HyperSense Complex: An Interactive Ensemble

Alistair Riddell
Centre for New Media Arts
The Australian National University
Canberra, 0200
Australia

alistair.riddell@anu.edu.au

Abstract

HyperSense Complex (HC) (Somaya Langley, Simon Burton and Alistair Riddell) is an ensemble bound together as much by performer awareness as by its networked technology implementation. This configuration creates a unique, singular and expansive performance relationship that has been explored through more than 20 performances from its inception in 2003. This essay describes some of the technical and conceptual framework under which, the ensemble operates, performs, creates new works and considers what the future might be in such a performance context.

Introduction

Interactive computer music is now something widely practiced; performing with other humans that are performing with a computer is less so. Certainly not an entirely a rare occurrence, but suppose that the performers share the same computational space? That they make the same or near similar performance gestures; that the performance is dominated by the performer's physical presence, not the display of the technological and, that the performers respond to and influence each other as well as the totality of their performance sound? This is perhaps less common in digital music performance. Such an ensemble experience is probably more familiar to traditional instrumentalists as it is as much apart of the learning experience of the instrument as it is dependent on the maturity and history of traditional instrumental practice. However, in the digital music context, where instrument construction is likely to be as new as the creative vision itself, the entire experience is very different.

So while it is understood and accepted that performance actions in experimental digital musical systems entail certain gestures of the fingers, hands and body that are unconventional, collaborative group dynamics are far from understood in practice. By the term "group dynamics" I mean those moments when it is realized that something, like the sound, eye contact or audience reaction, is giving a signal that a point of collective aesthetic agreement has been reached. Nothing more need be said and the moment is gone. It is an obvious and significant instant in an otherwise exploratory time and space marked by individual maneuverings. These moments are not all that frequent for HC, often seemingly timeless but illusive, and I wonder how obvious they are to the audience.

HC differs from other glove/hand based sensor projects of the 1990's by being first and foremost an ensemble. Not simply because there are 3 performers but being ingrained in the creative process that brought the technology into existence, is the role each of us plays in the development of new performance ideas. While others, exploring similar hand based performance systems, pursued singular artistic statements in their performances, the members of HC negotiate creative positions within a performance space defined by the context, time and composed/programmed material. While obviously collaborative in nature, underlying each performance are formal structures defined in the software that manages each performer's data. In addition, as will be described in more detail later in the essay, the performers can often affect each other's sound. The potential for this to happen creates the necessity of watching each other.

Context plays a big part in performance. Viewed from the outside, Manovich's observation in 1995 gives some indication as to the external perception of such a performance:

> Under the black hemispherical ceiling with mandatory models of planets and stars, a young artist methodically paints an abstract painting. Probably trained in the same classical style as I had been, he is no Pollock; cautiously and systematically, he makes careful brushstrokes on the canvas in front of him. On his hand he wears a Nintendo Dataglove, which in 1995 is common media object in the West but a rare sight in St. Petersburg. The Dataglove transmits the moments of his hand to a small electronic synthesizer, assembled in the laboratory of some Moscow institute. The music from the synthesizer serves as an accompaniment to two dancers, a male and a female. Dressed Isadora Duncan—like clothing, they improvise a

> "modern dance" in front of an older and, apparently, completely puzzled audience. Classical art, abstraction, and a Nintendo Dataglove; electronic music and early twentieth-century modernism; discussions of virtual reality (VR) in the planetarium of a classical city that, like Venice, is obsessed with its past—what for me, coming from the West, are incompatible historical and conceptual layers are composited together, with the Nintendo Dataglove being just one layer in the mix. (Manovich 2001:5)

It is interesting how Manovich's observations take in the inner space, the artists and the broader locus as a means to illuminate the historical contradictions, incompatibilities and high Art sensibility conflicts, to build the impression that being there was a worthwhile and intriguing experience. It seems an implicit consequence of experimental projects that the artistic result is often less important than the successful presentation of the concept. Having the technology work without apparent problems also constitutes a measure of success in the totality of experience, certainly for the artist.

It was our experience also, that context had a decided but unpredictable influence on performance and audience; yet few people ever seemed in agreement when it came to determining what constituted those favorable or unfavorable conditions.

Historical Precedents

The inspiration for the use of the sensors on the hands in musical performance came from an experimental position along with a limited technical understanding of those historical precedents described below and which might also include the work of Michael Waisvisz who placed the hands in a new space for performance during the 90's thus making the statement that the gesture potential of the hands was far from exploited.

