

chopping and changing

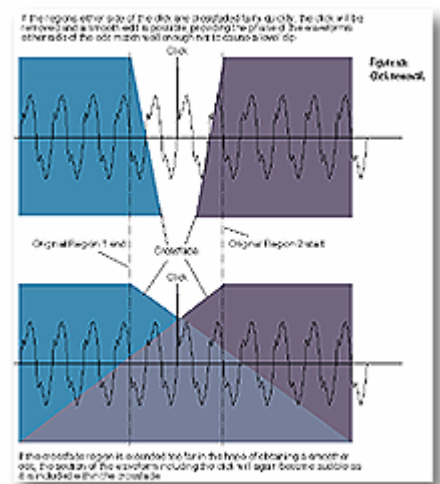
STEREO EDITING: PART 3

In the final part of his series on digital editing, **Paul White** examines some methods of removing clicks from a recording, before looking at how to burn a production master CD.

As I've observed in earlier parts of this series, stereo editing occasionally means fixing problems as well as making artistic decisions. One of the most irritating of the problems you might have to deal with is clicks in audio material, so the first thing I'm going to do this month is offer a few strategies for dealing with them.

Click Start

There's some very sophisticated software available for identifying and removing clicks automatically, and if you have access to one of these dedicated packages I'd suggest you try it, to see if it can do the necessary invisible mends. As a rule, the more expensive systems work best, with CEDAR probably being at the top of the tree in terms of both quality and price. The vast majority of us turn instead to something more affordable, such as Steinberg's *De-Clicker*, though some general-purpose editing packages also provide tools specifically for dealing with individual clicks. In the case of the latter, though, be aware that not all clicks may be identified correctly, and attempts to remove them may not all be seamless.

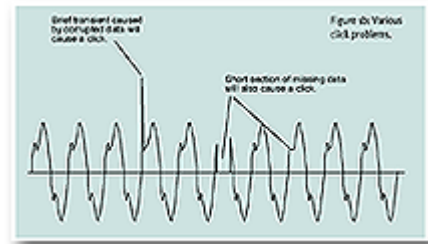


Even if you don't have specialised click-removing tools, where clicks are readily identifiable and not too frequent it's generally possible to remove them manually, using simple edits and crossfades. This technique is useful for clicks caused by electrical interference that cause effects lasting several cycles of the audio waveform.

- First, create two regions, one stopping a few cycles before the click and the next starting a few cycles later.
- Line up the edit points so that they occur on zero crossings and are in phase.
- Use a short crossfade to smooth the join. If you're lucky, the tiny portion of audio you've

lost in getting rid of the click won't throw the timing out.

The important thing to watch here is that you don't make the edits too close to the click you're trying to remove -- otherwise when you create your crossfade the click will be allowed to creep back in. The same is true if you make the crossfade too long, as you can see from Figure 1a. If you're planning to do a 10mS crossfade, for example, you need to leave at least 5mS' worth of material either side of the click.



Not all clicks are visually obvious, but Figure 1b on page 56 shows a section of waveform with several problem areas that would cause clicks. Most of these could be cured by redrawing and smoothing the affected area, using a waveform-drawing tool to replace the corrupted waveform with a best guess as to what should be there. With very brief clicks this technique can work very well, but it requires a steady hand if your new waveform isn't to cause a thump or click of its own! Digidesign's *Sound Designer II* has a smoothing function that evens out the waveform around the point you've redrawn, and I find this almost always gets rid of clicks.

Unfortunately, not all clicks are straightforward to remove. If all else fails, as a last resort you may be able to replace a damaged or corrupted bit of audio with a short section copied from elsewhere. If you find a click or period of interference in the middle of a sustained note, for example, you may be able to copy and paste a few cycles from just before or after

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the affected section, to plug the gap. Alternatively, you could try to find an identical musical bar from elsewhere in the song, to splice in. This does, however, require a lot of skill and patience, because if the ends of the new section of waveform don't line up exactly with the existing material the result will be another click! You also need to look carefully at the waveform pattern and pick a sequence of cycles that appears to match the damaged section fairly closely -- most real-world audio is a lot more complex than a continuous sine wave. If your editing package has an automatic smoothing option, you'll have more success with edits such as this. It may be possible to smooth out minor discontinuities between edits manually,

using the drawing tool, but it's often very difficult to get a seamless-sounding edit unless you have a smoothing facility. Sometimes it's easier to edit in a longer section, such as a whole musical phrase or even a verse (providing a suitable section exists elsewhere in the song), as a separate playlist region.

