Eventide the next step

Technical Note #80

How Pitch Shifters Work (and Time Delays through them)

Eventide first introduced Pitch Shifters with the H910 Harmonizer(R) as long ago as 1975, but the 910 and its successors essentially operate in the same way.

The pitch of the signal is changed by passing it through a delay, whose length varies linearly with time - this is in effect the same as the Doppler effect produced by a moving car or train. An increasing delay gives a reduction in pitch, a reducing delay gives an increase. The rate of change of delay determines the amount of pitch shift.

Clearly it is not possible (or desirable) to continuously increase or reduce the delay ad infinitum - this would require a delay of infinite (or negative) length. As a result, commercially available pitch shifters increase the delay from a low amount to a high amount and when the upper bound is reached, reset the delay to the lower bound, performing an edit with the incoming signal so that this change is masked. The reason that the lower bound cannot be zero is that the pitch shifter needs a certain amount of stored signal available to find a good place to edit. Thus the actual delay through the pitch shift process will vary from somewhat below the lower bound to somewhat above the upper bound, giving an average value of about 20mS, but with instantaneous values ranging from near zero to about 50mS. Note: the above applies to a pitch *reduction*, for an increase the opposite applies.

Most Eventide pitch shifters also allow an extra delay to be added, but even when this is set to zero, the above considerations will apply. If the pitch shifter is set to give zero shift, the delay will be constant, and will usually be the instantaneous delay the system was using when it was set to zero (otherwise changing the pitch setting would give a 'whoop').

If the pitch shifter is powered up with a zero setting the delay will be fixed at some point between the upper and lower bound - depending on the pitch shifter in use, this may vary from session to session. Again, this delay is necessary so that the amount of pitch shift may be smoothly changed from zero to some other value without unnecessary edits.