Modeling a Hypermedia Composition/Performance System

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ABSTRACT

A functional model for a hypermedia composition/performance system is explained with examples specific to the presenter's composition, AccidentIisTwo: Sound Projections for Pianist with Computer Music (1992), commissioned by the Monmouou/Meax Piano Plus Electronics Duo and funded by a Faculty Research Grant from the University of North Texas. This paper reports on continuing research and compositional realizations by the author to synchronize and integrate electronic and computer music performance with soloists, ensembles, and other media [Austin 1967, 1968, 1970, 1975, 1982, 1985, 1987, 1991; Clark, 1984, 1989].

1 Introduction

The author's musical work, AccidentIisTwo: Sound Projections for Pianist with Computer Music (1992), scored for electronically amplified/preprocessed piano with pre-processed computer music and performed by a pianist and a sound projectionist, is described as a model for a hypermedia composition/performance system. "Hypermedia", in this prototypical application, is defined as a system in which various forms of information—data, text, graphic notation, and audio—are dynamically linked and interpreted by the performers. AccidentIisTwo can be performed in open, set, or open/set form, the continuity and combination of individual musical events defined and realized in both graphic and sonic terms. The sound colorsation and diffusion of AccidentIisTwo are dynamic—continuing, alternating, contrasting, projecting, and integrating the constantly moving, amplified/preprocessed sound colors of the piano with constantly moving, pre-recorded, pre-processed computer-generated sonic events. The graphic notation, read and interpreted from projected score-slides by both the pianist and the sound projectionist, has its analog in traditional musical notation and in graphic plots representing functions over time and space, involving a special performance protocol, integrating and coordinating the performers' roles in the piece.

2 Performance

2.1 The Medium

AccidentIisTwo is scored for electronically amplified/preprocessed piano with pre-processed computer music, performed by a pianist and a sound projectionist with assistance, in current development, with computer-aided automation.

2.2 Form and Continuity

AccidentIisTwo can be performed in open, set, or open/set form. In open form, the piece begins, continues, and ends at any point in time, its continuity of musical events and their ordering randomly programmed by the performers. In set form, the piece begins and ends at specific points in time, its continuity of events and their ordering empirically programmed by the performers. In open/set form, the performers create a continuity of random and empirically ordered events.

2.3 Pre-processed sonic events

In AccidentIisTwo, the continuity and combination of individual pre-processed sonic events are defined and performed in both graphic and sonic terms. An open, set, or open/set selection from the total collection of 51 graphic events in tablature notation is read by both performers, the 1-4 score-slides(s) for each graphic event successively advanced by the pianist. Each of the total collection of 73 pre-processed sonic events is accessed for playback by the sound projectionist by incrementing or decrementing program number indices for each sonic event on a digital audio tape (DAT) or optionally with a computer, accessing numbered soundfiles stored on disk. Notated graphic events have an open, variable duration ranging from as brief as 20 to as long as 120 seconds and averaging about 40 seconds. Each pre-processed sonic event, of course, has a specific duration, ranging from as short as 10 to as long as 150 seconds and averaging about 30 seconds.

2.4 Accidental sonic events

Piano sounds are produced through accidental rather than deliberate action. The pianist depresses the keys silently so that sound occurs only when a hammer, by accidentally striking a string, the sustaining pedal is fixed with a weight, so that it is constantly engaged, lifting the dampers and allowing the strings to vibrate freely. "Accidental"—accidental sounds—occur, depending on the key action, the pressure applied to the keys (i.e., velocity), and the sensitivity and proximity of three microphones placed strategically above the
strings in close proximity to the dampers/hammers. The dynamic range of the piano sounds can neither be controlled nor predicted. In general, however, this will depend on the strength of the sound of the accidents, the sensitivity of the microphones and electronic sound processors, and, finally, the discretion of the player. Depending on the proximity of the microphones to the piano strings, feedback is probable and should, with reasonable discretion, be exploited by using such electronic artifacts in the processing and movement of the sound. It is, in fact, desirable that the sounds of the "silent" action of depressing the keys be heard as an audible artifact of the piano amplification and sound processing. It will be found that signals, once initiated, can be prolonged and affected by the next accident—and the next, etc. The scored events of the piece should always be played as fast as possible and at the most hazardous pace, making accidents—sounds—highly probable. With successive performance it is possible that the pianist may develop techniques to avoid accidents; this happening, the pianist should counter (sic) such gradually acquired technique by playing faster and with more abandon.