Burning Issues

Sometimes it can be useful to work with more than one piece of software. For example, I'll often edit my tracks and create regions within *Sound Designer II*, then assemble the playlist using Adaptec's *Jam* CD-burning software (PC users can use Adaptec's *Easy CD Creator*). *Jam* is based around a straightforward playlist, into which you can import regions or complete files, and is able to handle crossfades and level adjustment (left and right independently, if need be). The *Jam* playlist is shown in the screenshot on page 60. Levels can be increased by up to 6dB or attenuated as much as you like, but -- as with any digital software -- if you increase the level to the point at which clipping occurs you end up with some very nasty crunches and bangs. If you're going to adjust track gain at this point, rather than in your editor software, I'd recommend that you normalise each track separately, then use the gain controls in the *Jam* playlist to reduce the levels of those tracks that need turning down. The result should be a perfect balance with no risk of clipping.

Jam also makes it possible to enter text that can be embedded in the CD's subcode -- such as album details and ISRC (International Standard Recording Code) tags for the individual tracks. It's also possible to turn the copy-prohibit flag on or off for each track individually, as well as selecting whether tracks should be played back with 'de-emphasis' or not. As most modern DAT recorders don't record with pre-emphasis, the latter box would normally be left unchecked. Any part of the playlist may be auditioned, just to confirm that all is well before you go for the burn, then it's time to slip in that CD-R and make your master. CD-Rs produced with *Jam* conform to Red Book specifications and are suitable for use as production masters -- see the 'Little Red Book' box for more on the Red Book standard. I've used *Jam* as an example, by the way, because it's straightforward and offers a basic playlist approach, though there are numerous other pieces of software that follow a similar paradigm.

I generally burn my CD-Rs at four times normal speed, as that's the speed most blank discs are optimised for. Those whose computers are a little on the slow side may find it helps to create a disk image of the whole album before starting, but my relatively aged Power Mac works fine without doing that.

On the subject of blank media, I can't emphasise too strongly the false economy of using cheap, unbranded CD-R blanks. Some of these have astoundingly high error rates, and you can't really be sure about their life expectancy either. Considering that a reputable branded disc costs under £1.50 these days, there's really no excuse to skimp. It is also vitally important that CD-R blanks are scrupulously clean, so don't open the packet until you're ready to use the disc, and always hold the disc by its edges. Check that there's no dust on the recording surface. If you need to remove dust particles, a compressed air spray from the local camera shop will do as good a job as anything. Under no circumstances touch the recording surface with your fingers, as you'll play havoc with the error rate if you do.

Finally, CDs intended for use as production masters should always be recorded in one pass (disc-at-once mode), because pausing the recording process between tracks introduces errors that some duplication plants can't deal with.

EQ & Dynamics

Digital equaliser plug-ins can be extremely useful during editing, but there are potential problem areas you need to be aware of. First and foremost, if you intend to do any significant equalising ensure that you have enough audio headroom available to accommodate it, especially if boosts are involved. Most of the better equaliser packages include a gain control, but if yours does not it might be wise to reduce the level of the original file before you start to work on it.

Less obvious is the fact that most equalisers introduce a degree of phase shift. As an example, if you select a section of audio and equalise just that section you'll probably end up with an audible glitch at the start and end of the treated area. A glitch like this is caused by the EQ phase shift -- equalised and unequalised sections being, in effect, slightly displaced in time so that the waveforms no longer join smoothly. Unfortunately, this means that you're unlikely to get away with selecting, for example, a short section of audio containing a vocal pop, then applying a heavy bass cut just to that section. It's still worth trying, providing you have the ability to Undo afterwards, as some designs of digital EQ cause more phase-shift problems than others. But there are really only two *reliable* ways to use EQ in most systems: EQ the whole song, or break the song into regions and EQ only specific regions. You can then use short crossfades to ensure that the region transitions are free of clicks.



