

I'm Doug Fearn and this is My Take On Music Recording

The harpsichord is an interesting instrument, challenging to play and difficult to record well. My previous experience with harpsichord recording was only as an accompanying instrument. But now I was trying to figure out how to record it as a solo instrument.

George Hazelrigg has been playing harpsichord since he was three years old, and he has studied the instrument ever since. His main keyboard these days is the piano, but he always wanted to record a Bach Fantasy and Fugue piece on harpsichord.

We moved the instrument into my studio several days before the session so it could settle in and get accustomed to the new environment. My studio is pretty tightly controlled for temperature and humidity, and the instrument was stable right away.

We spent the next couple of days figuring out the best way to record it.

First, a little background. The harpsichord dates back to 15<sup>th</sup> century, and the concept was inspired by the keyboard used in pipe organs. The organ is actually much older. Like most instruments, the harpsichord went through a long evolution, but the design was pretty much established by the late 1700s.

Somewhat later, the piano was developed, and the two instruments share a lot of ancient DNA. The key difference is that the harpsichord uses plucked strings and the piano uses hammers. That wouldn't seem like a huge difference until you realize that mechanically-plucked strings have only one loudness. No matter how hard you hit the keys, the harpsichord note is essentially the same volume.

The original name of the piano was the piano-forte, which are the musical instructions for soft and loud. That's because, within limits, the harder you strike a piano key, the louder the note sounds. This is an obvious benefit, and explains why the piano eclipsed the harpsichord in the 19<sup>th</sup> century and has been the dominant keyboard instrument ever since.

The plucked strings of the harpsichord are not very loud. It's not an instrument that fills a concert hall with impressive sound. But the sound can be quite piercing, because plucking generates a lot of extreme transients, harmonics, plus other sounds that extend above our normal hearing range. It is this needle-like sound that allows the harpsichord to cut through, even when playing with much louder instruments.

But that also creates a difficult recording problem, since the peak energy of the plucked string is many dB louder than the sustained note.

To get a clean reproduction of the harpsichord note, really good dynamic range is required in the microphone, preamp, and recorder, plus in any other processing. It is a real test of your equipment and your skill in using it.

Our first approach to mic'ing the harpsichord was to use the same technique as we use for recording grand piano. That's outlined in a video we made about our technique and available at the link in the description. Basically, we remove the lid of the piano and place a pair of ribbon mics in a Blumlein configuration. Blumlein has two bidirectional mics at right angles to each other. Our standard mic for piano is an AEA R88, which is a stereo ribbon microphone permanently set to Blumlein.

We place the microphone over the bridge of the piano, about two-thirds of the way from the tail end of the piano and usually at a slight angle upwards. Finding the best spot takes some experimenting. And every piano is different. The mic is typically about a foot or two above the strings.

Note that the sound of a piano comes from the sounding board, which is analogous to the top to an acoustic guitar, or any other stringed instrument, for that matter. The sound does not come from the point where the hammers hit the strings.

Varying the position of the mic in any of the three dimensions will change the character of the pickup. It is always a balance between an intimate versus distant sound, an even response to all the notes, and an appropriate stereo spread.

So that's where we started with the harpsichord. Well, that sounded pretty amazing, and we were encouraged. But there were a couple of problems that made that mic position unacceptable.

First, the stereo image was impressively wide, but inappropriate. The bass notes were almost entirely in the left speaker and the highest treble note was on the extreme right. It seemed as though every note had its own distinct position in the stereo field. That might be great in some music, but it was ridiculously unrealistic for a classical music recording.

The other problem was noise pickup from the harpsichord mechanism. The instrument's mechanical noise is worse than a piano, and since the instrument doesn't produce much volume, the ratio of note to noise was not good. Piano action has benefited for a couple of centuries of refinement and even a 100-year old piano can still be quiet mechanically, if well maintained.

We could not live with the thumping noise of the harpsichord action, which seems to be amplified by the sounding board much more than in a piano.

Our next step was to use two separate ribbon mics instead of the R88. That way, we could reduce the angle between the two mics and consequently narrow the stereo image to be somewhat more realistic.

That had an added benefit that the mechanical noise was reduced somewhat by placing the null of the mics more in line with the action of the instrument. The noise wasn't eliminated by any means – a lot of the thumping was coupled into the sounding board. The noise was reduced by only a few dB.

That was encouraging, however, and we continued to experiment with the mics. For this, I used a pair of Coles 4038 ribbon mics. We thought we were heading in the right direction.

But after moving the mics in every dimension many times, we were still getting too much thumping from the instrument action.

We were running out of ideas, so we decided to put the lid back on, opened as wide as it would go, and placing the mics out in the room. We were pleased that this reduced the thumping considerably. That can partially be explained by reduced bass boost due to proximity effect of the ribbon mics. With the mics above the harpsichord, to get rid of the thumping entirely, required a pretty severe low-end roll-off starting at around 300Hz. That thinned out the sound of the harpsichord more than we could tolerate. But it did give us a sound that was more like traditional recordings of the harpsichord. That was not what we wanted. We desired the full sound of the instrument, which meant minimal bass roll-off.

