Programming Machines and People: Techniques for Live Improvisation with Electronics

Chapman Welch

ABSTRACT

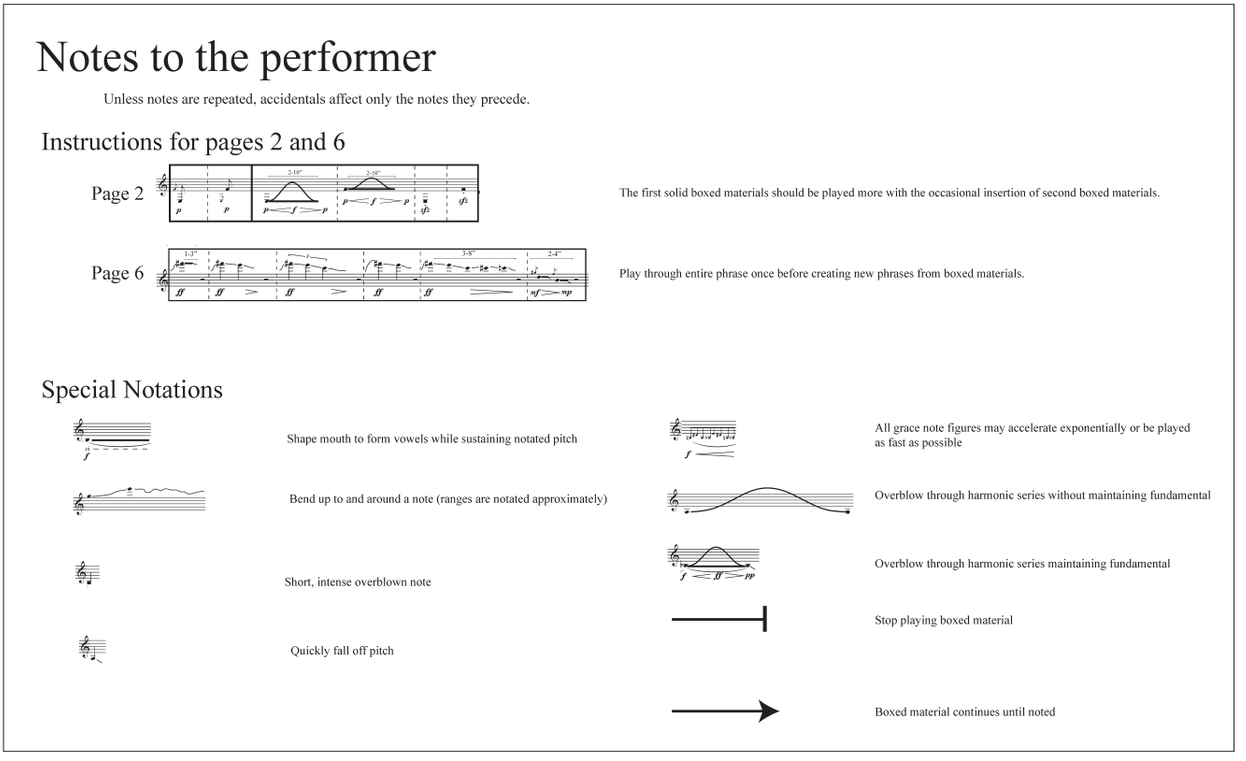
Many performers of new music do not come from an improvising tradition, and the addition of live electronics to works written for these performers may be intimidating due to their inexperience with improvising and/or working with technology. Although inexperience may be a problem, it can be overcome. The author describes techniques and strategies for creating rule-based improvisation environments with live electronics.

