Piano Interactions
for piano and computer
by Robert Hamilton (2003)
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Piano Interactions #1

Interactions #1 attempts to create a subtle soundscape of delicate piano gestures and related computer-processed recorded phrases while allowing the pianist to control the nuances of phrasing and timing with a footpedal soundfile triggering system. The piece should be played with a light and somewhat dreamy air, with the pianist feeling free to extend each phrase as long as he or she wishes. When played with the subsequent pieces Interactions #2 and Interactions #3 the performer should treat the three pieces as related movements of a larger work, starting each subsequent piece while the last soundfile of the previous piece is fading out.

Interactions #1 makes use of a relatively simple pedal-triggering system that allows the pianist to control the entrance and exit points for the associated pre-recorded "tape" part. Each depression of the pedal causes one pre-recorded section to fade in while at the same time fading out in the next pre-recorded section. The recorded material was composed using Max/MSP, Digital Performer, and Peak editing software on an Apple Powerbook computer. The pedal-triggering system was written in Max/MSP and can be triggered either by a standard MIDI footpedal or by a user-defined keystroke on a computer keyboard. In this manner the piece can be performed by a lone pianist with pedal or by a pianist with an assistant cueing each successive computer section.

Duration: approx. 4’

Interactions #2 is structured as a two-voiced canon where each phrase that the pianist performs returns in transposed form. By using computer processing to capture and subsequently play back the initial performance of each phrase, the computer enables a pianist to create rhythmically-complex and harmonically challenging structures without the aid of any other musicians. Like the first piano Interaction in the series (Interactions #1 for piano and triggered-tape), the pianist communicates with the computer by pressing a MIDI triggering pedal. When the computer senses the pedal has been pressed, it begins recording the sound of the piano through a microphone and, if the piece is not right at the beginning, plays back the recording of the previous phrase played by the piano. Additional processing is performed by the computer that causes the recorded sound to be transposed up or down an interval ranging from a perfect octave (12 half-steps) to thirteen half-steps, to fourteen half-steps. The pianist is therefore playing a duet with him or herself, and must be continually conscious about the future impact any dynamic or tempo modulation might have.

Interactions #2 makes use of the number sequence 12, 13, 14, 13, a sequence utilised in determining the length of each phrase and in determining the size of each phrase's transposition. The pedal-triggering system was written in Max/MSP and can be triggered either by a standard MIDI footpedal or by a user-defined keystroke on a computer keyboard. In this manner the piece can be performed by a lone pianist with pedal or by a pianist with an assistant cueing each successive computer section. Additionally, the piece may be performed without computer by two separate pianists (with two pianos) or by one pianist utilizing a pair of MIDI controlled pianos (additional computer patches will be required for the MIDI piano version).

Duration: approx. 1’ 20”

Interactions #1 and #2 are the first compositions in the Interactions Etudes, a series of studies for interactive computer system and instruments, written in conjunction with the Digital Music Interactions project, and sponsored in part by the Johns Hopkins University Center for Educational Resources, the Peabody Conservatory Computer Music Department and the 2003 Johns Hopkins Technology Fellowship program. The Interactions Etudes are a set of 10 studies for instrument and computer system that are designed to introduce musicians to different performance practices for computer music performance. Interactions #1 (piano and computer), Interactions #4-6 (flute and computer), Interactions #7-9 (violin and computer), and Interactions #10 (trio/quartet for piano, flute, violin, and computer). The first study for each instrument (Interactions #1, #4, and #7) all concentrate on the techniques of performance with pre-recorded "tape" or audio tracks, and are available both with static backing tracks as well as with more flexible pedal-driven audio triggering software. For more information regarding the Digital Music Interactions Project, visit http://pcm.peabody.jhu.edu/interactions
Pedal Cue Markers

Interactions #1:  
This marking denotes a cue for the performer or assistant to trigger the next sample, either using a MIDI footpedal or an assigned key on the computer keyboard. There are twenty cues in Interactions #1, the first of which will start the piece and the last of which will end the piece.

