

MONO, STEREO OR AMBISONIC?

The business of recording sound commercially is so serious (because of its financial connotations) that those of us at the sharp end tend to view the whole thing in a grossly irreverent manner. Monitoring is just sticking up a huge loudspeaker driven by a suitably lunatic power amplifier for the purpose of checking that the tape was laced right side out on the machine—and so that the character known as the producer can pretend to listen out for the most artistic take and decide where his edit points are going to be.

In the old days when machines were more like washing machines and the standard monitor was the dreaded Tannoy *Red* driven by glowing tubes under a pile of melting acetate tape, that was about the beginning and end of it; the march of technology now demands extremes of sophistication, even to the point where it has become important to appreciate the *quality* of the recorded results of the artistic types on the other side of the glass. Monophonic monitoring was delightful: no real restraints on where to place the loudspeaker, no monitoring position, little necessity to modify the acoustic environment in the control room, just lots and lots of power and a system that didn't send you deaf after six hours of Beach Boys clone sounds.

Reality?

Stereophonic sound was demonstrated successfully in 1932 by that extraordinary personality Blumlein (who invented more electronic wizardry than anyone else before or since). The early experiments were based on a first principle approach to the way we

In this episode Ted Fletcher goes in search of phantom images

hear, and the way we expect to hear any sound—in other words, what we now call binaural recording. His name lives on in the Blumlein pair, where a coincident pair of microphones are arranged to sense the complete width of the sound field. But how does one listen to stereo properly? The history of the answer to that question is crushingly boring and paved with a catalogue of systems, weird devices and hype. The true answer has evolved over the years, and the true technology is still not with us yet.

The definitive answer to monitoring (or listening to) stereo sound is that the sound shall emanate from two points in space and that the listener shall be positioned at a point that produces the third point in an equilateral triangle with the sound sources.

In 1984 this does not sound too difficult, the reality however, is far from easy and is met about as often as a Tory in the Kremlin.

**UNTWISTING ALL THE CHAINS
THAT TIE THE HIDDEN SOUL OF
HARMONY** (*Milton*)

In researching for this diatribe (yes, it is sometimes approached seriously!) some practical experiments were carried out—listening to some pre-recorded and some specially recorded material in mono, stereo and ambisonic formats. (Here comes the deadly serious bit folks.) During this slight but careful research, an interesting effect came to light that

induced sitting and looking at the ceiling and thinking carefully about the way the human mind (the ear/brain combination) hears directional information.

The pan-pot we all know and love, splits a mono signal into two, and drives signals that are identical in all respects except amplitude, to a pair of outputs. This gives a reasonable directional image and a combination of such images produces the sort of 'stereo' that our Lords and Masters (the record buying public) have come to accept and expect to hear.

The coincident pair of microphones (totally contrary to the thinking of quite eminent sages of the industry) produces roughly the same results, but without the phase anomalies associated with multi-mic techniques. The image created is purely based on amplitude—how can it be otherwise when the heads are coincident?

Real stereo can only be created by injecting the exact sound into each ear that that ear would receive at a live performance; ie a dummy head recording replayed via high quality headphones. So why is there such a great divide between the conventional commercial way of recording and the purist correct way? Stand by... the question is about to be answered by a description of that silly little bit of research founded on an inkling of understanding, and proved by a 7-year-old.

Snurdcraft lives at Cruchfield!

The story starts one evening in deep midwinter at Cruchfield Manor; the home of one Keith Mansfield (a dear

A PERSONAL VIEW OF PSYCHOACOUSTICS

and talented friend) and the stamping ground of one Richard Elen (the same but more boistrous). The event was the demonstration of Ambisonics to Steve Dove and myself. We duly arrived to be greeted by a control room decked in Tannoy's. The early demonstrations were less than satisfactory due to matching errors between the front and rear arrays. The problem being that the front pair were Tannoy *Super Reds* and the rear pair, more elderly *Reds*. Unfortunately their phase characteristics seemed to generate an audio battleground. The effect was one of total loss of image—even complete disorientation at the sides of the sound field. A thought crossed my mind—there is no startling error in amplitude information across the spectrum in that area—therefore it has to be a

positioning in the front part of the field.

It was much later that we found that the phantom violin was nothing at all to do with Ambisonic reproduction; the effect is actually there in the Queens Hall!

