Mashup Realities: Exploring Experience In Networked Interactive Environments For Dance

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Abstract

This paper explores user experience specifically in the context of telematic dance and networked spaces. New electronic sensor technologies that capture the movement of bodies provide opportunities to redesign the body in space. While much research in this area is informed by technology directly, in this research a 'user-centered' point of view is used to explore new design criteria for movement-based interaction. I discuss a series of performance-based projects titled *Mashup Realities*, an online platform for interaction, collaboration and creativity. The starting point for these projects is the exploration of people's performance experiences of communication and interaction through bodily movement, to make this experience a source of inspiration for the resulting designs. In this paper I will describe the process and technology behind *Mashup Realities*. By working with a range of dancers, choreographers, musicians, designers and programmers through adopting a participatory approach, this paper will outline how performers can be supported in developing a more meaningful and richer interactive experience to extend non-verbal communication and collaboration through the internet.

Keywords

User Experience, User Experience Design, Networked Interactive Environments, Dance and Technology, Non-verbal Communication

Introduction

In 1977, Kit Galloway and Sherrie Rabinowitz created *Satellite Arts Project,* the world's first interactive composite image satellite dance, between performers on the Atlantic and Pacific Coasts of the United States [1]. Existing research on the subject generally takes the viewpoint of the technologists or the performer. This research focuses instead on user experience design, speaking to the needs of the choreographer and dancers as they develop their art within the technological environments. This approach will outline design criteria to contribute to the development of a framework for technologists and non-technologists alike to utilise these tools and create interactive networked performances of their own. To achieve this, I am looking into the best possible way for available technologies, both hardware and software, to be redesigned, rebuilt and reengineered for an optimal performance space and spontaneous, real-time reaction and interaction in dance performance.

Mashup Realities is a platform for interaction, collaboration and creativity between dancers separated by distance, and will drive the practice-led research. Through observation and experimentation, we aim to develop a cross-cultural and cross-disciplinary platform to facilitate a cross-pollination of dance and new media arts. This paper discusses three dance projects: *Experiment.spaces no.1*, *Metakimosphere no.1* (MetaSeminar Digital Technologies Lab project, Brunel University) and *Experiment.spaces no.2 [Spheres]* that make use of a interdisciplinary approach, enabling collaboration between dancers, choreographers, musicians, designers and programmers. Given its key role in the practice-led research, *Mashup Realities* has two ultimate objectives: (1) supporting creativity in performance by investigating the potential for user experience design and (2) increasing non-verbal online communication and collaboration in remote Australia.

The internet is a key tool for the performing arts, especially in geographically remote locations. Online, networked communication offers artists working in these areas opportunities to network, research and create international collaborative relationships, when they would otherwise experience professional and social isolation relative to their city counterparts [2]. It expands the realm of their collaborative opportunities and vastly increases their interaction with other artists.

In this study, interactive environments are defined as spaces with technology-based interfaces that react to user input creating responsive physical and virtual spaces. Users are able to form embodied experiences by seeing, hearing, and feeling realistic perceptual cues linked to those experiences. Embodied experiences are defined as the state of being 'surrounded by simulated sensorimotor information in mediated environments that create the sensation of personally undergoing the experience at that moment' [3].

The term user experience (UX) is used by web designers and developers to describe the human–computer interaction between the application and user. The user in this context is not the audience but the dancers using the environments. UX encompasses all aspects of the dancer's interaction with the environment covering whether the system is easy to learn, efficient to use, pleasant, satisfying and meaningful.

According to Jodi Forlizzi, a rich experience is an interaction 'with a product which is satisfying, an experience that has a positive and pleasing value for the user, allowing the user to perceive beauty in the product and its use' and which 'has a sense of immersive continuity and interaction, which may be made up of a series of satisfying experiences' [4]. This term 'rich' is useful as it helps to describe the forms of interactive models and UX design methodologies used to create complex digitally mediated interactive environments.

The term networks in the present context means the distribution of content (visuals, audio and movement) over telecommunication and information technology systems. Research into telematic performance, dance and technology has described the application of information technology in dance as 'digital or virtual extensions of the body' [5] and 'the intersections of technology, body and code' [6]. Space, time and body are components of movement for contemporary dance, and space in particular is a key factor contributing to the shape of movement. This research aims to investigate distributing space – extending the physical parameters in which artists can perform – through the creation of hybrid connected environments, both physical and virtual.