Improvisation is a word loaded with sociocultural, political and musical meaning. In Western classical music the term is often bypassed and substituted with "indeterminacy" or "chance music" [1], and the musical structures that these processes generate are given names like "open forms" or "mobile forms." In jazz, improvisation is the norm, although trends within the art form, bebop and free jazz for example, may serve to expand the original meaning. Despite the social weight of the word or the question whether certain improvisations should be labeled *Eurological* or *Afrological* [2], the majority will agree that in all but the most simplistic improvisational situations there is a certain amount of skill required from the musician. These skills are usually ingrained during a musician's early musical development, and their cultivation is part of a constantly evolving musical, cultural and oftentimes academic continuum that can be referred to as a style, performance practice or improvising tradition. Seasoned performers of improvised music are well aware of the stylistic boundaries of their respective improvising traditions: There are rules, and the performer must follow them or consciously disregard them.

The addition of an interactive computer system within an improvisation adds a new layer of musical input and complexity that is foreign to many improvisers. Consummate improvisers and improviser/technician pairs such as George Lewis, Kevin Patton and Seth Paynter, or Evan Parker and Joel Ryan, are more than capable of successfully incorporating the new musical entity. However many performers of "new" music do not come from an improvising tradition, and the addition of the "computer as improviser"

Chapman Welch (composer), Shepherd School of Music, Rice University, 6100 Main Street, Houston, TX 77001, U.S.A. E-mail: <chapman.welch@gmail.com>.

Fig. 1. *Moiré*, notes to the performer. (© Chapman Welch)



may be intimidating due to their inexperience improvising and/or working with technology. Although inexperience is a problem, it can be overcome. Improviser and interactive performer Elizabeth McNutt provides a possible strategy:

> When the terms of a piece are clearly understood by the performer, there is a corresponding increase in interpretive engagement and refinement. With live processing, for example, it is useful for a performer to understand the results of her actions on the processed sound output, so she can navigate these elements as part of her larger job of interpreting the music [3].

In the following examples, I will illustrate a few of the methods that I have used for controlled improvisation with interactive systems. These methods focus on creating rule-based improvisational systems that are both easy enough that performers may learn to use them quickly and nuanced enough to allow for a number of interpretations. Although I have used these techniques in both past and upcoming works, I will only discuss my work *Moiré,* for clarinet soloist, computer and ensemble (2008–2009) as it provides the most salient and comprehensive examples of these methods. The electronics were created using the Max/MSP programming environment [4]. Notes to the performer (Fig. 1) are given to clarify the musical notation. I will use the term improvisation exclusively to describe all elements of indeterminacy.

Moiré, for Clarinet Soloist, Computer and Ensemble

Throughout much of the work, the clarinetist improvises by overblowing through the harmonic series, inserting short outbursts of multiphonic violence and bending notes freely around estimated pitches. Though the clarinetist is improvising with the duration and timbre of these materials, the order is set and the form is not malleable. However, sections I have termed *harmonic/melodic states* are interspersed throughout the work. Within these states, the soloist and the ensemble are given rules with which to improvise using harmonic and melodic materials provided in the score. Although there is a conductor, during these passages, the conductor does not cue events and simply provides a tempo for the instrumentalists that are bound by it. The clarinetist is the only performer who is processed by the computer and may improvise with the materials with no regard to the tempo set by the conductor. The clarinetist also determines the length of sections, as it is up to him or her to decide when the current state is over and when the next section will begin. The first example from the score is found in Fig. 2. The rules for the ensemble during this section are as follows:

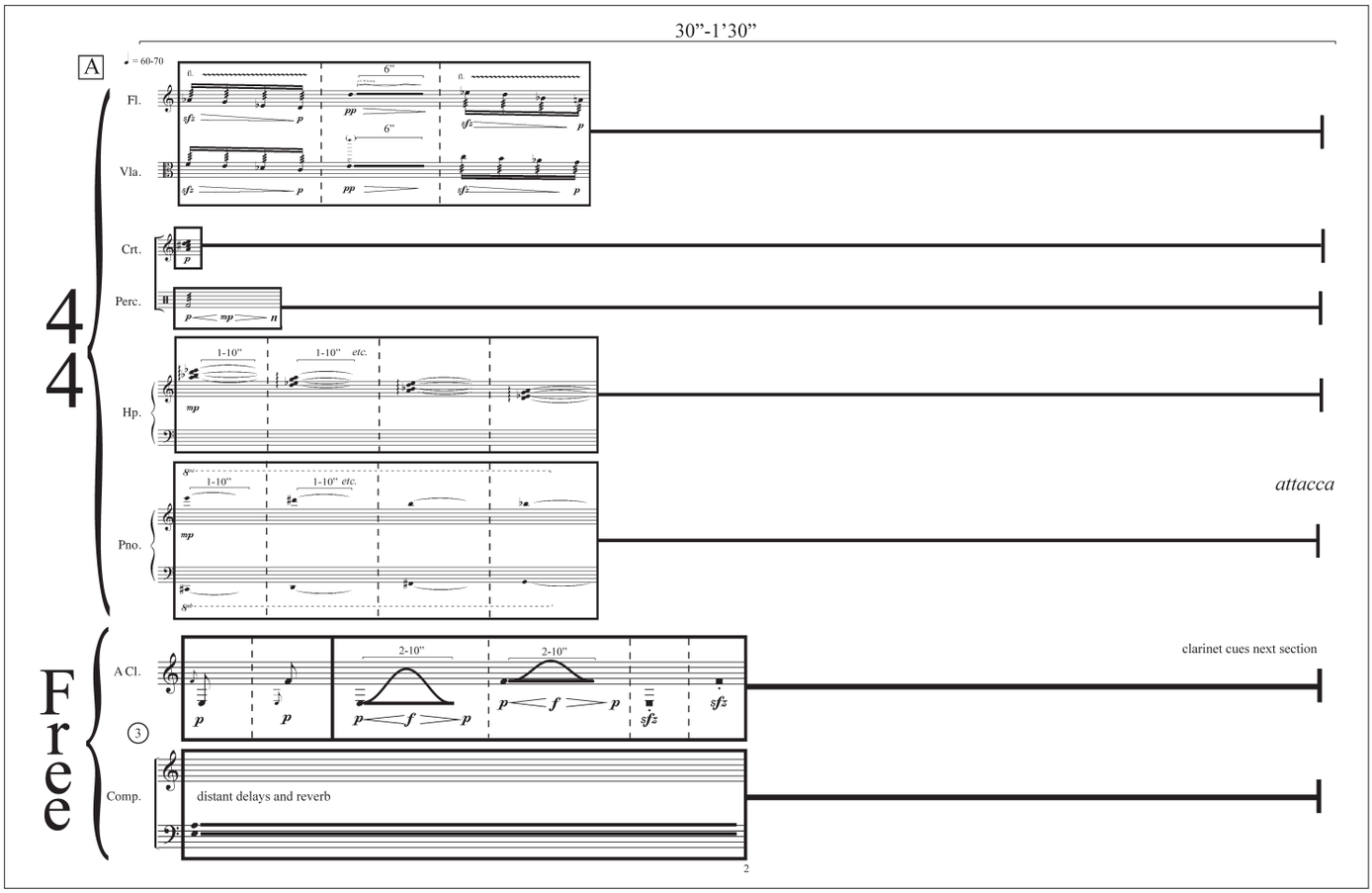
Conductor

The conductor begins the count before or after the clarinetist begins the boxed patterns. The conductor may give density cues (cue to play more gestures) to groups and individual instruments, but they may not cue entrances directly. The clarinetist gives a cue to begin the next section, and the conductor must cue the piano chord slightly before the clarinet begins.