Though a discussion of dynamics processing really belongs in an article on mastering rather than one on editing, gentle compression is often used during editing to make tracks sound more even and radio-friendly. I tend to use low ratios (between 1.1 and 1.5:1) combined with low thresholds (-30 to -15dB). A soft-knee compressor generally sounds the most natural for this job. You can also increase the loudness of a recording considerably by using a limiter, set just below digital full scale, to deal with short-duration peaks. Up to 6dB of limiting can be applied to most material without any obvious side-effects, which in turn provides 6dB more apparent level.

Hardware

Often you can manage EQ, level and dynamic processing within the computer, using software plug-ins, but sometimes you may want to use a hardware processor such as a TC Electronic Finalizer, Dbx Quantum or Drawmer DC2476, which have digital ins and outs. In this case, assuming you're using a computer-based CD burner, you have two choices: process the unedited source material (coming from DAT, say) as you record it to your hard drive; or play back the compiled album file from the hard drive via the mastering processor after all the editing has been done, recording the result to DAT. It would then have to be recorded back to the hard drive and thence to CD, but providing you work in the digital domain there should be no appreciable quality loss. (If you have a stand-alone CD recorder you could send the compiled file through the mastering processor straight to CD instead of DAT, of course. It may save blank CD wastage, however, if you go to DAT first, to make sure everything sounds right, then copy the DAT to CD afterwards.)

The benefit of processing the source material while recording it to the hard drive (the first option) is that you don't need to record an album file to DAT before you can make a CD, as with the other method. You can send the processed files, after editing and compiling, straight from your hard drive to the CD writer. However, this option subjects each track to 'finalising' processes in isolation of the other tracks; any subsequent fine-tuning of their sound in relation to each other will have to be done in software. Sending the *finished* file through a mastering processor, on the other hand, means that you can

A Different Approach To Mastering: *Waveburner*

Most CD-mastering software is based around a playlist, Adaptec's *Jam* and Digidesign's *MasterList CD* being two examples of this type of program (see 'Burning Issues' box for more information about *Jam*). However, there are alternatives, such as Emagic's *Waveburner*. This package allows the whole mastering job, including adjustment of the position of track-start codes and fine-tuning of gaps between songs, to be completed entirely from a waveform window. It's an approach that has advantages over purely playlist-based systems when you want to crossfade two tracks on an album, as it offers complete control over the fade-in and fade-out rates and curves of the two tracks involved. Furthermore, you can see the fades superimposed on the waveform display and can physically drag one song over another if you need more overlap. It's also possible to create level envelopes using this software, so instead of being limited to fade-ins or fade-outs you can drop the level of the whole mix by a dB or two in a sensitive section if you need to. Handles on an envelope line are dragged to form the desired level envelope, as shown in the screenshot on page 60. New handles can be created just by clicking on the line.

Which of the two software approaches is best depends on the job in hand. Most jobs can be handled perfectly well with a playlist editor, but just occasionally you'll come across a problem that a playlist editor can't handle.

create settings to suit each track, and check how the processed tracks sound *together* before you play the file out to your DAT machine. On a conventional album you should have enough time during the track gaps to change presets on the mastering processor. You'll probably have to do this by hand, though, as none of the software editors I'm familiar with allow you to output MIDI Program Change

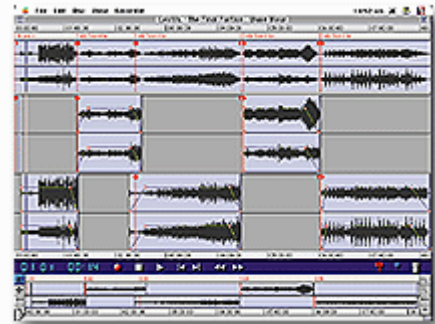


messages between tracks in a playlist -- an obvious facility which would be very useful.

All Together Now...

When the editing process is nearing completion, you should have a file containing a number of regions representing finished songs, to which destructive processing -- such as level increases, compression, EQ and limiting -- has already been applied. If you decide to employ de-noising software at this point you should use the process as gently as possible, as over-use often introduces unpleasant side effects in low-level passages or fade-outs.

