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The Independent News Magazine for Ensoniq Users

Synthesizing the Harpsichord and Clavinet

by Jim Johnson

People buy synthesizers for two reasons - first, to get access to sounds that they've never heard before, and second, to recreate traditional instruments that they don't have room for in the studio or on stage. This second application may seem a little strange to those of you who went out and bought a Mirage or an EPS for that purpose, but trust me, it can be done. In fact, in my humble opinion, a good synthesizer (like the ESQ-1) can often do a better job of this than a sampler can - because synths give the sound designer more control over the dynamics and subtleties of a sound than a sampler can.

All of which has nothing to do with the subject of the present article. Keyboard instruments are among the few that will always be better sampled than synthesized because their dynamic options are fairly restricted. With a piano, for example, you have only one dimension of dynamic control - loudness. You can strike the keys hard, or soft, or somewhere in between - that's it. You can't do swells like you can with a brass instrument, or use any of the different bowing techniques that a violinist uses, so there's no need to program such effects into the music. (Yes, I know, I'm ignoring the pedals, but those are really secondary; and they are just as easy to handle on a synth as on a sampler.) And when you get to an instrument like the harpsichord, which has no dynamic control whatsoever - well, the only reason you'd want to use a synthesizer instead of a sampler is that you might not have a sampler.

I fall in this category, so I when I want a harpsichord sound, it's up to the ESQ to provide it. As with all acoustic instrument simulations, synthesizing the harpsichord requires knowledge of the basic physical mechanisms used to create the sound. When I did my first harpsichord several years ago, the only information available was what I was able to cobble together from several acoustics textbooks, but modern synthesists have an advantage here, in the form of the *Synthesist's Guide to Acoustic Instruments*, from Amsco Publications. (This book occupies roughly the same position of importance in my library as the Bible does in a Baptist minister's. If you're serious about synthesis, get it.) RC030825

The harpsichord's sound has several distinguishing features. First of all, it's velocity-insensitive, so striking the key harder does not result in a louder/brighter sound. Most harpsichords use two strings per note, tuned an octave apart, so the second harmonic is especially prominent, but there are also plenty of the other upper harmonics, which die away more quickly than the lower harmonics. The harpsichord is a plucked instrument (unlike the piano, which is hammered), and because the plectrum is located a good distance from one end of the string, the attack portion of the sound is full of jangly inharmonics. None of this is terribly hard to synthesize; if you've got a good ear and a solid grasp of the basics of synthesis, you should be able to get this far without any help.

But one of the harpsichord's most distinctive features is not quite so simple to synthesize. When a key is released, the plectrum for that key brushes against the strings before returning to its original position. This causes a fairly loud second attack to occur at the end of the sound, which is very similar to the initial attack, though not quite as loud. This would have been easy to synthesize on a good modular synthesizer in the mid 70's, since (some of) those instruments would allow you to trigger a new envelope when the key is released; but how do you do it on

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