2.5 Sound Coloration and Diffusion

The sound coloration and diffusion of Accidents/Two are dynamic—combining, alternating, contrasting, projecting, and integrating the constantly moving, amplified/processed sound colors of the piano with constantly moving, pre-processed computer-generated sound colors. Processing the piano sounds involves two electronic devices: a multi-effect signal processor (e.g., the Yamaha SPX1000) and a digital delay processor (e.g., the Ikeda DB-80). The resulting processed sound is mixed and moved dynamically in the performance space with the pre-processed, constantly moving computer music stored and played back from DAT or computer. A network of loudspeakers should be placed about the performance space, so that the audience can experience the dynamic movement of the piano sounds and computer music.

3 Notation

3.1 Interpreting the notation

Illustrated in Figure-1 with boxed explanations on the first of two score-slides of event number 36, the notation is read and interpreted by both the pianist and the sound projectionist. The notation has its analog in traditional musical notation and in graphic plots representing functions over time and space. Traditional music notation, for example, involves the tablature notation technique, an analog to the registers and keys of the piano, the stems of notes, and the relative melodic contour of a sequence of designated pitches and their durations. Graphic plots, for
example, involve mapping of excursion of function y (e.g., 5 volts, amplitude) through vectors in a field over a unit of time x (e.g., 20 seconds).

3.2 Notation for the pianist

3.2.1 Score-slices—Each event consists of from 1 to 4 score-slices, the number and order found in bold, 16-point type at the lower left-hand corner of each score-slide; for example, "36-1/2" represents the first of two score-slices of the 36th event.

3.2.2 Time and pitch—The pianist reads each projected score-slide from left to right. The passage of musical time is measured in seconds, relative to spatial extenuity from left to right. The nominal duration of each score-slide ranges from 20 to 39 seconds. Pitch selection is relative to the outline of a piano, keyboard, opened rectangles found at the beginning of distinctive transients in the amplitude plot of the recording of an accident through the course of the score-slide(s) of any particular event. The highest register of the piano is at the top of the slide, the lowest register at the bottom.

3.2.3 Interpretation—The waveform plot seen on each score-slide is to be freely interpreted by the pianist as a graphic tracing of metodic rhythm contour. Pitches are improvised according to the contrapuntal lines and contours that the amplitude excursions of the waveform plot traces and suggests in relation to the keyboard outline. The pianist's right hand is used to play the metodic rhythm contours of the upper half of the waveform plot, the left hand to play the lower half. The pianist is encouraged to be inventive in interpreting this analog of traditional notation. For instance, the waveform plot can suggest a kind of random "wiggling" of the fingers over a random selection of black and white keys or, in contrast, relatively precise interpretation of interval displacement and pitch choice. Precise interpretation suggests interrelatedly distinct metodic line; freer "wiggling" suggests interrelatedly connected lines. Integrating precise playing with less precise "wiggling" yields a higher degree of variety in the improvisation.

3.2.4 Chord-clusters—The solid black rectangles appearing apodically and in diverse registries of the waveform plots are played as free chord-clusters, their range relative to their height. The pianist is encouraged to listen and improvise freely the density of chord-clusters, alternating apodically between playing them as 1) a cluster of all black and/or white keys depressed with the flat of the hand or—with the tallest ones—with the forearm; and others as 2) a cluster of a random collection of black and/or white keys depressed from two to five fingers.

3.3 Notation for the sound projectionist

3.3.1 Score-slices—See item 3.2.1.

3.3.2 Score-slide events—The positive and negative integers seen in bold, 44-point type at the top-right of each keyboard system allow each score-slide number to be incremented or decremented, when an accident occurs during a particular score-slide (see item 4.3).

3.3.3 Pivoted sounds—The positive and negative, real numbers seen in italicized, 14-point type next to the movement arrows on each score-slide represent digital delay values which the sound projectionist assigns during the course of a particular score-slide (see item 4.4).

