Nonobvious roles for electronics in performance enhancement

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Abstract

A new paradigm is proposed which overcomes certain shortcomings in our current models of performer/computer interaction. The "Standard Model", in which the computer passively waits for performer input can be extended to include closed-loop behavior, both stable and unstable. In the time range typified by the muscular and auditory subsystems, the existence [Cadoz] of approximately linear spatially modelled feedback is emphasized. On a longer time frame, the possibilities are more subtile and powerful. In a well-designed timbre space / control space [Wessel] the connection occurs on a more musical level and is evidenced in enhancements in the performer's own apparent output.

1 Introduction

We often hear that a too close scrutiny of the creative process can have the effect of blocking it. The parallel to quantum physics is always cited in the discussion. Attempts to unveil certain subatomic mechanisms will inevitably displace or destroy the object of interest, merely by the act of observing it. But in art, the reverse can also occur. One can sometimes enhance the creative process by diverting conscious attention away from it. This is an important, and largely unacknowledged, benefit that electronics can bring to musical composition and performance.

2 Physical Feedback

A favorite CMJ cover photo opportunity is provided by the parade of exotic new interface devices designed for stage and studio use. After all, the key offering of the computer as a musical instrument is that the musician can design the interface without regard to the way sound is to be produced. But in instruments which create sound physically, there are usually physical cues returning from the mechanism to the player. A good example is the piano, whose accelerating hammers can be felt by the player's finger as force.

A bad example of a human/computer interface for making music is offered by one commercial "wind controller" we have tested. The player is expected to hold a sort of bit in her mouth, hold various keys down, and blow – or indeed, not blow; there is no sensor either for air speed, air pressure, or bite. It could as well be held in her lap.

But players usually benefit from years of training and experience on their particular instrument, which itself is often the result of an evolution of ideas tempered by musical demands. Often these instruments make sense, that is,there is a "reason" for their particular form, playing technique and role in the musical literature. Because of the ease of designing new instruments in computer music today, performers are encountering new instruments, that may or may not be familiar to them. Nonetheless, since players are generally used to instruments that make sense, prescribing an electronic clarinet, that requires no blowing, to an accomplished clarinet player can have a destablizing effect on the player's performance. Choosing the right controller for the right situation is important. The automotive engineer chooses a steering wheel over left/right incrementing buttons. We should not hand a musician a butterfly net when a pitchfork is required.

[Cadoz] and [Gillespie] champion the idea that the computer could be programmed to provide force feedback using electrical actuators. This perfectly reflects the fact that muscular feedback can work on time scales far below those possible in auditory feedback. For controlling articulation, only physical feedback is fast enough. For more global controls, such as tempo,instrumental balance, and tone color, auditory feedback is sufficient. An example is described in [Lee].

3 Mental Feedback

At the 1992 ICMC, we listened to a short piece for violin andcomputer, played by a first-rate violinist. The rig consisted of a portable Macintosh and some portable MIDI synthesizer or other. Of course,the sounds coming from the violin were vastly superior to any that the synthesizer could produce. To members of the audience, the MIDI notes were mostly a bother: integral to the music, but perhaps best dispensed with anyway. This impression was strengthened by the Macintosh crashing about one minute into the piece. It was necessary to reboot the machine and start again.

The violin performance was brilliant. But what was distracting for the audience was certainly distracting for the violinist as well. In diverting the performer's thoughts from the details of the violin part, to the agonizing question of whether the machine was following correctly (and whether it would work at all,) the presence of live electronics may actually have improved the violin playing. Looking closer, we will see that this phenomenon underlies part of the interest of using electronics in live performance. (For another viewpoint on the impact of technology on musicians, see [Zicarelli]).

A possible mechanism is provided in [Freud], who sees creativity as being facilitated by a loosened sort of communication between the unconscious and the conscious minds. The unconscious seeks release and its attendant pleasure; but unconscious desires not being fulfillable (or even knowable), the artist manages somehow to find thinkable things which resonate with the deeper,unthinkable ones. This process requires a privileged access, if not to one's unconscious, at least to what Freud calls preconscious "daydreams."

If the conscious mind is suitably distracted, the unconsciousis more successful at "tricking" its way to the surface – in everyday life appearing as mistakes and parapraxes; in art, possibly appearing as a closer bond between the action and its underlying essence. The presence of live electronics, the necessity of their care and feeding and the awareness that they are not reliable, provides a sort of cigarette to smoke that can keep the hands (or the mind) busy.

To start with a classical example of this, consider the use of "compositional systems" in writing music. Many composers seem to believe that it is the system that gives the music its meaning. This is a delusion. At bottom, the system is there to distract the composer, to occupy her conscious, reasoning mind with the necessity of performing combinatorial operations on finite sets. This gives the unconscious mind easier access to the composer's pen.