I for one had seen the Mattel PowerGlove[1] used in a performance at CB's 313 Gallery in Manhattan's Bowery district in 1993. As a contributing performer to the event, I found my colleague's (a student from the Computer Music Centre at Columbia University) use of the Glove both a technically and aesthetically interesting achievement for the time. The surmounting of functional problems just prior to the performance probably added to the experience. Connected to a NeXT cube[2], the glove controlled synthesis processes and was seen as an exciting new direction in performance control even though its potential was nowhere near fully understood let alone realized. In such experimental events, we often experience the sense of a latent potential in the concept rather than a definitive statement in the work itself.

Around the same time as the Russian experience, in Australia Gordon Monro[3] was experimenting with the same device for the same reasons. To the antipodean audience, many cultural miles from the cradle of European New Media innovation, it was equally perplexing, stimulating and suggestive.

Quoting from Gordon's program notes to his work:

> New Stars is an improvisatory piece for conventional instrument (in this instance vibraphone) and glove-controlled synthesiser; much of the piece was worked out as a collaboration between the two performers. The inspiration for the piece came partly from modern accounts of star formation and partly from mythology and B-grade science fiction. (The glove used is a Mattel PowerGlove, which is such a fascist-looking lump of plastic that the references to B-grade science fiction were unavoidable).

Laetitia Sonami and her "LadyGlove" focus the artistic intention of the glove controller[4] more precisely. Originally, constructed from parts of a DataGlove, "LadyGlove" quickly became the centre of interest in its own right. Documented in numerous publications and on the Web over the past few years, Sonami's performances are expressed as defining a fusion of technology, explicit sensuality and aesthetics about space and memory.

> It's using an intuitive system, with the (gloved) hand sculpting or modifying sound in real-time, and also translating one set of activity - movement - and the certain logic that goes with that activity, into another, which is the music.[5]

1 Reference to both the Nintendo DataGlove and the Mattel PowerGlove are given here as used by the various authors. Further information on the device can be found on the PowerGlove FAQ: http://www.ccs.neu.edu/home/ivan/pglove/faq-0.1.html
where the follow excerpts comment on the devices' origins are made:
"In 1989 Mattel (yes, the toy company) introduced the PowerGlove, a handtracking device based on a glove. The PowerGlove was intended to work with the Nintendo Entertainment System (NES) in place of a regular controller.
The PG was designed by Chris Gentile (the "G" of AGE) and someone named "Novak" at Mattel…The data coming from the PowerGlove is not encrypted. Mattel/Nintendo just wouldn't spill the beans on how it works."

2 Steve Jobs left Apple Computers in the early 1980's and formed a company called NeXT. The NeXT machine was celebrated as a State-of-the-Art Machine in the late 1980s.

3 Gordon Monro. http://www.gordonmonro.com/pieces/newstars.html

4 Sonami's work predates those I refer to earlier commencing in 1991.

5 http://emfinstitute.emf.org/exhibits/ladysglove.html

In Sonami's approach, the technology becomes a vehicle for a more complex artistic statement. In part, I think this was made possible by the fact that Sonami chose not to use a pre-existing technology as the other performers had but to construct her own with a specific and artistically focused agenda. In this way, she was able to establish an entirely different aesthetic direction to her work. One she could control without too many external references interfering with the performance. Clearly Sonami's visual performance is the focus of this reviewer's attention.

> Sonami gracefully choreographs her unique hand-dance creations, inspired by a cross between East Indian singers and sign language. Watching her constantly adapt to the music she makes, you can clearly see that every composition requires a balance of prearranged physical movement and spontaneous improvisation.[1]

One wonders about the performance context. The quote also suggests that New Media presentation should reflect an artistic approach that transcends the technology.

Technical Synopsis

It was during a period of research using micro-controllers around 2000 that it occurred to me to experiment with flex sensors and consider their use in performance. It was clearly possible but something was missing in the motivation to use them creatively. Later, in 2003 when I began to have discussions about a performance system with colleagues in Canberra, one that might be based on such technology, I was initially skeptical. Perhaps, in a sense, it seemed clichéd and that such a system's success would have to depend on taking the technology in a new direction. However, a performance approach based around collaboration seemed to create a relatively unique and stimulating reason to use the sensors. Earlier research had demonstrated that the sensors could be easily configured with the micro-controllers and issues pertaining to related technical matters soon proved to be insignificant. These included sensor resolution, USB operation, power supply, robustness and finally the realization that the system would be a vehicle for interesting performances, if not for everyone, at least for us.

