Two Compositions for Interactive Dance

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Abstract
In traditional dance performances, dancers are expected to synchronize their movements to a fixed musical work. A rule-based interactive composition with a dancer as a performer allows the dancer to control musical processes within the composition. This paper describes two compositions involving interactive dance created by the author as part of the Digital Dance research project conducted at DIEM 1995 - 1998.

1 Background
The Digital Dance project [1] was a research project conducted at DIEM involving hardware and software development, as well as the creation and performance of works for interactive dance. The goal of the project was to create a computer music composition that allows a dancer to directly influence musical processes in a meaningful way. Our work included 1) developing an interface for detecting a dancer’s movements, 2) mapping these movements to musical parameters, 3) defining the roles of the artists involved and 4) creating a software composition for interactive dance.

2 Aesthetic considerations
Motion can be mapped to music or sound in many ways. [2] We found that simple mappings tend to be immediately understood by the observer but trivial, whereas the apparent relationship between movement and sound is lost when complex mappings are used. An artistically viable balance had to be found. The roles of the composer, choreographer and dancer needed to be defined. The composer constructed the musical form and structure that was the basis for a composition. The choreographer established the form and structure of movement. The dancer was responsible for realizing the choreographer’s visual ideas as well as the composer’s musical ideas.

These aesthetic issues were addressed in two very different ways in the two compositions for interactive dance discussed here, although both works utilize the same technology. Both works employ the DIEM Digital Dance system developed by Wayne Siegel and Jens Jacobsen. The system uses bending sensors worn by the dancer to measure angles of the dancer’s limbs. This data is sent to a receiver unit via a wireless transmitter worn by the dancer. Software for both works was written by the author using the MAX programming environment. In both cases the software interprets the incoming data to allow the dancer’s movements to control and influence the music.

Yet the musical ideas and working processes used in the two works are quite different. The first piece, Movement Study, was created as a rule-based composition first. This software composition was then interpreted by various choreographers in different ways, in compliance with a few very general ideas about how the music should sound in various sections. These ground rules provided a framework for the choreographic interpretation without limiting the choreographer to specific dance movements. In fact the various choreographic interpretations were all quite different, although the musical composition and structure is immediately recognizable from performance to performance.

![Pernille Fynne performing with the DIEM Digital Dance Interface.](image)

In the case of Sisters, the situation was reversed. Here the choreographer was asked to create a work without taking the music composition or dance interface into consideration. An initial choreographic sketch was created and rehearsed by the dancers before they began working with the
Digital Dance interfaces. A software composition was created to accompany the choreography.

In both works, the choreography as well as the music were altered and adapted during the rehearsal process in an effort to create an integrated work. It was apparent in this process that the dancer takes on a unique role in performing a work for interactive dance, since the realization of both the composition and choreography depend on the same performer(s).

3 Movement Study

The first sketch of this piece was composed in collaboration with the choreographer Warren Spears and presented at a workshop organized by DIEM and Nyt Dansk Danseteter in Copenhagen in 1996. A new version was developed with choreographer and dancer Helen Saunders. This work was further developed by dancer Perimille Fynne and performed at ICMC97 Thessaloniki. The composition software uses the sensor data to generate MIDI notes, patch changes and controller values to control two outboard synthesizers: a Proteus and a Morpheus.

The work falls into four sections that are performed without pause. In the first section, changes in angles of the ankles, knees, elbows and index fingers are mapped directly to amplitude and spectrum of eight independent long drone notes, one for each of the eight limbs. When an elbow is for example bent to its minimum angle or "closed", no tone is heard. As it is opened (angle increased) the tone becomes louder and brighter and then softer and darker as it is closed again. If a limb is closed completely, a new note event is triggered and a new pitch and timbre chosen by the computer program the next time the limb is opened.

The harmonic structure is determined by a set of compositional rules. There are seven subsections consisting of seven different harmonic structures or chords. In any one subsection each voice has a limited number of possible pitches that might be chosen in that subsection according to a set of pre-defined probabilities for each of these pitches occurring. The choices made by the composition software are tightly controlled random choices. On the one hand no one can predict exactly which pitches will be played at any given moment within a particular subsection, on the other hand it is certain that the pitches chosen will lie within the harmonic structure for that subsection.

The seven harmonic structures cannot be influenced by the dancer. The dancer can however influence the speed at which the piece progresses through the seven subsections before finally reaching the second section. Movement from one subsection to the next is based on the number of new note events triggered by the dancer. The more often the dancer's limbs are placed in the closed position, the faster the program moves to the next subsection. If limbs are never completely closed, the computer will remain within the current subsection allowing the dancer to manipulate volume and brightness only of pitches contained in this subsection. It is, for example, possible for the voice associated with the right index finger to remain in subsection 1, while the left knee is in subsection 2 and the right ankle in subsection 5. This would mean that the pitches chosen by these various voices would not lie within a single harmonic structure. This "incongruity" might be corrected by software in the course of the performance. If the limb of a voice that has fallen behind is finally closed, the software will skip to the highest section currently being used by any other voice. Or, in the example above, the next time the right index finger is closed it will skip ahead to section 5, the section that the right ankle has already reached.