Interactions #2:  
Footpedal cue markings in Interactions #2 serve dual purposes: cues triggered at these markings start recording audio input and for each pedal depression after the first, start playing back audio recorded with the previous footpedal depression. For example, when the piece begins, the performer presses the computer footpedal to start recording the piano into the computer. When the performer presses the pedal for the second time (at the start of measure 13), the computer stops recording the first sample, starts playing back the first sample, and begins recording the second sample. This pattern continues until the piece is finished and the last recording stops of its own accord.

Duration Cues

At the beginning of Interactions #1, the initial foot-pedal trigger starts the first soundfile playing before the piano enters. This durational marker of 18 seconds tells the pianist to enter after approximately 18 seconds have elapsed since the triggering of the first soundfile.

Boxed Waveform Notation

The audio waveform enclosed in a box corresponds to the introduction in the piece of a low-indeterminate frequency waveform, generated through the combination of discrete samples from piano wave forms slowed down and processed to create a thick sonorous cloud. The arrow extending to the right away from the box approximates the duration of the sounding waveform as it is played by the computer.
Performance Notes (continued)

Computer Box Notation

The use of a box surrounding a brief notated figure in the third computer staff of Interactions #1 implies that a figure similar to the notated figure (a randomized version of the general pitches defined within the box) will be voiced by the computer. The arrow extending to the right away from the box implies that the randomized figure will continue for the approximate duration of the length of the arrow in the score.

Computer Score Notation

The canonic line played by the computer is represented in the Interactions #2 score as a greyed-out piano staff system. All the notes output by the computer are notated traditionally in the score, taking account of the 12, 13, 14, and 13 half-step transpositions created by the computer software. Performers should use the computer staves to line up phrases in the piano part with the canonic-echo being played by the computer. As timing is very important in Interactions #2, great care should be taken to respect the relationship between the computer voice and the live piano voice. Performers should also note that dynamics and some articulations are not included in the computer staves. Since the computer voice is a reflection of the live piano performance, all dynamic and articulations performed by the pianist will be mimicked in the computer performance exactly.
Piano Interactions #1 and #2 make use of a number of hardware devices to create an interaction between the piano and the computer. The diagram at the right gives a general outline of the components necessary to perform these pieces. A more detailed description can be found below, as well as on the Digital Music Interactions website.

Piano Interaction #1

The first of the Interactions etudes uses a MIDI footpedal to send messages to the computer. When a message is received, the computer will start playing a sound file and if a sound file is currently playing, stop that file from playing. A MIDI footpedal can be connected to the computer using a number of methods, most commonly by using a MIDI interface which will convert the signal from the pedal into a MIDI message, and send that message onwards to the computer. If the MIDI interface being used does not support footpedals, a MIDI controller such as a digital keyboard which does support footpedals may be connected to the footpedal and then connected to the MIDI interface. Sound generated from the computer system must be sent to a stereo pair of speakers, connected to an amplifier or with their own source of power.

Piano Interaction #2

Interactions #2 requires the same footpedal and speaker configurations as Interactions #1. In addition, the second piano Interaction requires a single mono microphone to be connected to the computer. The microphone can be connected to any number of external audio input interfaces or to the computer's internal soundcard if it is of sufficient quality. The microphone should be positioned in such a way that it minimizes the amount of "bleed" from the output of the speakers, while at the same time, maximizes the tone and strength of the piano's sound. Steps should be taken so that the sound of the piano is not distorted by having the input level set too loud.

System Requirements

- Apple G3, G4, or G5 computer with OS 9 or OS X
- Intel-based PC with Windows 2000 or XP
- A processor of at least 867 Mhz (Apple) and 1.5 Gb (PC) is recommended.
- At least 512 mb of RAM is recommended, especially for Piano Interactions #2
allow computer to fade completely \textit{a tempo}
34

mp poco accel. poco rit. mf

a tempo

35

mp poco accel. rit. mf

38

let ring

39

pp

p
II.

Piano

Briskly \( \frac{d}{1} \) 200 \( \text{f} \)

Computer

start recording into buffer...

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Data and Audio CD

For more information regarding the Digital Music Interactions Project or any of the Interactions Etudes, visit the project homepage on the internet at:

http://pcm.peabody.jhu.edu/interactions

or visit the composer's home page at:

http://www.roberthamilton.org