OUTCOME REPORT: RASPBERRY PI AUDIO PROCESSOR

THOMAS SCHEEVEL

1. Motivation

I took on this project because I saw an opportunity for a new portable tool for audio work: a pc-grade sound card was released for the Raspberry Pi single-board computer. I saw that this could be used for portable live audio effects. The Raspberry Pi has become a favorite of hobbyists and experimenters due to its low cost ($25 or $35), small size (3.5" long × 2.5" deep × 0.75" or 0.5" tall), and open nature (it is a full-functioned computer, so every part of the code can be modified). The sound card was made by Wolfson Audio (now part of Cirrus Logic), and cost $33, placing the price of the whole unit well below the price for most portable audio effects in use by musicians today.

Though robust solutions exist for most effects that musicians want, an experimental musician often has no option but to bring a laptop on stage to run the effects that they have created. With the new possibilities afforded by the Raspberry Pi's new sound card, a system could now be created to put the complete flexibility of effects on a computer into a small, inexpensive package.

2. Methods

I chose to use a widely-used audio processing language, Pure Data, rather than trying to create my own. This was to save time and effort, and open up the large body of work that has been done in this language for use on my system, as well as to make this project accessible to other musicians.

After achieving a stable Pure Data configuration, I made a set of demonstration effects, within a framework to switch them in and out of the signal chain. These were a mixture of traditional effects, such as a noise gate and a delay, and experimental- a multi-band distortion. (What this did was to break the audio up into low, lower middle, higher middle, and high sounds, and then distort them individually.)

3. Outcome

Most of the time in the grant period was consumed getting the unit to function. Very shortly after beginning to work, the sound card manufacturer was bought up, and stopped supporting the card. Once the challenges of using out-of-date software were solved, work could begin in earnest on the audio design of the project.

The finished unit filled its role generally as expected, but there were a few drawbacks-most notably, there was a noticeable latency, near 30 milliseconds. Though this by no means disqualifies the device as an effective audio tool, it does limit its use to situations where either all sound runs through the device or where strict synchronization between processed and unprocessed sound is not needed. Also, due to lack of up-to-date software drivers, the non-extended Pure Data language had to be used instead of the more widely used (and more powerful) Pure Data-extended. However, almost anything from the extended version can be replicated in the older version without unreasonable effort, so this drawback is not a serious flaw.

Though the latency of the unit may prevent its use in many live situations, it has no parallel in systems of its size for its sheer flexibility. It is a fully open digital effect, until now, a rare breed of effect. (This rarity is almost entirely due to how touchy and strangely-behaved digital systems can be.) A knowledgable user can even use this to prototype effects onstage, and by putting a bit more time into their work, can produce polished sounds to their exact wishes. For example, it took me a relatively short time (several hours) to build one of the most robust and flexible distortion effects I've ever used, the multi-band distortion I mentioned earlier. All told, for less than $100 of parts, this unit can put experimental sound in a package that can fit onto a pedalboard.