Useful mental feedback of this sort comes from all directions. Take, for example, the pitch follower. We are never sure to what extent the pitch follower's output will resemble the stream of notes actually played by the performer. It is very frequently noticed that a pitch follower actually performs worse – sometimes much worse – in concert than in rehearsal. This is because the musician plays differently, more musically, in concert. The better the instrument is played, the worse the computer will track it.

This has an interesting effect on the player. Often the player believes that, if the pitch tracker makes a mistake, it is because the note was badly played (in contradiction with the above.) The player will play much differently if he can hear the pitch follower's output (for instance if used to double him with a synthesizer) than otherwise. Also, the composer, who is all too aware of the pitch follower, will write differently. This is often the source of unusually placed musical ornaments which serve as disambiguation.

Another source of enhanced output from both composer and performer follows from the rehearsal time constraints typical to computer music performance. The composer, who usually arrives in town a day or two before the performance, must first assemble the combination of local and flown-in gear which will permit the piece to be played. If time remains, the piece is rehearsed and adapted to whatever hardware changes were made. It is at this moment that the player meets her accompanist, or even encounters the instrument that she will operate for the first time.

A new version of the piece is put together. The software is modified and recompiled, pedals are added and deleted, and a playing style is developed which is compatible with the requirements of the performance monitor (score follower, input parser etc.), and the specific effects box, microphone, or other element in the audio chain that was changed in the previous step.

Supposing a foot pedal is the means of keeping the computer and the player together, the player must try to detect the fact that a pedal was missed or hit twice by accident. This will desynchronize the computer from the performer; the offset may be cancelled by the next mistake, but again it may be widened. Especially if the electronic response is to transform the live music, the player may be aware ofthe problem but unsure whether to jump ahead or back.

The video monitor can be used to reassure the performer in the case that the computer is in the right place, and indicate promptly and reliably when an error has occurred. The limitation is that the player, in addition to looking at the score and possibly a conductor, also must now consult the screen frequently. Variants have been tried: a system of flashing lights, for instance, mounted directly on the music stand. There is the old standby of offering a click track over headphones. It is not yet known which is the most distracting.

The composer must also take other physical matters into account when trying to win the player's trust. The player is sometimes required to hold or wear homemade equipment, sometimes with bare wires carrying voltages which are unknown to the player. The cables are often short which bind the performer to his station; he often feels at fault when feeble solder points break as he is putting the instrument down. Sometimes microphones and other detectors are attached to the performer's instrument. Part of the rehearsal is taken up by an extraordinary sound check in which sound engineers push the outputs all the way up to listen to hisses and hums. For the above reasons, the performer cannot move while this is being done. The computer software and hardware extend the sound check into a debugging session. The computer is rebooted again. Will it work this time?

The simple matter of keeping an appropriate monitor level is a problem. Performers' confidence is greatly reduced by the overactive sound engineer's occasional mistakes in setting monitor level. Since the sound engineer does not hear the monitor, the loop is open, and the performer is at the output. When the system goes into feedback the performer is the only person who can't clap his hands over his ears: they're holding the instrument. Monitors are the key cue the player uses when the tempo of the machine must be apprehended. A player's ability to locate beats in a given metric structure may be incumbered simply through the use of a harmonizer that introduces a small variable delay.

A relatively new phenomenon has appeared thanks to the possibility of single-handedly controlling extremely high sound pressure levels with speed, grace and precision. This possibility has introduced a form of rapture of the deep, into which improvising soloists may fall, no longer able to judge the passage of time.

Experience in pieces using tempo-synchronized machine accompaniment [Vercoe] has shown that performers can be affected by biasing the tempo reported by the tempo follower. If the tempo follower rushes, it is exceedingly hard for the live player not to rush to catch up. The result is closed-loop tempo runaway. There is also an effect on dynamic; if the computer lags, the player plays louder; if it rushes, either softer or louder depending on other factors. In general, overall loudness is enhanced by stress.

4 Conclusion

An act of bravery was required to break out of tonality's coffin earlier in this century. The rule-inventing and rule-breaking of that era unblocked new musical thoughts. Today, electronics require similar courage to approach and offer the same liberation. Atonalism also offered a distraction; suddenly,in order to be a composer one had to study mathematics. An equivalent distraction value comes today out of using electronics, particularly live electronics. Fear and distraction are an important part of electronic music today. Perhaps in the future the computer will be as easy to configure and use, and as reliable, as a piano is now. If this happens, composers and performers will seek new sources of uncertainty.

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