

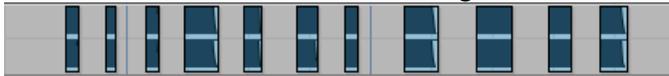
**025:250 COMPOSITION: ELECTRONIC MEDIA I**  
**Fall 2012**

**Generating Regions by Pitch-Shifting**

1. In recent years, pitch-shifting algorithms have improved dramatically. This allows a single sound to be transposed to different pitch levels. In turn, this allows the composer to incorporate voice-leading, harmony, chords, counterpoint, and pitch-set strategies in their electronic works. Because students in the composition program at Iowa are well-versed in these techniques in their instrumental and vocal writing, they are well-positioned to make new and unique contributions to the field of electronic music based on sound sample manipulation.
2. One barrier to using pitch-shifting in such a pronounced way is that it is somewhat cumbersome and time-consuming to shift the pitch of many soundfiles and regions. One strategy for alleviating the amount of time and effort required to pitch-shift many individual sounds is to treat it as a form of mass-production. This process is described below.

3. Prepare for mass-pitch-shifting as follows.

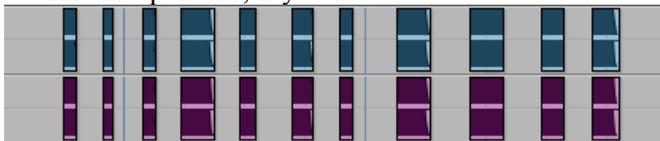
a. Create a series of 5-20 individual regions that are normalized and free from clicks, as shown in Track 1, below.



b. Copy these sounds to Track 2 by using the shift-click-drag technique discussed in class. These sounds are highlighted in Track 2 in the example below.



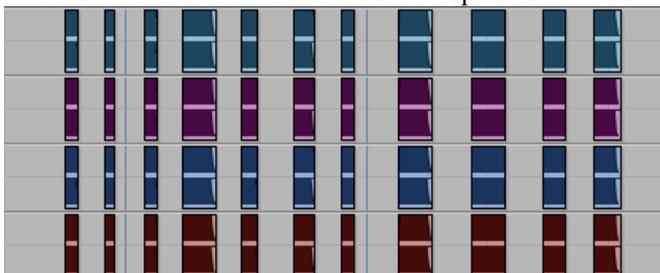
c. Use Serato Pitch n' Time to transpose the sounds in Track 2 up 1 semitone. The results are shown below. Notice that they are exactly the same length as the ones in Track 1, as we are not changing the duration of the sounds. Doing so often produces very good results, so consider using that method instead of keeping pitch and time independent, if you like.



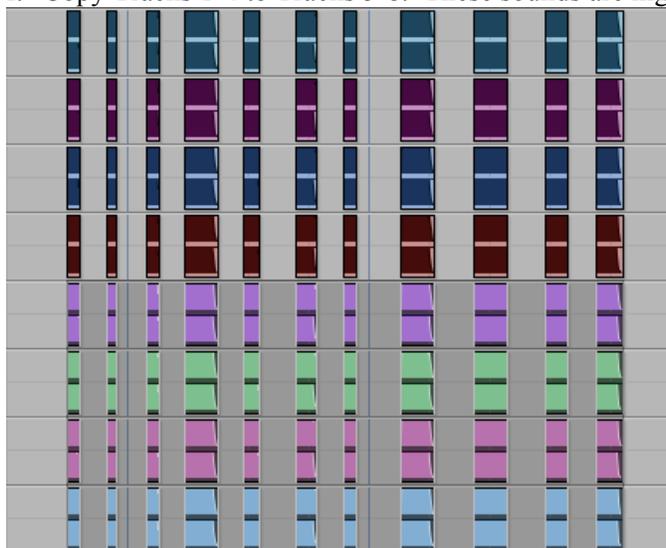
d. Copy Tracks 1-2 to Tracks 3-4, as described in Step 3b, above. These sounds are highlighted in Tracks 3-4 in the example below.



