Conversational Interaction in Interactive Dance Works

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Abstract

This paper describes an interactive dance/physical theatre work entitled *Encoded*, which made use of motion capture techniques and real-time fluid simulations to create systems intended to support, stimulate and augment live performance. Preliminary findings from a qualitative study of performers' experiences with the system raise a number of issues, including the challenges of creating theatrical meaning with interactive systems, using Contact Improvisation as a metaphor for engaging creative systems, and the impact that large-scale projections can have on performers' engagement.

In this paper I describe a collaborative project between the Creativity and Cognition Studios and the Sydney-based professional physical theatre company Stalker Theatre. The creative outcome of this collaboration was *Encoded*, an hour-long dance work, which premiered in November 2012.

Technically, the work involves motion capture and the use of multiple projectors. These include large scale, high-intensity projectors that project onto the performance environment and the dancers themselves, and a number of 'pico' projectors which were incorporated into costumes.

While the technical aspects of the work are interesting, our principle concern is with the creative, interactive possibilities the *Encoded* systems provide. The question of how the actions of performers should be linked to computer generated sounds and visuals is critical.

Encoded

Encoded explores how notions of digitised space alter our perceptions of physical space. Through a combination of large- and small-scale interactive projections onto the performance space and the dancers themselves, *Encoded* aims to blur the boundaries between physical space and digital space.

A core concern was how to realise the interaction between performers and the digital elements of the environment. One approach is to consider the physical performance environment and the dancers' bodies simply as 'surfaces' upon which various pre-prepared images and videos could be projected, but to us this reinforces the boundaries between the physical and the digital rather than providing opportunities to explore them.

The approach we applied is closely related to previous work by the author which used simple mass-spring physical models as a mediating layer between the physical gestures of performers and the visuals produced by the computer [1,2] in an attempt to create an "instantly knowable, indefinitely masterable interface" [3]. However, rather than using a simulation based on solid objects which are linked together, *Encoded* uses simulated fluid which is affected directly by the dancers' movements and projected onto their bodies.

The intention is that the appearance and behaviour of the software-simulated fluid is intuitively understandable for both performers and audience, yet complex enough to facilitate conversational interactions [4].

Technical Details

The overall technical structure can be seen in Fig. 1. The system is primarily written in C++ (OpenFrameworks [5]) and Pure Data [6]. The movements of the dancer are captured via a camera fitted with a filter which blocks visible light while allowing infra-red light to pass through. The camera feed is passed through an OpenCV [7] optical-flow module that tracks performer movement.

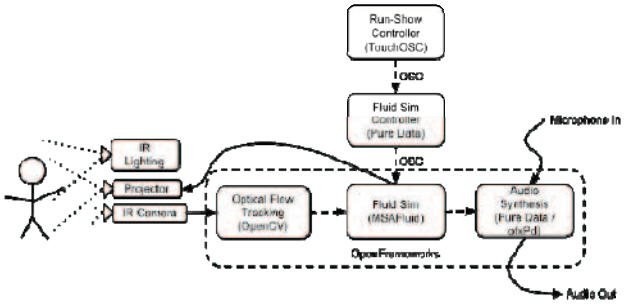

Fig. 1. An overview of the *Encoded* system. (© Andrew Johnston.)

The fluid simulation is a modified version of the MSAFluid simulation by Mehmet Atken [8]. The movements of the dancers' bodies effectively 'stir' the fluid. The fluid simulation is extremely flexible and there are numerous parameters which can be adjusted during performance. These include parameters that affect the response of the fluid simulation to dancers' movements (viscosity, for example) as well as settings that affect how the fluid is visualised (e.g. colour or black and white, particles or lines, etc). All parameters are set from a Pure Data patch which sends control messages to the fluid simulation.

In addition, I have recently been exploring a number of techniques for using the behaviour of the fluid simulation to control computer-generated audio [9]. These were not used for the performances in 2012, but are a focus for further development.

User Studies

While *Encoded* is in a sense a completed work, there remain a number of unresolved questions about the relationship between performers and the interactive systems that were developed.

As the fluid responds directly to gestures and can produce both sounds and visuals, it could be seen as a kind of audio-visual instrument. To what degree are the dancers becoming instrumentalists? Should we attempt to facilitate direct, instrumental control over the fluid? To what degree is this necessary if we wish to encourage a kind of embodied, conversational interaction in performance? How does the behaviour of the system impact upon the embodied experience of the dancer?

To explore these questions we conducted a series of 13 interviews with the performers, choreographers and lighting designers who worked with the *Encoded* interactive systems. The resulting 11.5 hours of qualitative data was analysed using grounded theory methods [10]. In the following section I introduce some of the key themes that emerged.

