Hum Drum Replacement

by Roger Nichols 4-1-92

The grass is always greener on the other side of the fence. The girl is always cuter on the other side of the room. The snare drum on the other guy's record always sounds better than the one you just recorded. The never ending quest for that extra ten percent.

Drums and other percussion sounds add to the basic feel of a song. The fundamental rhythm on which all of the other instruments rely. The three important factors here are the pattern, placement (in the attern) and sound of the percussion instrument. All three factors are inter-related to the point that any change in one greatly effects the others. A perfect scenario for endlessly chasing your tail.

In the MIDI studio we are blessed (or cursed) with an unlimited number of percussion sounds available to us. If we don't have just the right one, we can record it ourselves and add it to the collection. I have 400 megabytes of edited drum samples and at least four hours of DAT tapes that haven't been edited yet. It now takes longer to audition all of the drum permutations than it does to do everything else combined.

Usually when you start to write a song in your MIDI studio, you use a drum set that already exists or create one that has only the bare essentials to get you started. The initial groove seems fine. As you progress, you keep telling yourself "This is OK for now, but I'm gonna fix that snare and kick as soon as I get a chance." Well, you've put it off as long as possible. It's time to face the music (pun intended).

If you are still working in the sequencer domain, you have an advantage; all you have to do is substitute different sounds while the sequence is playing, almost. Since we know that the sound has a lot to do with the feel of the pattern, we have to choose a drum sound that appears to come in the same place

rhythmically as the drum we are replacing. You can put two sounds side by side on an editor screen and they look like the peaks are in the same place, but when you listen to them it is a whole other story.

One of the snare drums could sound early because of it's length. Where the sound ends makes you think that it starts in a different place. If the sound is too short it tends to sound early. If the snares ring longer, it makes it sound as though the snare is more laid back. This effect is more pronounced with sounds that are processed. Processed snares and other drum sounds use the decaying part of the sound to accentuate the effect. This makes the timing of the sound's decay as important as the sound's attack.

Placement of the new sound is critical. If you want to make the sound happen earlier, you can make the sequencer shift it ahead a slight amount. This amount usually has the resolution of the smallest increment available to that particular sequencer. If the resolution of the sequencer is 480 ticks per quarter note, then moving the snare one tick earlier at a tempo of 120 beats per minute will advance the snare by 1.04 milliseconds. This is of course the best case scenario. Most sequencing software won't have this high resolution and a lot of dedicated hardware sequencers don't allow adjustments of one tick. Moving the snare one increment earlier on an Akai MPC-60 will make the snare about 13 milliseconds ahead of where it was.

The way Donald Fagen works is to run the audio from each drum and sequenced instrument through individual digital delays. He can then move any instrument by any amount. Most of the delays he uses are made by Roland and allow increments of .1 milliseconds up to 10 milliseconds where the resolution drops to one millisecond increments. If he wants to have available .1 millisecond increments above 10 milliseconds then he puts two delays in series. There are delays available that allow increments of around 20 microseconds (which is 1/50th of a millisecond). Donald has a stack of these as well.

I am not saying that these are necessary devices for everyone. If you put together a sequence and everything sounds right, then that is just fine. If you bust your hump trying to get a machine groove to feel good and you aren't having much success, then try moving a few things around until it locks into the groove you're looking for. Put every instrument through it's own delay and crank them all to 15 milliseconds. Now you can make some sounds earlier and others later.

The biggest problem with using all of these delays is that they do degrade the quality of the sound passing through them. They also add little whirs and wheezes of their own to the sound. If the sound the delays add bothers you then there is a solution.

When you are ready to print the sequence on multi-track tape, stripe SMPTE on the tape and then use the SMPTE to drive the sequencer. Make sure you set the start offset so that the sequence starts where you want. Never start the sequence at 0:00:00:00. Always let at least 10 or 15 seconds of SMPTE go by before the sequence starts.

Now, let's pretend for this example that we have a 5.7 millisecond delay on the snare drum and a 2.1 millisecond delay on the kick drum. Take the snare drum audio out of the delay and run it as you normally would to the tape machine. Insert the delay on the SMPTE signal between the tape machine and the SMPTE reading device that is driving the sequencer. Make sure that the SMPTE is not clipping the delay. About half way up the meter should be fine. Make sure that there is no regeneration or any other effects active on the delay, we want straight, no frills delay. In the case of our snare drum, make sure that the delay is set at 5.7 milliseconds. Start the tape, punch up record on the snare track and let the sequence print the snare drum. If you have other instruments that were set for the same amount of delay, you can print them too. After the snare is printed, do the same thing with the kick drum, but change the SMPTE delay to, in our example, 2.1 milliseconds. Continue with this method until all of the instruments have been printed to tape.

