

Performing Technology

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As computing power has increased most digital signal processing software is now available in real time versions. This allows me to control the software as the sound is playing. Using real time software has changed the way that I compose. Now I can actually play the computer, controlling the sounds as they happen, instead of writing a program, waiting for it to compile, and then listening to the sound later. I can process and mix sounds in real time, slowly crafting a piece by ear until I achieve the intended goal. The act of composition can now be seen as the performance.

パフォーマンス技術

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コンピュータの演算速度の向上にともない、殆どのデジタル信号処理ソフトウェアで実時間処理が可能なバージョンが手に入るようになった。これにより音がなっている時にソフトウェアをコントロールすることが許されるようになった。このような実時間ソフトウェアを使うことにより私の作曲方法が変化した。以前はプログラムを書き、コンパイルされるのを待ち、そして最後に音を聞いたのだが、現在では実際、私は今鳴っている音をコントロールし、コンピュータを演奏することができる。実時間で信号処理をしたり音をミックスしたり、目的を達成するまでゆっくり耳で確かめながら作品を仕上げることができる。今日、作曲行為は演奏行為としてみなすこともできるようになった。

Over the past few years computers have become so powerful that it is now possible to run most digital signal processing algorithms in real time. In addition to the manipulation and synthesis of sound, there are also several digital mixing programs that let me create a composition in real time. By moving visual representations of sound files around on a digital mixing screen I can change the start time, volume, panning, and signal processing of several different sounds, mixing and adjusting the piece every time it gets played. With real time processing and mixing I actual play or improvise on the computer just like a musical instrument, slowly crafting and shaping the sounds each time I play them.

This year Brad Garton and Dave Topper created real time versions most of the Cmix instruments at the Columbia University Computer Music Center. Cmix instruments are digital signal processing algorithms, each designed for a specific processing function such as phase vocoding, room simulation, convolution, delay line, independent time and pitch shifting, fm synthesis, and amplitude modulation. There are also several of Perry Cook's physical models which can be controlled or "played" using Cmix programs. The way that I compose music at the computer has fundamentally changed because of the real time capabilities of these processing and mixing programs. In this paper I would like to briefly describe how I put together a piece of music that I performed at the computer. I say performed because I actually played the computer until I got a version of the piece that I enjoyed, which temporarily, became the final product.

I started the composition by sampling myself playing short passages on various instruments. Next I edited these sounds into short phrases and ran them through a real time granular synthesis program by Oyvind Hammer called Gran on an SGI Indy. Since the sound files loop through Gran in real time I can play the program, adjusting the 20 or so parameters as the sound plays, until I get the exact sound or effect that I want. I can create longer or shorter phrases, create new rhythms, add spatial effects and delays, alter pitch, speed, and harmonic elements while I listen, deciding by ear, what I want to keep and work with and what I need to throw away. It's just as if I were improvising on an instrument, working out phrasing, harmony, rhythm, timbre, and orchestration.

As I work on each segment in the granular synthesis program, I shape the rhythmic contour by adjusting the length and speed of my sound file using the many delay lines available until I have what I need. I work on the orchestration by creating different versions of the same sound file, all with slightly different signal processing, equalization, and structure. I worked with the real time Cmix instruments the same way I used the granular synthesis program, running my sound files through the instrument, adjusting the parameters a little each time until I'm satisfied. In this composition I used the real time comb filtering available in Cmix, slowly altering the harmonic content of my sound files by adjusting the relative volume of each frequency in a sounds overtone series. Between the comb filtering and the granular synthesis I had enough source material to load my soundfiles into Mix, a digital mixer also designed by Oyvind Hammer for the SGI Indy.

Once I have all my sounds in the digital mixer, I can move them around on the

screen until I have them arranged in the order I think I want them to play. On the computer screen you can see the wave shape of every sound and you can move them by pointing and clicking the mouse. You can drag the sounds around to different places and duplicate them if you want several copies of one. As I play them back I can adjust the start times, the volume envelope of each sound file, and the panning. I can also control mixer sends and returns in case I want to send a sound out to an equalizer or to one of the digital signal processors in the mixing software. I can also solo a single instrument for special attention or mute others that I don't want to hear.

Its as if I perform the composition over and over again until I have finished it. I slowly rehearse with all of my sounds until they are assembled in the proper order, playing the way that I want them to. I slowly make changes, sometimes significant, at other times, several subtle alterations, shaping the sound that I want the computer to perform. I perform the piece over and over again just as if I was rehearsing on an instrument or with an ensemble.

With real time control over digital sound files I really have learned how to play the computer or the program in order to achieve the effect that I want. Just like the physical models that have been created over the last decade, they sound great if they are played well. You have to teach the computer how to play each instrument just as you would have to teach a person how to play. You have to learn every parameter and how it will effect the sound of the instrument that you are trying to play.

You have to learn to play many of the new real time programs. A program like Gran on the SGI has so many different control parameters that I have learned to play it like an instrument. I have taught my fingers where and when to move and what effect that will have on the sound. I know how fast I can change parameters and at what speed I have to move the sliders. I had to learn how many changes I could make at a time so that I play the machine effectively without crashing the program. There is a tactile movement that is much like learning fingerings on a violin or piano. Patterns that yield specific results when used in different combinations. By playing these signal processing instruments you become better at manipulating them, just as would with an instrument.

Now that real time digital signal processing instruments are available and it is possible to control them by learning how to move our fingers over them we are in a sense performing a composition as we write it. We are performing at the computer, listening to the sound as we move various parameters and make adjustments based on what we hear in each performance. As we practice and rehearse our actions we mold the performance and let it evolve to a finished piece that can now be performed endlessly without change, or one that we can easily re-interpret another day.