From the start we individually contributed to the project's conceptual and technical design evolution, so when the first performance opportunity arose, it was logical that we should all be performers too. The ensemble however, could have been larger without too many technical difficulties, possibly one or two more people could easily have been included, but the group dynamics were right for 3 at the time.

The technical configuration stabilized with each performer having 8 flex sensors; 4 on each hand. Each sensor's movement is detected and converted into digital form through the 8 ADC channels of the AVR 8535 micro-controller. It was considered logical to divide the 8 sensors into two groups putting 4 sensors on each hand. Output from the controllers is sent over USB, which also powers the micros, to a Mac G4 PowerBook running a Python script. The Python code handles the input from the 24 sensors, interpolates the data into a composition framework and outputs OSC Datagrams over Ethernet to another G4 PowerBook running SuperCollider 3. The use of two computers instead of one proved to be necessary to optimize the performance of the Python script and SuperCollider. It is important to appreciate that the audience observes 3 performers with minimal visible technology.

Performance Interface

An impromptu opportunity for performance arose in early 2003 and we quickly decided to perform as a group. This accelerated work on a functional performance system, requiring in the construction of 3 sensor/micro-controller systems, programming the Python/OSC code, selecting the "synthDefs" to be used in SuperCollider and building a wearable system. With almost no opportunity for rehearsals, we had little understanding of how we might perform together other than a vague, yet collective intuition that it was possible.

We decided on wearing the sensors directly on the fingers rather than mounting them on a glove like Sonami had done. Understanding how that would work took a few attempts, as the sensors need to slide along the fingers as they bend. To achieve this the sensors are fixed at the fingertip and move through a guide further down the finger (see Image 1). With a combination of Heat-shrink and Velcro, a mount strategy was found that met the requirements of functionality and ease of setup. Each performer has a slightly different configuration depending on length of finger and how autonomously each finger moves. A logical starting point was to put sensors on the thumb and the first 3 fingers. This can vary depending on what feels comfortable and practical.

Due to the fact that the sensor data does not have the same functionality for all compositions, it is important that the performer feels the sensors are correctly placed for their required hand and finger movements. While a performer can watch their hands during performance, it is equally important to watch the other performers and their hands. It was my experience that listening was more important than looking and so hearing where my fingers are bent. Looking at my fingers too frequently was not conducive to engaging

1 Bean. June 1998.

with the evolving aesthetic of the performance, the ensemble or the audience.

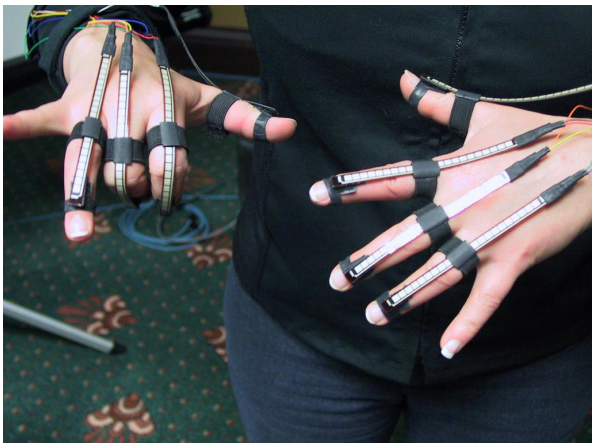

Image 1. Flex sensors mounted on the fingers

Once the problem of mounting the sensors was resolved, other issues of wiring and wearing the micro-controller were considered. Initially, the wiring was modified Ethernet cable held in place by Velcro straps on the arms. The micro-controller was worn on a belt. This proved to be difficult to put on and awkward to wear. After some discussion, the idea of a jacket emerged as the best option with the micro-controller mounted in a pocket on the back (Image 2). Jackets for this purpose were eventually custom made with their design undergoing a number of adjustments and modifications. The Ethernet cable was stripped of its insulation, increasing flexibility for the wearer (Image 3) and could remain on the jacket between performances.

Composition and Performance

An issue apparent from the beginning was what aspects of the sound would the sensors initiate and control, and how would this work in a multi-performer context? The sensor technology provides gesture data that needs to be cast into a creative context. That context was initially defined as an improvisatory program with structured elements accommodating the time and type of incoming data.