The first section of Movement Study gives the dancer direct control of two very perceptible parameters: volume and brightness. But the dancer does not make choices related to melody, harmony or rhythm. This allows for a certain degree of expressive control of the music without restricting the performer's freedom of movement or demanding excessive concentration on instrumental performance.

In the second section, the angular velocity of knees, elbows and index fingers are mapped to activity of eight voices in a contrapuntal texture of pluck-like sounds. Limb position is sampled every 80 ms. The greater the difference between the present angle and the previous angle, the greater the activity. The computer generates random rhythms in which the number of notes played by each of the eight voices is directly related to the activity of the associated limb. The choice of harmonic material is related to the technique used in the first section. This section serves as a transition between the first and third sections.

In the third section activity of knees, elbows and index fingers are mapped to activity in a pulse-based six-voice contrapuntal texture. Six polyphonic percussive voices are controlled by the knees, elbows and index fingers (angles of ankles are not used for this section). A fixed, regular pulse is set by the computer, and the six voices are always rhythmically synchronized. A 10/8 meter is implied in the software with pitch probabilities for all voices defined for each of the 10 beats as well as pitch probabilities for sixteenth notes which can occur between the eight note beats. Pitch choices
are made on the fly by the computer program according to the composition algorithm.

The dancer controls only the activity of each of the six voices, not the musical material to be played. The more the dancer moves, the more notes will be filled into the implied 16th note matrix. If the dancer stops moving, probabilities drop to zero and no notes are played: the music stops immediately. The tempo is fixed, but can be influenced slightly by the dancer: increased overall activity (average activity of all six limbs) increases the tempo slightly.

The fourth section is similar in construction to the first section, although the tonal material used in the two sections is different. The other main difference is that in some of the subsections of this section, the angles of each joint controls pitch bend as well as volume and brightness for the associated drone. This allows the intonation to change for each voice separately (+/- a quarter tone).

The transition between the first slow section and the second random rhythmic section consists of an overlap. The eight separate voices change sections independently, so that the left elbow might start section two while the right elbow is still in section one. A fade function is built into the software, so that all of the drone voices of section one finally fade out slowly once section two is underway. The transition from section two to section three is similarly an overlap, while the transition from section three to section four is abrupt. When the dancer moves into a certain position on the stage, section three stops with a loud gong-like sound and section four fades in. This is the only event triggered by a computer operator in the work. All the other processes are initialized by the software as a result of the dancer's movement.

An essential idea in Movement Study is that the dancer is able to influence musical processes and not simply trigger sequences and events. Since the compositional program and Digital Dance system were developed first, the task of the choreographer was to experiment with the hardware and software to get acquainted with the system and then begin to develop a choreographic idea that could integrate an artistically viable choreography with the movements necessary to control the music. The dancer must also be given a certain amount of freedom if she is to be able to react to the music and directly influence the music. Although the system has been used by choreographer/dancer teams, it seems that the best results can be achieved when the dancer and choreographer are one and the same person. This allows the choreographer to try out the system in a "hands on" situation to gain a better understanding of how various movements influence the music. Through the process of direct experimentation a fixed choreographic form and structure could be developed. The choreographer thus created a choreographic study within the framework of movement dictated by the hardware and software. The dancer is placed in an entirely new situation, with the responsibility of interpreting both musical and choreographic ideas and integrating them into a single work.

4 Sisters

The choreography for Sisters was created by Marie Brolin-Tani first, and the music was created by the author to fit the choreography. The work was premiered as a work in progress at an open house presented by the Marie Brolin-Tani Dance Theatre in November 1998. The dancers were Pernille Fynne and Sophie Konning. Marie Brolin-Tani's idea for the choreography was a work based on the life of the Mexican artist Frida Kahlo. The two dancers represent two aspects of the artist, which might be described as the contrast between the masculine and the feminine, or between physical beauty and a sick and fragile body dependent on "machines" to keep it alive. One of the costumes is inspired by the corsette worn by Frida Kahlo, and the wires of the interface are exaggerated and made visible to the audience. The other costume is more feminine and the interface is hidden. The composer's task was to create software that would produce sounds to accompany the choreography. When rehearsals began, both the music and the choreography were gradually developed and changed.

Pernille Fynne and Sophie Konning performing Sisters

The music composition was created for two dancers and interactive computer music system. Both dancers wear a Dlmen Digital Dance Interface. The technical setup consists of a Macintosh G3 computer with a Digidesign ProTools Project sound
5 Conclusion

The two works described were created under different circumstances and with different artistic goals. In both cases the author found that allowing dancers to control a musical composition opens for new possibilities of precise synchronization between dance and music. In working with interactive dance it became clear that the dancer must not be treated as an instrumental performer. Dancers are usually not musicians trained to interpret a musical work. It is important that the hardware and software allow the dancer to do what a dancer’s do best: dance! For an instrumentalist, physical movement is a means of controlling an instrument. For a dancer, movement is a mode of expression in itself.

All the dancers I have worked with were immediately enthusiastic when given an opportunity to control the music. Despite technical difficulties and the drawbacks of having to wear sensors and transmitters, they found that interactive dance opened a new and inspiring realm.

References

