chain, MIDI communicates over 16 channels allowing up to 16 MIDI instruments to be played from only one interface. Since the majority of sound cards are multi-timbral, 16 instruments can be played simultaneously from only one device. Adding a second MIDI interface opens up another 16 MIDI channels. Some MIDI interfaces offer as many as 16 outputs, making it possible to access 256 at the same time. This might sound ridiculous, but in large MIDI setups you can easily run short of channels.

### PCW Contacts

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