Counterlines: a Duet for Piano and Pen Display

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Abstract

This paper describes three introductory studies for an intermedia performance *Counterlines* - a duet for Disklavier and Wacom Cintiq, in which both performers generate audiovisual materials that relate to each other contrapuntally. In the described studies the pianist generates graphic lines while playing music and the graphic performer generates piano lines by drawing. To reinforce the clarity of relationships between visual contours all graphic elements are projected on a single screen. The paper discusses our approach to audio-visual interfacing and intermedia composition.

Keywords

Intermedia, Disklavier, Wacom Cintiq, mapping, visual music, sound-image relationships, interactive art, audiovisual performance

ACM Classification Keywords

J.5 Arts and humanities: Performing arts (e.g., dance, music). H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces.

General Terms

Performance, Experimentation.

Introduction

The essence of intermedia lies in the prefix 'inter'. According to the Fluxus founder Dick Higgins, what

defines intermedia works is that they fall conceptually between media [6]. *Counterlines* is an intermedia performance work built on the interactions between live music and real-time visuals. It uses Yamaha Disklavier piano, Wacom Cintiq 21UX and Mac 2 x 2.8 GHz Quad-Core Intel Xeon with patches programmed in Max/MSP/Jitter (see figure 1). It is a duet for a pianist and a graphic artist each of whom performs dual content in counterpoint to the other (see figure 2). So far, as part of the development process some studies have been produced and performed in two concerts. In describing them, this paper focuses on the issue of interfacing visual and musical elements.
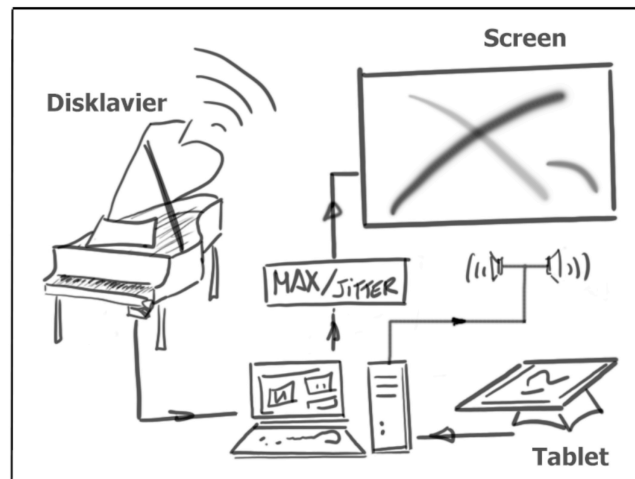

figure 1. Counterlines System description.

Musical counterpoint is popularly defined as two or more melodic lines that are independent in contour and rhythm but interdependent in harmony [1]. Our project seeks to simultaneously employ visual, musical and intermodal counterpoint. To reinforce the clarity of

relationships between visual contours all graphic elements are projected on a single screen. To provide a similar unified canvas for music all sounds, including those generated by the tablet use the piano timbre.
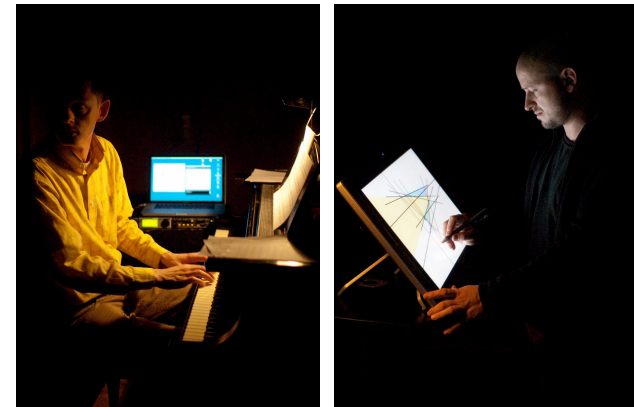

(a)   (b)

figure 2. Snapshots during a performance. (a) Piano performer (b) graphic performer.

We not only found this equilibrium necessary to serve the needs of performance clarity or contrapuntal development but also as a potentially most idiomatic characteristic of intermedia in general. In this paper we report on the most effective correspondences that served us to link elements from both domains.

Related Work

The emphasis on audiovisual coherence led us to draw on research related to mapping images to sound. Many artists and researchers have made visualization attempts capturing different aspects of music. Some approaches try to establish a mathematical or geometric analogy between visual space and pitch relationships [5]. The creation of analysis tools to

capture the structure of a melodic theme or patterns of form can be found in *Music animation machine* [11] and others [4,7]. Some researchers try to extract the harmonic structure and relationships between key regions in a musical composition [14]. The relationship between music and color has also been studied [16]. Numerous approaches were developed with the intention to capture and visualize musical expression [3,12,13,17]. This included the use of virtual objects or characters [2]. Many new interfaces were developed using visualization principles [8,9,10,15]. Having studied these examples and others we concluded that our approach could use selected elements of mapping to establish an audiovisual causality but no attempt would be made to consistently represent any aspect of music. In our project audiovisual coherence is only a tool needed to establish performance believability but it is not the conceptual or expressive focus.