Flute and Viola

Play any of the three boxed gestures on any of the four beats. It is not necessary to

Fig. 2. Excerpt from *Moiré*. (© Chapman Welch)



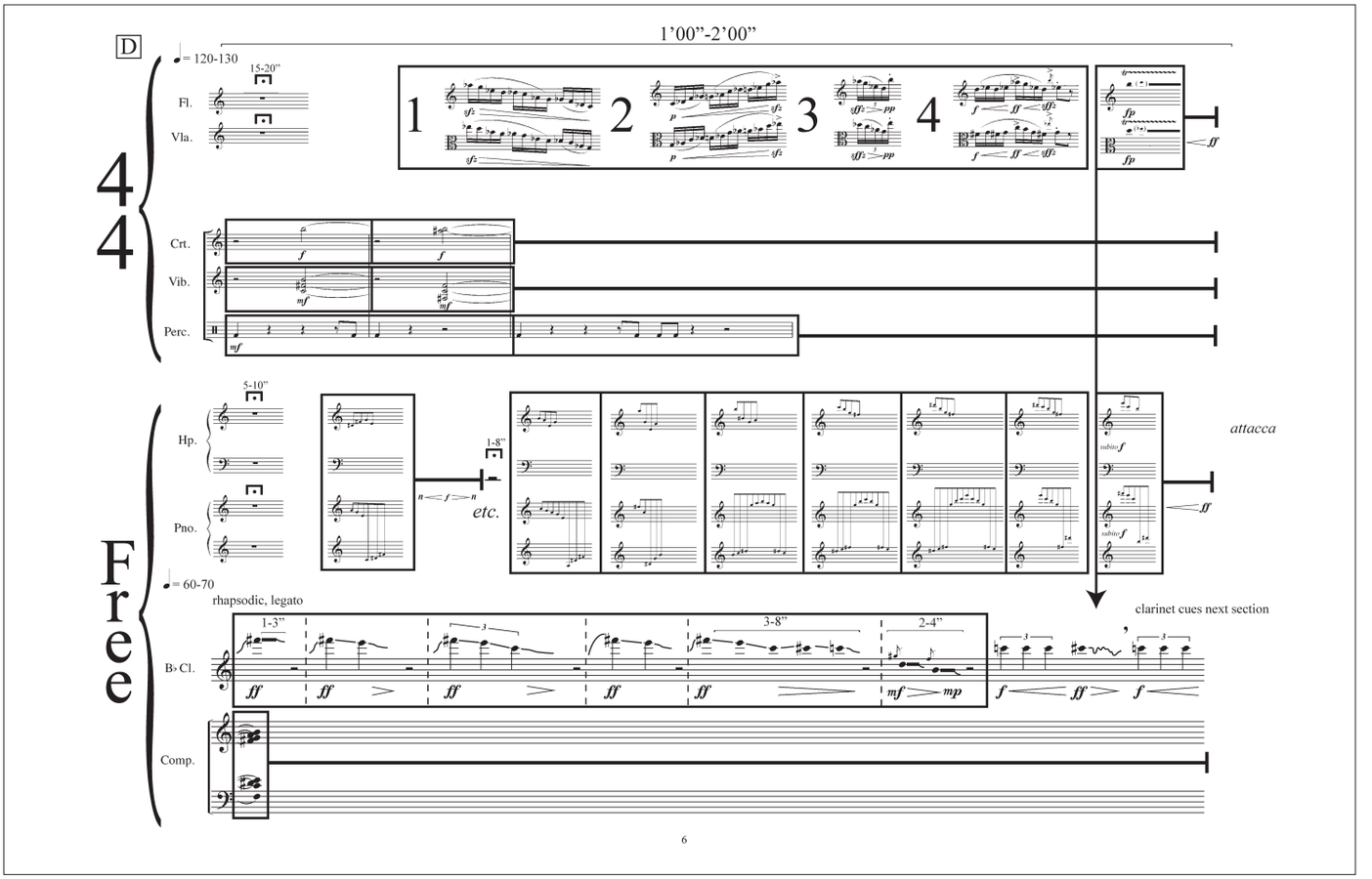


Fig. 3. Excerpt from *Moiré*. (© Chapman Welch)

synchronize which gestures are played. A designated leader cues the entrances for the beginning of gestures. The number (density) of entrances is up to the designated leader. The conductor may give density cues (cue to play more gestures) but does not give entrances. The conductor also cues the end of the page. The end should be as abrupt as possible and should stop even if the current phrase is incomplete.