Songs that have been made up by editing two or more regions together should also be assembled in your software's playlist (see 'Burning Issues' box), with a gap of zero set between the regions and suitable crossfades used where necessary. You can then change the length of the gaps between songs and decrease the level of any songs that are too loud. I'll generally set a gap length of two to three seconds between songs, then fine-tune this so that it 'feels' right. A song with a slow fade-out may need less of a gap than a song with a more abrupt end, and if there's a big change of mood or tempo between songs you may decide a longer gap is in order. There's no absolute way to work out what is the right gap, just as there is no way to calculate the correct relative levels for different tracks on an album -- you just have to get it to feel right.



What happens next depends on whether you're planning to make a master DAT or burn a CD. If I'm mastering directly to CD, using my computer-based CD writer, I prefer to create new audio files for any tracks that comprise two or more regions. It isn't absolutely necessary to do this, but you're less likely to end up with burning problems if the computer isn't busy trying to reassemble songs from their component parts during the burning process. On the other hand, if the finished album is to be run out to DAT all you have to worry about is ensuring that the DAT track IDs are in the right places. If you let the DAT recorder's 'Auto' mode do its thing, inserting track IDs automatically, each ID will be slightly late because an ID can't be written until audio has been detected. Accordingly, you may want to erase the DAT IDs and write in new ones a fraction of a second earlier. You should also leave at least two seconds after the first ID before the music starts, especially if you're going to copy the contents of the DAT onto a CD-R disc using a stand-alone CD recorder, as the latter sometimes take a second or two to pick up from a standing start.

Fading Out

The software and hardware available at affordable prices these days means that producing a neatly edited, professional-sounding album, that hangs together well and is noise- and click-free, shouldn't be beyond anyone. Use your ears and the techniques I've covered in this short series and you could master the process in no time! **SOS**

Glossary

http://www.sospubs.co.uk/sos/regular_html/glossary.htm

Little Red Book

A standard audio CD has a data capacity of around 650Mb and an audio capacity of up to 74 minutes - though 80-minute CDs are now available too. Unlike vinyl records or tapes, which carry only continuous audio, CDs record data into sectors, each sector on the disc holding up to 2352 bytes. On

an audio disc, most of this space is used to carry audio information. (A CD-ROM has a similar structure, but will use the space to store data, which is why the same blank discs can be used to record audio or data.) However, an audio CD also contains non-audio data relating to track timings, number of tracks, total playing time, time remaining, and so on.

The way data is arranged on a disc is governed by an agreement known as the Red Book standard, which ensures that any audio CD will work on any CD player. I don't have space to go into the full details of the Red Book, but the Red Pamphlet (OK, I made that up!) stipulates a 16-bit, 44.1kHz stereo file format and specifies the way in which it must be encoded. The standard also sets out the data structure that allows the CD error-correction system to work, and provides space for flags (such as Copy Prohibit) and non-audio data such as ISRC (International Standard Recording Code) and MCN (Media Catalogue Number) tags. The former can be used to give each track a serial number and the latter corresponds to the bar code on the CD's packaging.

If you've come across the Red Book standard before, you may also have heard of something called PQ coding. This, again, is concerned with ensuring that all CDs play back in all CD players. Each sector on an audio CD has 98 bytes reserved for 'subchannel control data'. The first few of these hold pause and track-start data, while the rest were put there for future expansion and are rarely used. The so-called 'P' subchannel information indicates where the music starts and ends for each track, while the 'Q' subchannel contains information relating to absolute and relative time, ISRC codes and Media Catalogue Numbers (if used), and indexes. Indexes are locator points within tracks, each track being able to contain up to 99 index points. (Interestingly, few commercial CD players can actually read indexes!) The Q subchannel also has another important function: it hosts the table of contents -- or TOC -- that informs a CD player how much material is on the disc, how many tracks there are, and the time at which each track starts. Without the TOC, the CD player wouldn't be able to find the start points of the various tracks.

A Red Book CD can contain up to 99 separate audio tracks, each with a minimum length of four seconds. It's even possible for material to be recorded in the pauses between tracks, so if you made a live recording and wanted the applause to carry through from one track to another you could use the pause area. On the Alan Parsons *SoundCheck* CD the pause area has been utilised for test-tone announcements. If the CD is played normally you hear each tone being announced, but if you use the track skip button to move through the tones you hear only the tones, and not the announcements.

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Europe's No1 Hi-Tech Music Recording Magazine

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