Stan's Safari *44*

WHY IS IT ALWAYS POSSIBLE TO TELL REPRODUCED FROM LIVE PIANO PLAYING? STAN CURTIS INVESTIGATES

It has always intrigued me that I can immediately tell if the sound of a piano is recorded or real when walking into a room. This is true no matter how big or small the room, and whether the piano is a Bosendorfer grand or Grandma's old front room upright. And this innate ability is shared by a large number of people. No matter how high-tech the equipment or the recording technique, there's something about pianos that causes us to fall short.

From time to time in my career I've pondered this challenge and tried to meet it, though as yet without total success. The last time was some twenty plus years ago when I was reworking the Quad *ESL63* loudspeakers to become the *ESL988* & *'989* models. Although the larger *'989* reproduced a piano more convincingly than the *'63*, it still fell short, so for my own interest I built a still larger version which was used as a mono source. This became my test bed and led to me to consider dynamic range and the propagation of sound.

A good grand piano has a wide dynamic range, as anyone who has played one in a small room can confirm. With good fingering you can make the hammers almost stroke the strings and therefore produce a very quiet sound. At the other extreme a couple of high impact chords can produce a huge volume of sound. [Maybe that's why its full name is pianoforte – *Ed*!]

I never actually measured the dynamic range, but soon discovered that my electrostatic test bed just couldn't match the loudness of the real piano. Hardly surprising given the limited excursion (*circa* ±2mm) of the Quad's diaphragm. But I knew of other loudspeakers that could deliver this requirement – in particular my JBL-driven horns. My mind then turned to the propagation of the sound, because emulating a large acoustic source with a small loudspeaker poses a number of questions.

This aspect of sound reproduction was brought home to me when I was engaged in designing some loudspeakers for use by digital church organ manufacturers. Such organs use recorded samples of the pipe sounds from real organs in a high resolution (24 bit; 96 kHz) format. The samples can then be modified to produce a sound that in some respects is better than a real organ. But there is a problem. The final sound comes out of a loudspeaker instead of a pipe, and all too often the loudspeaker systems consist of a large number of hi-fi cabinets spread around the church.

This brings two problems. First, with a real pipe organ the sound emanates from a single point; specifically a closely arranged group of pipes usually in an organ loft. This arrangement creates a 'point' source, generating a sound which then sets off a multitude of reverberation modes to give a rich, full sound. Sometimes this can be too rich, so the organ designer fits ranks of pipes which cut through the reverberation to preserve a staccato like sound. Spaced hi-fi loudspeakers, however, create a multitude of reverberation modes in different locations of the church, and these all mix together to create a bit of an acoustic muddle. Admittedly the final sound can be quite rich & fulsome, and is often popular with audiences too. but for many organ enthusiasts it isn't quite right, especially when playing solo pieces from the organ repertoire rather than Victorian dirge hymns.

Secondly, it's easy to demonstrate that the

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sound of vibrating air emanating from a pipe with a diameter anywhere from 5mm to 50 cm in diameter is somewhat different to that heard from a loudspeaker. The sound of, say, two five-note chords with one pedal note could be created with 12 ranks of pipes, so the sound will be coming simultaneously from over 130 pipes. My own experiments led to a design using an array of loudspeakers, all located together to replicate the ranks of pipes. This in turn led to a system using small loudspeakers, installed at the end of each pipe in place of the air stream. This arrangement works well, but also has its downside: as a conversion of an existing pipe organ it is just about viable, but a new installation ends up with a comparatively inexpensive digital organ costing as much as a glorious pipe organ.

With these lessons in mind I looked again at the construction of a piano. The instrument is rather like a large guitar, but has up to three strings per note, and these are struck rather than plucked. Like a guitar the vibrations of the strings are coupled to a large soundboard. (This large slab of wood is made up of planks of spruce, a wood that is known for having many resonant modes that create a tuneful coloration.) The sound we hear is mainly the radiation from the soundboard plus the direct sound of the strings vibrating. The design and construction of the soundboard needs a similar blend of science and art as that found in the design of the best violins and guitars, and has a large impact on the sound of the finished instrument.

This analysis led to my construction of an extra large electrostatic loudspeaker. This was a task easier said than done as quite a lot of reinforcement was necessary to maintain rigidity throughout its construction. Even an amplitude of ±0.1mm of flexing would be 5% of the maximum movement of the diaphragm and thus a large degradation. This Frankensteinesq loudspeaker was fed with a mono signal and yes there was a definite improvement.

Of course in an ideal world all solo piano recordings would be three-channel 'stereo', as originally demonstrated by Bell Laboratories in 1933. The piano would be centre channel with the original acoustic ambiance recreated through the other two channels. It is this same ambience that often allows the piano to be reproduced as convincingly as it is from a pair of stereo loudspeakers. We are usually listening to a composite of the instrument in the original acoustics so the sound already has become diffuse to a degree. (Few recordings are dry with only the microphones above the strings being recorded.)

However, at this point I realised that I was becoming obsessive, and also had other work to do. And the experiments were not without practical benefits. They proved that the Quad *ESL*s benefitted from having reinforced frames to improve rigidity (a shortcoming that was rectified in later models). To this there is a postscript. At a subsequent Heathrow show, Quad took a ballroom as a large hospitality area with tables and chairs. It was not intended as a demonstration area but at one end I had positioned eight *ESL989* loudspeakers (mostly driven in mono, because nobody was sat in an optimal stereo listening position). To my surprise, on entering the room from outside, when piano music was playing, the system almost passed my 'real versus recorded' test. I say almost but that was during my obsessive period. Certainly for the guests sitting down with a cup of tea they were experiencing an authentic palm court ambience.

Perhaps my whole quest was a waste of time. After all we all enjoy listening to good piano recordings whether the inspired interpretations of Hélène Grimaud or the rambling improvisations of Keith Jarrett. And the music clearly transcends any perceived limitations of the equipment. I've always maintained that I would prefer to listen to great musical performances than indifferent "audiophile" recordings played back through the finest sound systems. (A philosophy I confirm daily whenever I listen to music through my iPhone and earphones.) But a touch of mild obsessiveness now and then can lead to unplanned improvements, as with the Quad *ESL*s. It does show that there will always be inherent limitations in two channel stereo sound, and it does no harm to remind us designers that we are still some way from perfection. Perhaps the old Quad slogan "The closest approach to the original sound" is about as realistic as we can hope to expect. We can approach but we can never get there.

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