See how easy this is? Maybe some day we will have Super MIDI and sequencers with high enough resolution so that we won't have to do it this way, but let me tell you, we've come a long way since 1978. There were no sequencers to speak of in 1978, especially universal ones that you could use with any synthesizer. Everything we sequenced back then was based on the timing of the 1/8th note click on tape. I guess the resolution was two ticks per 1/4 note. We had to build our own delays to get small increments. It worked, sort of.

Replacing Snare Drums For Fun And Profit.

OK, sports fans, what if you already put everything on tape and your spouse got your sequencer in the palimony settlement and you need to replace that ugly snare drum with one that doesn't rip the top of your head off every time you play it back? Well, that's just what were going to cover next.

There are basically two ways to replace or add to an existing snare drum:

1. Build a tempo map and play it back to trigger the new snare.
2. Trigger the new snare in real time from the existing snare.

Right here, let me say that if the drums on tape were played by a real live human person type drummer, I would prefer to add the sound of the new snare to the sound of the existing snare rather than replace it entirely. This greatly improves the chances of the finished track sounding like a person played it.

Tempo Maps.

If the snare drum you are replacing plays a regular pattern, such as two and four, all the way through the song, then you can use a wide variety of devices to create your tempo map. These include, but are not necessarily limited to, the Roland SBX-80, the Roland SBX-1000, the Aphex Studio Clock, Syncman Pro and Opcode's Studio 5. Each unit operates a little differently, but basically they read SMPTE to figure out where they are and you feed them audio from the snare drum so that they can determine where the beat fell. Some units have the ability to mask out unwanted sounds that occur between the snare beats. If the unit that you are using does not have this capability, then you may have to gate the snare drum or otherwise process it to mask out the junk.

Next, write a simple pattern into your sequencer that will play the new snare drum on every quarter note. This is because the tempo mapper thought it was hearing quarter notes when the snare was fed to it and that the first snare that it heard was the downbeat of the song. Make sure that it is quantized to play exactly on the beats. Hook up the device used to make the tempo map so that it reads SMPTE from the tape machine and sends MIDI song pointer to your sequencer. Set the sequencer to "External MIDI" and play the tape.

In reality what is happening is that the sequence is being played back at a variable tempo. Let's say that the tempo of the original song was 120 beats per minute. The tempo displayed by the sequencer when playing back should read 60 beats per minute (because of the half note snare part). When we get to a bar where the snare drum was rushed, the tempo will jump up to 60.13 bpm or 61 bpm. If the next snare beat was right on the money, the tempo will drop down to 59 bpm so that the average comes out to be 60 bpm for the duration of the song.

Now that we have the new snare playing along with the old snare, we have to determine if the new snare is in the right place. If you listen to both snares at once, you like where the new one lands and don't hear

any flams, then cool. Print it. If you are not exactly sure whether the new one is right, then you can try a few different things to see how they line up.

One method is to make the new and old snare drum the same apparent level. It doesn't matter what the meters say, just make them sound like they are both at the same volume. Now pan them to opposite speakers. If the snare appears to come from the right speaker, then the snare panned to the right is earlier than the one panned to the left. If the image seems to come from between the speakers, then they are probably happening at the same time.

I have seen a few people use the Russian-Dragon to determine which snare is early. The only problem is that it is not calibrated so that you can tell how early or late one input is to the other. The Bee Gees used to record the new snare on the multi-track tape and then by scrubbing the tape across the heads (like finding an edit point) mark both snare drums and measure the difference with a ruler. At 30 inches per second, 1/4 inch would be about seven milliseconds. I use a dual trace oscilloscope to see the difference between the events.

If the new snare is late, because of MIDI slop or the difference in sound quality or whatever, the same methods used earlier to shift sounds around can be employed. Shift it earlier either by the sequencer or the offset in the tempo mapping device and then run it through a delay to line it up. Then move the delay over to the SMPTE line and print it to tape.

If the snare part is not as straight forward as our first example, we can resort to another method of mapping where the snares lie (where the snare lies? If only chickens lay, should we call it lieback instead of layback? Never mind.)