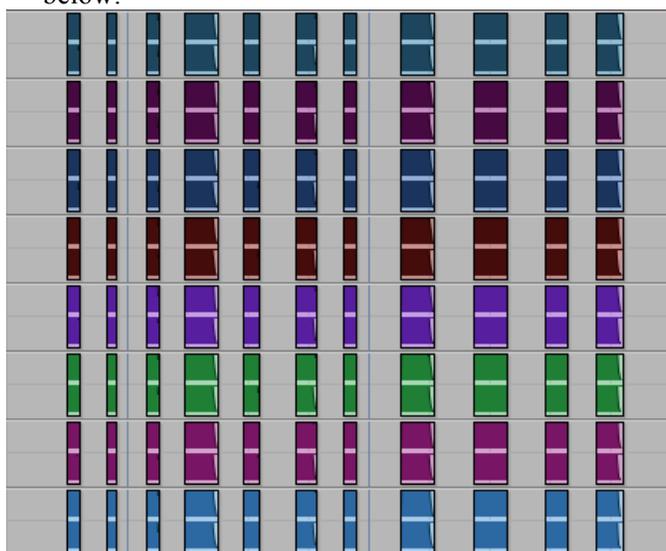
e. Use Serato Pitch n' Time to transpose the sounds in Tracks 3-4 up 2 semitones. The results of this are shown below. The rationale for these transposition values will be discussed in Step 4, below.



f. Copy Tracks 1-4 to Tracks 5-8. These sounds are highlighted in Tracks 5-8, below.



g. Use Serato Pitch n' Time to transpose the sounds in Tracks 5-8 up 4 semitones. The results of this are shown below.



h. The transposition values of the sounds in Tracks 1-8 are given below:

- Track 1 = +0 semitones
- Track 2 = +1 semitone
- Track 3 = +2 semitones
- Track 4 = +3 semitones
- Track 5 = +4 semitones
- Track 6 = +5 semitones
- Track 7 = +6 semitones
- Track 8 = +7 semitones

4. To transpose down 0 to 7 semitones, repeat Step 3, but replace the + sign by a - sign.
5. To transpose up in whole-steps, multiply the numbers in Step 3 by 2. This gives the transposition values shown below:
  - Track 1 = +0 semitones
  - Track 2 = +2 semitones
  - Track 3 = +4 semitones
  - Track 4 = +6 semitones
  - Track 5 = +8 semitones

Track 6 = +10 semitones

Track 7 = +12 semitones

Track 8 = +14 semitones

6. To transpose down 0 to 14 semitones, repeat Step 5, but replace the + sign by a – sign.
7. Sometimes you may not need to transpose a great many times. Consider this, for example.
  - a. Create Track 1 from any sounds that you wish.
  - b. Copy it to Track 2 and pitch-shift it up 3 semitones.
  - c. Copy Tracks 1-2 and paste them to Tracks 3-4. Pitch-shift Tracks 3-4 up 5 semitones.
  - d. This gives the transposition values shown below:
    - Track 1 = +0 semitones
    - Track 2 = +3 semitones
    - Track 3 = +5 semitones
    - Track 4 = +8 semitones
  - e. To transpose down by these values, replace the + sign by a – sign.
8. Notice that there are no semitones in Steps 6-7. These transpositions have larger values, but fewer transpositions. Here is another example that has larger transposition values.
  - a. Create Track 1 from any sounds that you wish.
  - b. Copy it to Track 2 and pitch-shift it up 4 semitones.
  - c. Copy Tracks 1-2 and paste them to Tracks 3-4. Pitch-shift Tracks 3-4 up 6 semitones.
  - d. This gives the transposition values shown below:
    - Track 1 = +0 semitones
    - Track 2 = +4 semitones
    - Track 3 = +6 semitones
    - Track 4 = +10 semitones
  - e. To transpose down by these values, replace the + sign by a – sign.
9. Serato Pitch n' Time allows time-shifting as well as pitch-shifting. Consider these possibilities:
  - a. Pitch shift without time-shifting (which is what we did in Steps 2-8).
  - b. Time shift without pitch-shifting.
  - c. Correlate pitch and time-shifting using varispeed.
  - d. Pitch shift by a given value and time shift independently.
10. By mass producing pitch- and time-shifted sounds using the techniques described above, you free yourself from having to attend to so many individual steps. The time that you save with mass production can be used for other important tasks, such as working out compositional plans and details on paper or Sibelius. You can do homework, study scores, do situps, go to the bathroom (well, it's true), email, google, record and edit in Peak, work on a Max patch, write program notes, and so on. Seriously, being a composer in today's world requires you to learn how to make time, and use it efficiently.
11. The saving in time using this method comes from letting the computer perform all of the necessary calculations, leaving you time to do other things for, say, 5-20 minutes. I have done some mass calculations that take several hours. This is analogous to time spent rendering video. The trick is to have a plan for other work you will do while the computer is calculating transpositions or other operations.
12. HOWEVER, a big caveat here. One thing you cannot do, is do other work in Pro Tools while calculations are performed in the background. Any kind of AudioSuite and plug-in operations completely takes over Pro Tools, so you won't be able to do even the simplest, most basic work in the program when operations are running. You can, however, use any other audio programs on the same computer.
13. You can perform other mass-production operations on regions in Pro Tools. With all of these, the first step is to organize your regions in the Edit Window in a way that allows you to select all of the desired regions with a few basic mouse moves. This will allow you to mass-process using the operations listed below:
  - a. Normalize
  - b. Reverse
  - c. Add reverb
  - d. EQ