Interactive Systems and Live Performance

Introducing interactive systems into dance/physical theatre need not necessarily change the practices of choreographers and performers to a significant degree. It is perfectly possible to use the systems as a slightly more sophisticated approach to lighting, or as a technique to provide animated backdrops, for example. The experience of the artists working on *Encoded*, however, indicates that they perceive interactivity to fundamentally change many aspects of their approach to making a work:

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"I'm still figuring this out, but from my engagement with the interactive systems, if you really choose to see what they're giving you they fundamentally change the way the actor works with space, and so in many ways I'm still reeling from that." (Choreographer/artistic director)

There are many practical issues that need to be considered when mounting a performance work that makes use of interactive systems. One obvious, but perhaps often neglected, issue is how hostile the typical performance environment is to meaningful interactive work. In *Encoded*, the stage lighting, the position of projectors and the location of the audience all tended to conspire against improvisational interaction with the interactive systems:

"It's like the choreography [is] assumed to encourage the interaction but … it's very hard to interact when so often the ability to see is compromised…by lights in the eyes or projectors in your face…" (Performer 2).

Perhaps for this reason, most of the improvisation took place during early workshops when stage lighting was simpler and projections were a much smaller, 'body-sized' scale. An intriguing metaphor that emerged in one interview when discussing the more free-wheeling interactions during the earlier stages of creative development was that of Contact Improvisation (CI) [11]. CI is an approach to improvised dance that focuses on non-verbal creative communication through touch.

"Yeah well it's a duet isn't it? A form of dance that I do is called contact improvisation. It's a partnering dance form that is also improvised and you're in contact with another person but through that point of contact there's an immense listening. . . . Through the contact you're listening and the dance begins. So it becomes a dance of one but with two bodies without verbal communication. So I think you know the interactive systems are that - it's just finding the listening point between the projections or the music and the person playing..." (Performer 1)

We find CI a compelling metaphor for interactive system designers. While the physicality of current systems is very limited, mainly due to a lack of haptic communication from the computer to the performer, it is a tantalising concept to work towards. It is also interesting to consider the role of the designer and operator of the interactive systems in this dialogue. Because the real-time systems we use can be continually modified during performance, the dialogue can (and did, in the earlier stages) become three-way: the physical performer manipulates the interactive system that is also manipulated by the interaction designer. The interactive system may itself act as the 'listening point' in a contact improvisation between the dancer and the person operating the system perhaps.

The use of interactive systems in performance can disrupt performers' focus during performance. Dancers are accustomed to using their bodies as expressive 'instruments':

"I work so much within this space which is my body underneath my skin and feel quite intimately aware [that] that's where my skills [are]. Like knowing where my body lies and how that will affect space and how visually that will look..." (Performer 2)

The *Encoded* interactive systems can disturb this established way of working, because they demanded that the performer attended not only to their bodies and how they relate to other performers, the audience, music and the space around them, but also now to computer-generated material. If they become immersed in manipulating the computer system they fear becoming less aware of what their bodies are doing:

"I'm making interesting shapes and interesting patterns on the projection. And is that what I'm interested in? And...the movements that I'm making in order to make those interesting projections - are they interesting? Are they as aesthetically pleasing?" (Performer 2).

The scale of projections had a significant effect on the feelings of intimacy between performer and system:

"[The smaller projection] was a complete different feeling because you had…the fluid projected onto your body and then it was around your body rather than being [on] a really large wall. So it was more intimate and it definitely felt more connected to my body or my aura in some ways." (Performer 1)

The increasing availability of high resolution, high intensity projectors tends to lead to larger and larger projections. Performers' experiences with the *Encoded* systems suggests that the visual spectacle afforded by these projectors may come at the cost of interactive intimacy in performance.

Conclusion

The use of interactive systems in *Encoded* provided opportunities to examine the impact these kinds of systems can have on live performance. The use of a real-time fluid simulation was largely successful in encouraging intuitive, playful interaction, particularly in the early stages of development.

The emergence of Contact Improvisation as a metaphor for live performance interaction provides challenges and opportunities for us as designers and performers that we are still coming to terms with. It hints at an approach to rehearsal and development that explicitly searches for 'listening points' between performer, interactive systems and system designers, allowing the 'operators' of interactive systems to become engaged as co-improvisers in the moment of performance at a more sophisticated and nuanced level than simply triggering pre-set interactive system states.

References and Notes

* Based on a presentation at the first International Conference on Live Interfaces (ICLI), 7–8 September 2012, hosted by the Interdisciplinary Centre for Scientific Research in Music at the University of Leeds, U.K. See <http://icli.lurk.org>.

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