There are a few devices around that will produce a MIDI event when given an audio trigger. The ones that I have used over the years are the Simmons MTM (MIDI-Trigger-MIDI), the Akai ME-35T and most recently the Alesis D4 drum module. Some of them have internal processing to mask out the junk, while others make you do it yourself. Whenever you get the masking straightened out so that as few stray triggers as possible exist, play the tape, record the MIDI events into your sequencer and delete any of the bogus events from the sequence. An added advantage to using this method of mapping the snares is that you can record the dynamics of the live snare. The MIDI devices I just mentioned follow dynamics rather well.

All audio trigger to MIDI devices have delay associated with this process. The MTM has about a five millisecond delay between the time the audio event happens and the MIDI event is transmitted (all three bytes, channel, note and velocity). The Akai ME-35T is pretty quick with only two milliseconds delay. The Alesis D4 delay depends on which trigger type is selected. If you use one of the low trigger types, intended for triggering from pads, the delay is between three and four milliseconds. If you use type 21 thru 25, the ones that Alesis recommends for triggering from analog tape, the delay is between six and seven milliseconds.

You have to remember, though, that the delay amount doesn't really matter, as long as you figure out what the delay is for your unit. You are going to compensate for it when you print the new snare anyway. Once you have your map cleaned up, shift it earlier by whatever the delay is. If your sequencer shifts the sequence earlier by 13 milliseconds and the delay in the D4 is six milliseconds, then crank seven milliseconds into the delay fed by the new snare. Everything should line right up. Do a little delay shuffling to compensate for the new sound, move the delay over to the SMPTE line and print it.

Real Time Triggering.

This means that you don't want to build a tempo map into a sequencer, you just want to play the tape, feed the snare drum into something, and come out with the perfect snare sound. OK, if you figure it out, I want to be the first to know how you did it.

All trigger units have delay, some just have more than others. If you are going to use the original snare in addition to the new snare, then some delay in the triggering may not matter. If the initial attack is used from the original snare and the added snare is used for the meat of the sound and doesn't really have a sharp attack of it's own, then a delay of a few milliseconds will slip right by. I have used the Alesis D4 (with it's 500 built-in drum sounds) in real time to add fatness to a snare that was already on tape and the six millisecond delay didn't show at all. The resultant snare composite sounded great.

The Akai ME-35T has no sounds of it's own, so must trigger a sound module via MIDI. The Simmons MTM must either send out MIDI to an external sound module or send trigger pulses designed for Simmons Drums. With these devices you have to add the MIDI delay of the sound module to the trigger-to-MIDI delays. In the case of an Alesis D4 triggering a sound in an Akai S-1000, this could add up to ten to 14 milliseconds. Now anybody can hear that, even with one ear tied behind his (or her) back.

If you are recording on analog tape, you can compensate for the delay by turning the tape over and delaying the trigger source over to another track. When the tape is turned back over to travel in the right direction, the trigger source is early. You can then run the trigger source through a delay on it's way to the drum trigger. Now you can slip that new snare right to where it is supposed to be.

If you are recording digitally, you can't turn the tape over 'cause it won't play. You can only lock up a second machine with a copy of the trigger and offset it earlier. I have used the Fostex D-20 SMPTE DAT machine for this purpose, but you could use a two track analog machine or just about anything that allows SMPTE synchronization. The other choice would be to use a device that triggers with no delay.

The Wendeljr drum replacement module has the fastest real time trigger, measured at three microseconds. Yup that's a 3/1000th of a millisecond. The Wendeljr, however does not follow dynamics, so you have to either automate the dynamics during mixing or use multiple Wendeljrs when replacing. There was a prototype Wendel dynamics unit that would trigger in 60 microseconds but it was never produced. Wendeljr could fake dynamics by switching between two different samples during fills, eliminating the machine gun effect common to drum machines. Wendeljr is not made any longer. Fostex was distributing the remains but I think they are all gone. Some rental places have them, but they always seem to be rented out.

Bob Clearmountain sells a little box that alternates between samples during fills by sending out separate MIDI events. I haven't used one yet, so I don't know the delay situation. It contains no sounds of it's own, but the idea is to trigger two separate sounds in a MIDI sound module.

The Forat F-16 (drum sampler) is pretty fast when dynamics are turned off and can be used in real time. It slows down considerably when following dynamics. I have seen a few drummers with them in their racks.

I know that there are other samplers that trigger from audio, other tempo mapping devices and other audio to MIDI converters, but the principles remain the same. Just substitute the machines that you want to use and go to work.

Well there you have it, everything that you ever wanted to know about replacing drums, and some things that you probably didn't want to know. This should give you enough background to tackle just about any problem you come up against. Good luck!