SAMPLING THE PAST: A technological solution to instrument preservation

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For as long as I can remember I've been fascinated with the notion of musical instruments as exhibits. There is something disconcerting about witnessing musical instruments as museum pieces, bereft of the functionality for which they were created; to be forced as a spectator to gaze upon the ornate furniture of an early keyboard instrument, with its lid perched open, tantalizingly revealing the keys beneath. Haven't we all at some time stood behind the impenetrable red velvet cord that invariably surrounds such pieces and wished that we could reach out and play… anything?

Of course, that velvet cord exists for a reason. A good many instruments are so fragile or of such cultural or historical significance that they could not be subjected to the deterioration that would result from their regular use by a variety of hands. On the rare occasions that such instruments do see action, it is invariably at the hands of an experienced virtuoso: the majority of us will never get the chance to experience first-hand those rare and beautiful instruments.

The antique harpsichord appeals because it combines form and function in an enchanting, entertaining and above all, engaging way. The flowing, elegant lines and craftsmanship add visual appeal and desirability to the function of the instrument, but without this, all we have is an ornate and ultimately impractical piece of furniture.

And that is where technology can lend a hand. One of the benefits that music technology has brought us is the ability to model digitally the sound and the character of acoustic instruments, making it possible to construct fully-playable digital emulations that allow the public to 'play' antique instruments without risk of further damage to the originals. In the article we'll look at the technology of sampling and explore how its application can quite literally put an antique Kirckman harpsichord at your fingertips.

Sampling

The concept behind sampling is straightforward. At its most basic, a short digital recording, or sample, is taken from the sound source. On playback, this provides a perfect digital copy of the timbre of the original, which can be played back at any pitch. Indeed, if you have ever played a digital keyboard instrument you will almost certainly have come across this technology in action. One criticism that is often labelled at such instruments is that they sound sterile and without the character we might expect from a good acoustic instrument: although they sound like *a* piano or harpsichord they don't much sound like any *particular* piano or harpsichord.

The issue here is one of economics: each sample is essentially a static snapshot of the sound, capturing a particular note at a particular time as played with a particular force. On playback, as the pitch of the sample increases, the recording replays more quickly and if the sample is transposed more than a few semitones, the associated audio artefacts become noticeable and the synthetic nature of the instrument is betrayed. We could get around the problem by storing separate samples for each note of the keyboard, and for the varying degrees of force with which each note could be played, but very quickly the number of samples

required can grow to an immense number, and instrument manufacturers are limited in the amount of onboard memory that they can economically provide.

Recently, a new technology known as *disk-streaming* has come along. Using disk-streaming, hard-disk storage can be treated much like computer memory, and multiple sound samples can be played from storage in real time. One of the benefits to this approach is that very large capacity disk drives are available relatively cheaply. Therefore instruments can be sampled with an almost pathological attention to detail with little risk of running out of storage space. With much more space available to the samplist, not only can the timbre and pitch be captured, but so too the instrument's characteristic idiosyncrasies and body resonances.

Taking this idea one step further, if each note is recorded several times, the instrument can be constructed with a number of copies of the same note, each of which will differ very slightly. By selecting randomly one of these recordings on playback, we can fool the ear into thinking it is listening to an acoustic performance by subtly varying the tone when otherwise-identical notes are played back in rapid succession.

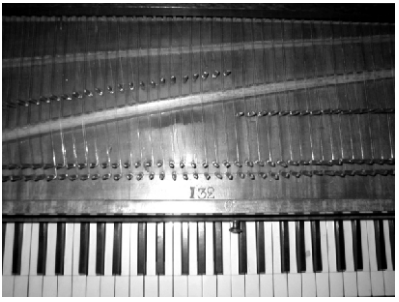
By recording the key mechanism and the 'chirp' sound of the jack as it returns to rest, and incorporating these elements into the digital instrument, we supply the ear with a further acoustic cue as to the true origin of the recording. The trick, so to speak, is to supply the ear with sufficiently many of these acoustic cues so that it believes that it is listening to the original instrument.

Recording the Kirckman Harpsichord

The harpsichord that unwittingly found itself at the end of this virtual

reconstruction is a single manual instrument, made in 1776 by the Kirckman family of London. The instrument was almost certainly commissioned by Richard Parrot of Hawkesbury Hall, Warwickshire, and is signed “Jacobus et Abraham Kirckman Londini fecerunt 1776”.

As you can see from the image below, the instrument is stamped with the number 132 on the top panel. It is disposed with three sets of jacks and three sets of strings, two at 8' pitch, and one at 4' pitch. The strings can be operated individually or in combination using manual stop levers on the front case of the instrument. The compass is a full five octaves from F to F, but in common with most English harpsichords built before 1785, there is no F#1.



The instrument forms part of the collection at Hospitalfield House, which now operates as a residential arts

centre in Arbroath. Hospitalfield House was originally built during the thirteenth century as a hospital to the Abbey of Aberbrothock. Purchased and extended by James Fraser in 1665, and dramatically altered by Patrick Allan-Fraser in the mid-nineteenth Century, it became Scotland's first School of Fine Arts, sowing the seeds for much of the first-class arts education from which Scotland now benefits.

Picture: Susannah Silver, Angus Digital Media Centre

The significance of its collections are today widely acknowledged, and Hospitalfield House is recognised internationally as a world cultural heritage site. Its art and artefacts continue to enjoy a life as inspirational teaching collections, as was brought home to me when Willie Payne, the Director of the Patrick Allan-Fraser of Hospitalfield Trust, let me loose on the instrument.

During the late summer of 2003, I made a number of trips out to Hospitalfield to play the harpsichord and make a number of test recordings and discovered that the instrument had a beautifully resonant tone with real body and presence. After a bit of experimentation with a variety of microphones, a stereo pair of small diaphragm condensers was used to capture the recordings and I emerged with around 6 hours of material ready to be edited and pieced back together to create a playable digital instrument.

And the results? On the whole, very positive: when hooked up to a suitable digital keyboard, the digital harpsichord plays well and manages to capture the sound and character of the Kirckman

instrument. In fact, were I to be bold I might even say that the digital instrument has a number of significant advantages over the original. Firstly, because the tuning is controlled digitally, it remains completely stable irrespective of the air humidity and temperature. It is also much easier to retune the entire instrument and change the temperament. And because the sound source is now separate from the fragile keyboard mechanism, anyone can 'play' the instrument without risk of damage to the original.

Part of the experience of playing an antique instrument is in feeling the hand-crafted keys under your fingertips and in marveling at the ornate workmanship that forms the body of the instrument. With a digital keyboard that is, unfortunately, lost. The action of a harpsichord also has a particular feel and a fast action, and this is a vital ingredient when playing the fast scaelic runs that characterise much of the repertoire. Without this, it is fair to say that the overall experience is somewhat lacking.

These issues aside, the digital instrument represents a valuable educational and performance resource, and has already found its way onto one set of recordings - Clement Matchett's Virginals Book, a collection of keyboard pieces from the Panmure Collection. The instrument may not feel or play exactly like the original, but it is not an antique instrument and has no pretensions as such. The technology is simply an enabling tool, a means of opening access to a musical resource that would otherwise remain out-of-bounds. After all, wouldn't you like a chance to lean over the red velvet barrier and play?