3.4 Sound diffusion—The bold, arrow-tipped lines found on each score-slide are movement arrows, tracing the direction of movement of the amplified/processed piano sounds through a two-dimensional field as viewed from above the performance space. The movement so indicated in an event on each score-slide begins at the black circled-tip of the first movement arrow. When there is more than one score-slide in an event, the movement is continued on the next slide from the last loci to the new loci is adjusted freely. The speed of the continuous movements of sound through the space is relative to the length and direction of the movement arrow(s). Since each score-slide ranges in performance time from 20 to 30 seconds, the speed of movement is measured by how long it takes to trace the course of the indicated movement arrows. When there is only one movement arrow partially crossing the space, the movement of sound is slow; when there are multiple crossings and/or loopings of the space with continued movement arrows, the movement of sound is rapid.

3.5 Sound processing—The color bars framing the top and bottom of each score-slide indicate the type of signal processing set and invoked during that particular numbered event. The color bars are as follows to the following categories of signal processing: modulation; or, pitch-change; or, distortion; or, compresion; or, expansion; or, light blue; or, dark blue; or, comb filtering; or, orange.

4 Continuity protocol

4.1 Score-slide projection—The slide projector carousel is loaded with the appropriate score-slices and positioned so that both performers can clearly see the projected slides. Ideally, the piano lid should be removed, the keyboard facing the audience with the pianist seated at the piano downstage, further back to the audience. The sound projectionist is positioned with the electronic equipment configuration at the center of the performance space. A large projection screen or white flat is positioned upstage from the piano, directly in front of the pianist, the sound projectionist, and the audience.
4.2 Score-slide incrementing
The score-slides are advanced periodically or spri-
tically in the chosen order. The length of time for
each score-slide seen, before advancing to the next,
is, optionally, a) advanced automatically at a pre-set
rate of 20 seconds per slide or b) advanced at varying
rates from 10 to 40 seconds by the pianist with his/ her
foot, utilizing the remote control device for the
projector, or by an assistant on cue from the pianist.

4.3 DAT sonic event stream
At the beginning of the performance, the DAT is
cued at the first positive Program Number (PNO)
appearing on the first score-slide of the first event, set
on “pause”, ready to play. When the first accident
occurs during that or a subsequent score-slide, the
sound projectionist presses “play” on the DAT,
cauing the currently selected PNO sonic event to
begin its playback. When subsequent accidents
occur, he/she increments or decrements the PNO by
freely choosing one of the numbers appearing on the
current slide, ideally (if audibly discerned) the PNO
determined by when and where an accident occurred
in the course of an event. Upon hearing the next
accident, he/she plays back the newly selected PNO.
Incrementing or decrementing the DAT should take
place just after the computer music of the current
PNO ends in silence. DAT machines which can be
cued quickly to a specific PNO are preferable.

4.4 Delay rate and signal processing
Meanwhile, the sound projectionist is setting the
digital delay values to make changes in every event on
each score-slide. The digital delay values range from
0 to 4 seconds. When a positive number goes above
4, the difference between 4 and the greater number
is added to zero for the new rate. When a negative
number goes below zero, the difference between 0
and the lesser number is added to zero for the new
rate. Also, meanwhile, the sound projectionist is
changing and monitoring the signal processing
prescribed by the color bars of the current event (see
Slates 3.3.5), as well as the amplitude level of the
overall mix of live and pre-processed sound.

5 Performance manifestations

5.1 Current performances
The preview performance in August, 1992 (Darling-
ton, UK), and the premiere performance in June,
1993 (London, UK), of AccidentsTwo have been
successfully presented by the Stephen Montague/ Phillip Mead Piano Plus Electronic Duo. In both the
preview and premiere performances, the pianist and
assistant to advance each score-slide manually. The
sound projectionist required an assistant in the
preview performance to monitor and manually oper-
ate DAT sonic event access and playback; in the
premiere performance the sound projectionist per-
formed all processing, diffusion, and playback manually.

5.2 Future manifestation
The author is currently developing an automated
computer-implemented realization of the Acci-
dentsTwo manual model involving a dynamic, real-
time, interactive computer music performance system
on cd-rom, which will serve both as a real-time
graphic score, an event-controller, and an electronic
processor of live and pre-processed piano sounds.

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