Percussion

Play the rolled figure or any of the boxed pitches (singly in any register) on any of the four beats. The number (density) of entrances is up to the performer. The conductor may give density cues (cue to play more gestures) but does not give entrances. The conductor also cues the end of the page.

Harp and Piano

Play any of the four boxed gestures on any of the four beats. The number (density) of entrances are up to the performer. The conductor may give density cues (cue to play more gestures), but does not give entrances. The conductor also cues the end of the page.

During this first state, the computer reacts in a variety of ways, depending on which materials the clarinetist chooses to play. For example, when the clarinetist performs the first set of solid boxed materials, this input is routed into a reverb module in which the amplitude of the input controls the intensity of the effect. In contrast, the second set of solid boxed materials triggers short bursts of the soloist's input to be fed into another effects system that yields a dramatic, sputtering response from the computer. As this interaction is not notated in the score, the soloist must learn this behavior during rehearsals with the system. However, since the computer's reactions mirror the musical choices that the soloist makes, the performer is quickly able to learn both the cause and the range of the computer's responses.

Although the computer is not processing the ensemble, the rules guiding their improvisations are inspired by common computer music practices. For instance, since the ensemble's entrances must occur on a conductor's downbeat, they are quantized or synced to the conductor's tempo. The result of this is analogous to a sampler instrument whose events are triggered by certain statistical probabilities. The combination of this temporally rigid "virtual instrument" with the freely improvising clarinet/computer duo yields two unique musical and temporal strata that coexist simultaneously. Although the result of this relationship is complex and unpredictable, the simplicity of the rules allows the soloist and the ensemble to easily start improvising with the materials and with each other.

The second harmonic/melodic state is similar to the previously discussed example, but with a few exceptions. In this section, the conductor supplies the rhythmic grid for only the flute, viola and percussionist, while the pianist, harpist and clarinetist are free from tempo. The clarinetist again decides when the state ends by signaling the conductor with a change in their melodic material. However, after this signal, the conductor cues the ensemble's transitional material and moves the piece forward to the next sec-

tion. The second example from the score is shown in Fig. 3. The rules for the instrumentalists during this section are as follows:

Conductor

The conductor begins the count before or after the clarinetist begins their boxed patterns. The conductor may give density cues (cue to play more gestures) to groups and individual instruments but may not cue entrances directly. The clarinetist gives a cue to begin the next section, and the conductor must cue the final boxed material for the flute, viola, harp and piano during the extended c-sharp glissandi in the clarinet part.

Flute and Viola

Play any of the four boxed gestures on any of the four beats. A designated leader cues the entrances for the beginning of gestures and also cues which gestures are to be played.

The number (density) of entrances is up to the designated leader. The conductor may give density cues (cue to play more gestures) but does not give entrances. The conductor cues the final boxed material during the extended c-sharp glissandi in the clarinet part.

Percussion

Play any of the phrases as written. Phrases may be repeated as many times as desired and may even establish a rhythmic pulse. The number (density) of entrances is up to the performer. The conductor may give density cues (cue to play more gestures) but does not give entrances. The conductor cues the next section.

Harp and Piano

Play the boxed figures in order as instructed (starting from nothing, crescendo, and fade to nothing over 5–15 seconds with 1–8 seconds of rest). A designated leader cues the entrances for the beginning of gestures. The conductor cues the final boxed material during the extended c-sharp glissandi in the clarinet part. This should be played immediately even if the current phrase is incomplete or all boxes have not been played.