The stereo image was still pretty wide – more than you would get with a piano when mic'd this way. That was a surprise, but when we listened in the studio, the harpsichord really did have that kind of spatial spread from bass to treble, so we felt we weren't far off from a realistic representation.

Harpsichords are usually thought of as a chamber music instrument, meant to be heard in a relatively small listening environment. Think luxurious living room with a high ceiling. The listener would be relatively close to the instrument, and they would hear that wide acoustic image.

Still, we were not entirely happy with the sound. We missed the intimacy of the close-mic'ing.

By this time, it was getting late and our hearing was fried, so we quit for the day.

In thinking about this dilemma, I thought it would be worth trying some different mics next time. We experimented with some condenser mics, but we quickly realized that the ribbon mics best captured the sound of the instrument.

Then I tried a pair of AEA R44C mics, in Blumlein, out a few feet from the harpsichord, with the lid on as before. It was amazing to all that the 44 sound was so different from the other ribbon mics. The instrument seemed to be much closer, more like the sound of the mics over the sounding board, but with a pleasant solidness that wasn't apparent with the other mics. The stereo image was better, too, with just enough spread to be interesting, while still sounding natural.

The mechanical noise was pretty minimal, too. I used just a bit of bass roll-off at 100Hz, from a D.W. Fearn VT-5 stereo equalizer. Just enough, I thought, to compensate for proximity effect, which in a 44 goes out a long way from the mic. According to AEA, the 44 does not become flat in the low end until it is 9 feet from the sound source!

We could have further experimented with mic placement, but it sounded so good now we decided to leave it alone.

I am always amazed that the world's first really high-fidelity microphone, the 44, invented by Harry Olsen at RCA Labs in the 1930 is still my choice in so many recording situations. That's also the mic I usually use for the podcast.

This was one of the few times when I felt that the sound in the control room was better than what I heard in the studio.

All told, we spent about 10 hours over two days experimenting with the mic'ing. During this process, we also changed the room acoustics by opening some panels that allowed more reflection from the concrete outer walls of the studio. We also moved the harpsichord around to find the best balance between direct and reflected sound.

I also experimented with some artificial reverb, from Quantec and Bricasti digital units, which sounded very nice, but ultimately, we agreed that no reverb was best. The harpsichord has its own intrinsic reverb from the strings vibrating sympathetically. The strings are not as damped as effectively as they are in a piano.

We left everything set up for the next day, when we would start recording the Bach piece.

Here's the signal chain I used: The AEA R44C mics in Blumlein pattern, about 4 feet from the harpsichord with the center of the mic array about in the vertical and horizontal middle of the instrument lid, that went into a D.W. Fearn VT-2 vacuum tube mic preamp followed by a VT-5 equalizer, and then into a Merging Technologies Hapi converter, recording in DSD256. That's 11.2MHz sample rate. The software was Pyramix.

In addition to the several dB of roll-off at 100Hz, I also used a few dB shelving cut at 28kHz on the VT-5. Although the high cut didn't make any discernable change in the sound, it did provide us with some protection down the road when the recording might be converted to PCM, or even a bit-reduced format like MP3.

Now we were ready to start recording. We had Geoff Hazelrigg and George's long-time harpsichord teacher, Gavin Black, in the control room with the score so we could make sure we got a perfect performance. They followed along and made pencil notes on the music, which we then discussed during the playback. We did not want to do a lot of editing for the final version, but there will probably be some sections from various takes. I left the editing to George and Geoff.

The actual recording of the piece only took a couple of hours. George has been playing this piece for decades, and practicing it intensely for several months, and his preparation made the session go quickly. The instrument required touching up the tuning from time to time. Fortunately, George has experience in rebuilding harpsichords, and he is in demand for tuning for others before major concerts.

The fugue section of the Bach piece was recorded with the two keyboards "coupled," which is mechanical feature of the instrument that allows two separate sets of quills to pluck the strings when any key is depressed. This increases the volume, but only by a few dB, but dramatically changes the sound of notes. It is like double-tracking. No change in the setup was required for this change.

The final version will be released later this year. We plan to keep the recording in the original DSD format, straight to the listeners who have DSD playback capability. There will also be versions in traditional high-res PCM formats.

So, what did I learn from this project? Well, at least in this case, mic'ing a harpsichord like a piano does not work.

For my taste, ribbon mics and an all vacuum tube recording chain captured the sound of instrument in a natural way. The recording was not annoying, like I find in most harpsichord recordings.

A bit of low-end roll-off compensated for the proximity effect of the ribbon mics, and a roll-off above our hearing range should help when the recording is translated into lower resolution formats.

And I learned that trying something that doesn't seem like the way to go can lead to just the sound you are looking for. After 50-plus years of recording, I still learn something new from every session.

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This is My Take On Music Recording. I'm Doug Fearn. See you next time.