Counterlines duet

Most musical studies are characterized by an expansive use of a strictly defined, limited, often simple musical idea or performance technique. Some of the best examples of piano etudes by composers like Chopin, Debussy or Ligeti prove that this approach can be extremely fruitful. In our view the clear presence of a live performer does not have to be based on virtuosity defined as a large number of notes executed in a short time. The refined and skillfully controlled timing and articulation of simple elements was to us even more desirable as long as it showed potential for interesting intermedia elaboration.

The melodic and graphic lines seemed to fulfill this requirement. We will begin by shortly describing aural and visual materials by medium then proceed to the

intermedia entities, as they were composed within the three studies.

Melodic Lines
The basic expressive unit of melody is an interval of two notes. These can be considered as basic melodic vectors or lines. We decided to compose the studies using rhythms or melodic structures that would emphasize two-note groupings. Using MIDI a two-note motive can be represented by two events of given pitch, velocity and timing. The time, attack velocity, direction and the interval between events can be measured and used as input. Additional expressive potential of intervals seems to come from harmony or the relationship to a tonal center. For this reason we decided also to allow occasional presence of notes, which did not have to be interfaced with graphics .

Graphic Lines
In geometry the fundamental element analogous to a melodic interval is a line. It is constructed with two end points with a defined X and Y positions, distance and orientation. Such simple data can easily be tracked by Max/MSP/Jitter when drawn on a Wacom Cintiq. The added advantage was that from the computational point of view lines could be efficiently generated in real-time within the Jitter visual programming environment. A lot of effort was put in making the lines appear analog or hand-drawn but for lack of space it will not be further discussed in this paper. Background graphic elements were considered acceptable in the same way and for the same reasons as the background notes.

Interfacing Graphic and Melodic Lines
A central element of our research was the interfacing of graphic and melodic lines to create expressively

engaging and audio-visually coherent entities and composition. Since we are accustomed neither to seeing a piano generate imagery nor to hearing drawings generate sound this kind of linking or causality had to be established anew. As mentioned earlier, for that purpose certain elements of mapping seemed to be useful. Quasi-synaesthetic correspondences were applied to varying selected parameters while preserving the independence of the remaining ones.
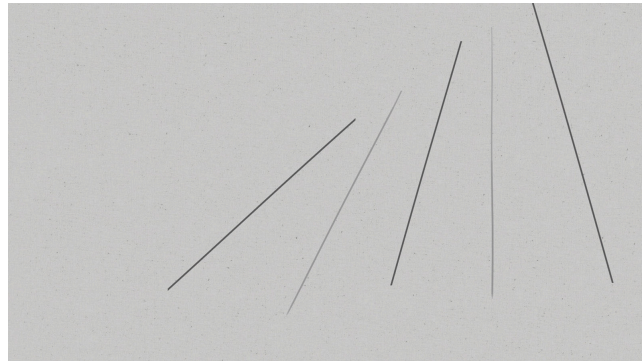

figure 3. *Counterlines.* Still frame from Study 1.

The three studies were based on a principle that one melodic interval generated one graphic line and vice versa. The basic approach to interfacing sounds and images is synchronicity. In our case the two participating elements did not always start together nor were of equal duration. It seemed to us that even if they profited from happening in temporal proximity and from overlapping, the coherence can be given also through the sense of a cause and effect relationship, which can be perceived even when one modality precedes a reaction in the other modality.

Intermedia linking can be observed and composed on various formal levels. Depending on artistic need it can manifest itself in a short audio-visual motive or as a much larger phrase or section. The detailed description of individual studies that follows will show examples of varying approaches to linking formal levels as well as parameters.

Different sets of audio-visual correspondences dominate in each of the studies and change even within single ones. In the first section of Study 1 melodic intervals get gradually smaller and softer. This is paralleled by the gradual counter-clockwise change in orientation from vertical to horizontal and shortening length of consecutive graphic lines. In the second section the size of intervals remains static but they get louder and move steadily higher. The graphic lines match it with new lines appearing at a steady distance while gradually getting longer (figure 3). The main rules of the third section are a reprise of the first but in a variant – extra layer of melodic intervals is played by the piano, which is reflected by graphic lines now allowed to cross each other. The fourth section brings back musical material from the second section but with irregular transpositions in register. These skips are linked with irregular distances between the graphic lines, which are now all horizontal.

The premise of Study 2 is to link the expression of groups of lines rather then single ones. The melodic material is based on permutations of very few notes within a very limited range. The graphic lines are also limited in number and are drawn to form a rotating but single geometric figure of a triangle (figure 4). At a central stage six held melodic notes are matched in number with a structure of six graphic lines. As the

study progresses some of the new notes are held while the older ones released. This is paralleled in the graphic structure by older lines disappearing as new ones are drawn. When fewer piano notes are held fewer graphic lines remain.

figure 4. *Counterlines.* Still frame from Study 2.

The visual language of Study 3 is limited to vertical and horizontal lines appearing either very fast or very slowly (figure 5). Musically it consists only of major tenths appearing either melodically or as a repeated dyad.