The mono compatibility of Ambisonics recordings (and indeed the stereo compatibility) is less than convincing in such practical tests. It is reasonable to say that all the material we listened to that night was compatible in that listening to it without the advantage of the decoder was still pleasant and devoid of horrors, but the resultant stereo imaging would have been better had the original recording been made using conventional techniques. This sweeping statement is hotly disputed by our

fool the brain into ignoring the amplitude information and work entirely on the time elements.

The equipment was reset to play back the same recording to a pair of small loudspeakers but with a simple digital delay-line with variable delay included in one side. Dan the guinea pig was then asked to stand in the middle (sort of piggy in the middle) and, with absolutely no prompting, was asked to point to where his voice was coming from. No prizes for guessing the results; a time delay of 1 ms offsets the sound distinctly towards the undelayed side, but (and this is the odd bit) the effect gets progressively more apparent until the delay reaches 4.5 ms at which point the sound gets odd and jumps out the window! Listening to the effects with my own cloth ears, the image shift is so startling that one immediately suspects a failure of the delay channel—but no; a quick burst of channel off shows that all is well, it's the old grey matter that is telling lies.

If human beings had one ear in the middle of the forehead, we wouldn't have all this trouble

gross phase anomaly. (Of course it's obvious).

Richard then re-rigged the whole control room with point source monitors and we settled down to listen with bated breath and unbiased (?) ears to the Culwreck Soundfield mic impressed on to Stoney F1 and re-created via the monitor section of the Snurdruff.

It has to be said that the results were impressive without being enthralling. In the centre of the field, the image placement was adequate to the front, but decidedly iffy to the rear. The sides were there—but not there sometimes. The whole edifice gave the sonic appearance of being vaguely holographic and decidedly lacking in substance.

At this point we were joined (having almost fallen apart) by the Sage of ambience, Dr Geoff Barton, who suggested that we turn the lights off. With some trepidation and suspicion of intentions this was agreed to, and the Queens Hall in Edinburgh was transported to Maidenhead by the action of one light switch.

The removal of the visual stimulus was dramatic to say the least, the effect was that the front images hardened to reality while the sides and rear moved outwards to embrace what we all knew were sound treatment and brick walls. However, even with this new-found reality things were not absolutely right: a solo violin playing roughly at stage centre was well in place, but also created some extraordinary phantom images at rear mid-left! This effect came and went, seemingly dependent upon a combination of frequency and left/right

reversed Elen who insists that direct A/B listening tests in stereo and Ambisonics are equivalent to comparing a power boat and a sports car—they are so intrinsically different that no comparison is possible. The fact that the sound field in Ambisonics is theoretically radial while stereo is linear between the speakers further complicates such tests. Let's just leave it that, there are horses for courses.

Are you phasing the right way?

Dan is seven years old. Having a rock star brother and a dad who makes mixers, a little of the business is being rubbed off all the time. Our experiment combined trying out a pressure zone mic selling in the local store for about the same as a round of drinks, and an investigation into how the brain really perceives direction.

Dan needed little persuasion to demonstrate his reading ability in the studio at Havoc House, the results were recorded direct in wonderful 16-bit, in parallel on to two channels. The resultant recording was understandably clean and beautiful, the image when replayed via the standard playback speakers being faithfully in the centre (just to prove the absolute phase and to look for gremlins).

When a person is listening to a point source of sound—say another human voice to one side of him—the sound obviously comes from only one place, but affects the ears differently: the closer ear hears the sound first. The experiment was to attempt an artificial creation of time delay and to

The millenium in stereo

Ever felt like re-inventing the wheel—and then finding that nobody uses them any more? Time domain panning is not new. Perhaps it hasn't been tried in quite the controlled way that we did it but the response from Transatlantic Steve was typical: "What happens in mono—who wants to listen to a comb filter?" It's true, it produces rotten mono pictures, but used carefully and in moderation, the stereo images are startling!

Don't forget that true dummy head recording does suffer from this comb filter effect by definition—the only way to achieve absolute mono/stereo compatibility is to use coincident microphones and lose effects generated by distance/phase.

It would seem that we have got to the crux (or one of them) of stereo monitoring, by the circuitous route of Ambisonics. The trouble lies in compatibility and by definition, if we want it to sound right in mono, then the way we do it now is right.

Bearing in mind that orchestral recording is only listened to critically in stereo (or Ambisonics), it would follow that some phase errors introduced by the sound field system or the dummy head are acceptable—so why not use them? But for pop music where the last gram of selling potential has to be wrung from the final mix, it would seem that such degradation of quality would be unacceptable. Is this a Luddite attitude?

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