14. When mass-processing a large number of regions, you should keep copies of the original files and regions as a safety measure. Normally, I do this in the Edit Window, where the regions being processed sit in one area of the window, while copies of these files and regions are stored elsewhere in the Edit Window. In some instances, I will save the session under a new name, confident that I can recover from a hung or crashed process.
15. At home, I will sometimes mass-process something overnight. Be warned that doing something unusual like this, may bring unintended consequences, i.e. crash. If you do this at school, I think it would be better if you do it in Studio 2. Normally, I don't like to see any scraps of paper laying around, but I think it makes good sense in this case to leave a note explaining what you are doing. This brings a very important point, deserving of its own item number, below.
16. When processing material overnight, leave a note saying what you are doing. Then, give instructions for the next person who comes in to work on the computer. The session should be saved. However, I suspect that the audio files created by the mass-process will already be sitting in your Audio folder within the main session folder. I would check this right now, but, I'm actually mass-processing sometime right now.
17. Here is an idea. In addition to have Pro Tools running on the two desktop computers in Studios 1 and 2, we also have Pro Tools installed on 2-3 MacBook Pros in the studios. I think it is perfectly acceptable for anyone to use one of the laptops in one of studios, in order to perform some mass-processing. This frees up the desktop computer so that you can do other work in Pro Tools on it. One catch, though, is plug-ins. Pro Tools comes with many plug-ins that are OK, but not great. On the plus side, I believe we have 2-3 copies of Serator Pitch n' Time. This is not the exact same thing as the Pro version that we use on the desktops in the studios, but the quality is exactly the same, as it uses the same algorithms as do the Pro versions. What the non-pro version is missing, is the graphing capabilities of the Pro version. Personally, I don't use the graphing feature very often. Something to think about with Dan and Will.
18. Another idea. It has long been my policy that students can check out a laptop to take home for a short period of time. In rare cases, this could be as long as a period when school is not in session, such as spring break, part of the summer break, Thanksgiving break, and the winter break. There are two basic principles involved with this. First, equipment we have in the studios is meant to be used. Consequently, I am very happy to know that a student has some gear at home, whether microphones or laptops. The second principle is that the assistants need to be able to use 1 or 2 laptops for concerts and other performances. To help ensure this accessibility by the assistants, they will work out a schedule for keeping laptops and gear at your home. Food for thought.
19. Yet another idea. I don't think we should install EMS software on your personal laptops, although I imagine that exceptions could be made. As an alternative, you could look into buying, for less than \$100, a copy of Reaper. Reaper is like Pro Tools in many ways. Significantly, professional recording engineers have really gotten on board with this program. I see its praises being sung all the time. It won't have the same plug-ins that we do, but maybe they have some good alternatives. This would be sometime to explore.