On the tablet side all lines and musical motives are fast. Every vertical line generates a staccato melodic interval while every horizontal line triggers a fast repeated dyad. The up-or-down direction of the interval is dependent on the up-or-down direction of drawing. The pianist also plays major tenths but both his musical and graphic lines appear very slowly. When the pitch material for both performers matches harmonically, the graphic lines generated by the pianist cross the ones drawn on the tablet.
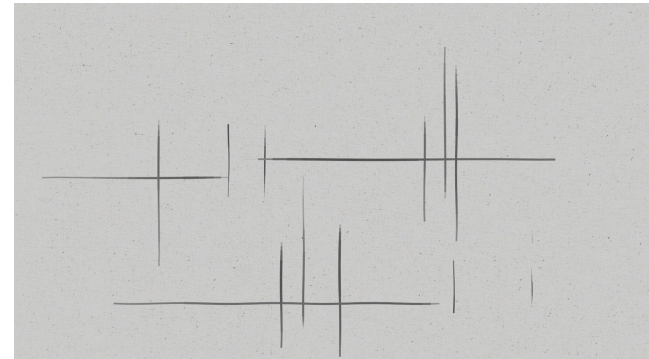

figure 5. *Counterlines.* Still frame from Study 3

Conclusions

Counterlines is a work, in which two performers generate sounds and images but one from musical, the other from a graphical input. Our need to clearly perceive who at any point was in control of the audio-visual material led us to the use of audio-visual mapping. As we tried a variety of strategies we found that using linear mapping of parameters, even if conceptually logical was not very expressive and did not hold interest for a long periods of time. Reductionist by necessity, fixed and strict use of mapping better serves the purpose of analysis than creation. We opted instead for correlating relative changes in parameters and for frequent shifting of interfacing rules. This allowed us to be less predictable and gave more expressive freedom to individual layers as well as more creative freedom to the composition as a whole.

In this spirit, we saw *Counterlines* as a system that allows flexible performance of composed sequences with only limited elements of improvisation. The use of pre-composed elements was not a creative limitation. To the contrary, because any sensing of live input by

the computer results in a reduction, a 'direct' output into the other dimension is impoverished without some process of enrichment or pre-composition. The triggered composed elements could have the refinement and expressive precision that satisfied our artistic needs. We strongly believe that even composed materials have space for spontaneity and expressive freedom.

References

[1] "Counterpoint", retrieved January 2009. URL http://en.wikipedia.org/wiki/Counterpoint

[2] Farbood, M. M. and Pasztor, E. "Hyperscore: A Graphical Sketchpad for Novice Composers", *in IEEE Computer Graphics and Applications*, Jan-Feb 2004, Volume 24, Issue 1, pp. 50-54

[3] Friberg, A., Schoonderwaldt, E., Juslin P.N., Bresin R. "Automatic real-time extraction of musical expression", *in Proc. of the International Computer Music Conference-ICMC*, 2002, pp.365-367

[4] Foote J. and Cooper, M. "Visualizing musical structure and rhythm via self-similarity" *in Proc. International Computer Music Conference*-ICMC, 2001.

[5] Hall, R.W. "Geometrical Music Theory", in *Science*, April 2008, Vol 320, pp. 328-329,

[6] Higgins, D. "Synesthesia and Intersenses: Intermedia", *Something Else Newsletter* 1, No. 1, Something Else Press, 1966.

[7] Isaacso, E. "What you See Is What You Get: on Visualizing Music", in *Proc. of the 6th International Conference on Music Information Retrieval, ISMIR*,, 2005.

[8] Levin, G. "Painterly Interfaces for Audiovisual Performance. Thesis", *M.S. Thesis*, MIT Media Laboratory, August 2000.

[9] Levin,G., Lieberman, Z. "Sounds from shapes: audiovisual performance with hand silhouette contours in the manual input sessions" *in Proc. of the conference on New interfaces for Musical Expression-NIME*, 2005.

[10] Levin,G. "The Table is The Score: An Augmented-Reality Interface for Real-Time, Tangible, Spectrographic Performance", *in Proceedings of the International Conference on Computer Music-ICMC*, 2006.

[11] Malinowski, S. "Music animation machine", 2005. URL http://www.musanim.com

[12] Poast, M. "Color Music: Visual Color Notation for Musical Expression", *in Leonardo*, June 2000, 33(3) pp. 215-221

[13] Rovan, J.,Wanderley, M. ,Dubnov, S. "Instrumental gestural mapping strategies as expressivity determinants in computer music performance", *in Proceedings of the Associazione di Informatica Musicale Italiana Workshop*, 1997, pp.68-73.

[14] Sapp, C, "Harmonic Visualizations of Tonal Music" *in Proceedings of the International Computer Music Conference*-ICMC, 2001, pp. 423-430

[15] Solis, H. "Improvisatory Music and Painting Interface", *Master Thesis*, MIT**,** 2004

[16] Smith, S.M. Williams, G.N.. "A visualization of music" *in Proceedings of IEEE Visualization*, 2007.

[17] Taylor, R., Torres, D. "Using Music to Interact with a Virtual Character" *In Proceedings of the 2005 International Conference on New Interfaces for Musical Expression-NIME*, 2005, pp. 220-223