The clarinetist plays through the complete boxed melody one time before making new melodies using the dashed boxes as melodic cells for their improvisation. Like the "acoustic sampler" from the previous section, this melodic process also has an electroacoustic origin as the clarinetist's reworking of the melodic material is not unlike live sampling where input is sampled, fragmented and remixed in real time. The computer responds to and accompanies the soloist with a distant, ghost-like doubling of the fragmented yet plaintive clarinet melody. By means of pitch-tracking, certain pitches route the soloist's input into a series of effects systems, creating a synth-like, pulsating ostinato. Once again, the clear relationship between soloist and computer allows the performer to quickly begin improvising with the invisible partner.

As in the first state, the ensemble's rules for improvisation are also inspired by electroacoustic techniques. In this example, the conductor again provides the tempo for the flute, viola and percussionist's virtual sampler. The piano and harp are free from this tempo and serve to reinforce the harmonic material found in the computer accompaniment. Although the computer material is static and drone-like, the harp and piano emerge from the texture in waves of undulating energy before disappearing back into the computer harmony. This yields an effect similar to what would be created if the computer harmony were being processed using granular synthesis. Furthermore, due to the similarities between their materials, the harp and piano sound as if they were actually manipulating the computer material. This relationship creates a sonic environment where it becomes difficult to tell who is affecting whom as all the parts merge into a cohesive and symbiotic musical unit.

Future Work and Closing Remarks

The previous discussion provides an overview of how I have implemented improvisation within a concert music setting. Although *Moiré* represents the culmination of my past experiments, there are a number of projects that I am completing that use these techniques in new ways. For instance, I am currently finishing a piece for erhu, yangqin, bamboo flute and laptop ensemble. As in *Moiré*, there is a conductor who provides a rhythmic grid to which the laptop musicians sync. Instead of triggering samples, the laptop musicians use these rules to choose both the timing and the types of computer processes that are applied to the improvising musicians' input. Unlike in *Moiré*, in some sections the instrumentalists are allowed to improvise freely on written melodies with no instructions or rules. This lack of instruction owes to the performer's expertise in the rich tradition of Chinese melodic ornamentation (*jia hua*). In addition to this work, there is a version of *Moiré* planned in which information about a performer's choices during an improvisation are stored in a database. This data is then analyzed in real time and used to tailor the effects system in a type of feedback loop. When the performer is satisfied with the state of the effects system, they may save these states as presets and reload them in future performances.

As with every improvisation, each performance of *Moiré* is slightly different, even when performed by the same ensemble. With each ensemble's rendition of the work, new insight is gained into both the system of rules and the musical materials themselves. For me as a composer, giving the performer control over the form and execution of the work is both liberating and unnerving, as I am ultimately relying on the intuition of the individual players. Still, for an interactive musician, this is not a new feeling, as the computer algorithms that respond to a performer's input often react in unforeseen ways. However, unlike with the computer, these glitches in the instrumentalists' "programming" are a result of their unique musical sensibilities. As these sensibilities are the culmination of a lifetime of music making, they cannot be understood or predicted by any algorithm that I can program. Rather than seeing this as a weakness in my system, I welcome the unknown, as unpredictability is at the heart of any improvisation.

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3. E. McNutt, "Performing Electroacoustic Music: A Wider View of Interactivity," *Organized Sound* **8**, No. 3 (2003) p. 298.

4. See <cycling74.com/products/maxmspjitter/>.

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Chapman Welch received his D.M.A. in music composition and electronic music from the University of North Texas, where he worked at the Center for Experimental Music and Intermedia (CEMI) from 2001 through 2006. He has taught at Rice University, the University of Houston and the University of North Texas. Currently, he serves as the support specialist for the Rice Electro-Acoustic Music Labs (REMLABS). Welch's music has been presented at numerous festivals in the United States and abroad, including the LaTex festival, June in Buffalo, SPARK, Hawaii International Conference for the Humanities, the Florida Electro-Acoustic Music Festival, ICMC and SEAMUS conferences.