Image 2 . Micro-controller location on the back of the jacket

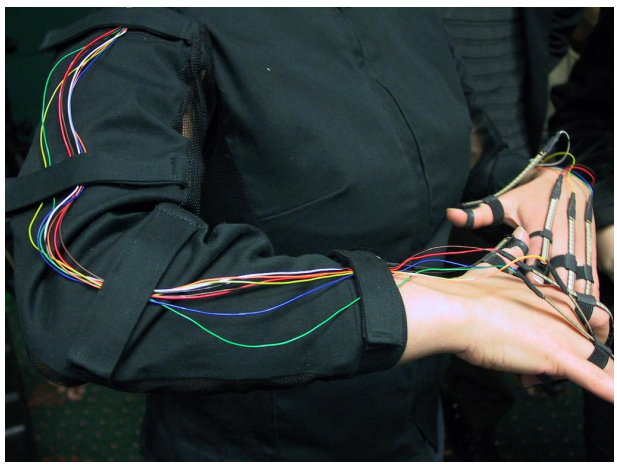

Image 3. Cabling mounts from the sensors

Several strategies have been explored for this kind of improvised context. The first and obvious approach is a simple mapping of the data to control parameters effecting the selection and control of the sound, amplitude and effects. That was a convenient starting point, which inspired more ambitious strategies in due course but also important in allowing us to understand how we would work together. I think this remains the most challenging aspect of the project and determines, to some extent, the approach to composing works. Another interesting issue was that we did not emphasize or particularly discuss, in any critical detail, our individual technical competence in moving our fingers.

This seemed very personal and not initially relevant to the development of the individual works. We were all aware that our fingers often did not move with a degree of flexibility we would have liked and that virtuosity was still something unknown and dependent on later repertoire. This did become a more acute issue as the performance/composition design became more complex.

Indeed, programming complexity soon became the new challenge and it quickly became apparent that increased sophistication could be achieved by superimposing the sensor data onto pre-defined structures, which might evolve over time. One such work, *Drumming Tree*, required two performers to trigger events along transparent cyclic rhythmic structures while the third controlled effects. The temporal nature of this structure was defined initially by a cycle of 5 beats, the first of which was slightly accented. Each beat could have a second and even third temporal layer where events could be place by the performer at any time and the accenting altered. The result was a rapid and often difficult to comprehend growth in rhythmic detail. Add to this the effects and the performance quickly became chaotic, often precipitating a reduction in activity to facilitate an understanding of what one was controlling.

Another approach was to use a binary coding for 8 sounds on the three fingers of each hand. The thumbs was reserved for amplitude or effects. This work was later modified to change sounds and switch between amplitude and effects at certain time intervals over the course of the performance, which was timed to be about 40 minutes. At that point the program stopped. It was an interesting but unnerving experience.

We have only just touched on the possibilities of composition structures for the ensemble. Yet it seems inevitable that more sophisticated applications will require refined and studied finger and hand movements. The works will also require more rehearsal. Another thing that has been considered is the augmentation of control through other sensors like accelerometers so the entire arm can be used in performance. This remains under discussion since it increases performance complexity at a time when we are still getting comfortable with 8 (possibly time varying functionality) channels of control.

Conclusion

If we had been put off using the flex sensors by the fact that the mode of interaction had, in a way, been done before, we would have missed a unique opportunity to understand and experience solving certain technical and creative problems. More important than this, however, was the experience of the group dynamic, where often, simple sounds from each us, were remarkably configured in a moment.

This project also demonstrated the potential for networked systems with multiple users but by no means revealed all possibilities. The technology for such music systems is now widely available and the communication protocol reasonably well developed. What are less understood are matters concerning implementation and creative objectives. What sort interface should be used? How is the sound being produced and manipulated? How does the group collaborate? What is it that the ensemble wants to express? Can the ensemble accommodate additional members easily? HC was fortunate in that these questions were answered over time and with a favorable configuration of participants. Tasks that needed to be done could often be effectively distributed and often run in parallel.

Collaborative projects are, at the best of times, difficult. What each performer expects to get out of the project, their level of commitment in terms of time and other resources, and their feelings about the collaborative experience, are subject to ongoing reappraisal. Finding the right players is probably, very much a matter of chance.

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