These interactive environments offer rich layers of perceptual information encompassing lighting, costumes, choreography, sound, visuals and movement. Furthermore, digital scenography, as defined by Birringer [7], is the live performance architecture incorporating analogue, digital and network dimensions, where performers are inside and outside the digital worlds simultaneously. Meaningful interaction between the performer and space is crucial for the performance, and designing UX for these hybrid spaces will be an exploration of the 'convergences between performance, telematics, textile/fashion design and movement, clothing and choreography, visual expression, film/photography, and interactive design' [8].

In this paper I describe the process and technology behind the ongoing dance projects, *Mashup Realities*. These projects investigate user experience in networked interactive environments for dance, and methods that can be used to design for 'rich' experience. I aim to identify design criteria which support the creative process for dancers in interactive environments. To this end, flow theory and quantifying tools will be used, as well as industry UX testing methods. A user-centered approach is being adopted in order to create meaningful embodied experiences in interactive environments. A key question the research addresses is: what makes a meaningful 'rich' experience for the people choreographing, rehearsing, performing or collaborating within a networked interactive system?

Exploring user experience

Within the scope of this research, 'the performer is always the user, player and participant in an operating system' [8]. The dancer, understood in the context of interaction design as a user, has a unique set of requirements and aspirations.

Through researching existing UX models and methods I aim to not just clarify the immediate needs, but also to get behind the driving motivations and values of the user: the dancer.

The initial approach will be to examine Birringer's research into telematic performance by applying the ideas from Csikszentmihalyi's flow experience, and its possible role in measuring and supporting engagement. Johannes Birringer is the Chair of Drama & Performance Technologies Research for Theatre at Brunel University London's School of Arts. He is focused on the exploration of networked performance and 'the intersections of technology, body and code; the aesthetics and politics of programming, the poetics of online communication or online contact improvisation, and the relays between architectural structures, institutional structures and distributed networks' [6]. Mihaly Csikszentmihalyi, who first developed the 'flow' concept in 1975, is a leading researcher in positive psychology and currently teaches psychology and management at Claremont Graduate University. With the aim of understanding experience and mental states in order to improve the design of the interaction, an user-centred approach will be used, or in other words a 'direct and active participation of all stakeholders in the design development process' [9].

Body (wetware)

Human bodily movement, non-verbal communication and interaction may be subtle or expressive, and occur at different scales of gesture or expression. In the context of software and hardware, the thought processes of users which lie behind the operation of computer systems are referred to as "wetware". Of relevance in the exploration of embodied experience are the thought processes behind bodily movement within interactive environments. Flow theory can help us to better understand these processes.

Csikszentmihalyi's flow theory has been used extensively in the study of human computer interaction (HCI) as an important means of understanding the efficacy of interactive environments, and in dance research for gaining insight into the possible facilitating and inhibiting factors that would support flow for dancers.

Flow experience is defined as a state of concentration so focused that it amounts to absolute absorption in an activity [10]. With relation to dance, 'flow is believed to be a psychological state in which the mind and body 'just clicks', creating optimal performance' [11].

The dancer has a unique set of skills, needs, emotions and experiences. *Mashup Realities* will study and evaluate how to support dancers own flow experience and how they feel about performing in an interactive environment. The aspirations of dancers will be factored into the system's design in order to understand how good UX design 'allows for personal and useful interaction, and arouses an emotion which unifies a satisfying experience' [4].

According to Jaime del Val (2013): '93% of our expression are in the form of non-verbal communication, yet current media reduce non-verbal interaction to a highly

reduced set of standardised and traceable gestures of interaction through interfaces' [12]. This research addresses the importance that non-verbal communication and embodied expression has for dancers and their collaborative processes. Throughout development, the aim is to utilise UX design to support non-verbal communication in networked interactive environments.

Code (software)
Movement-based and gesture-controlled interfaces will be designed and built to detect, measure and interpret physical movement. This creates a HCI system for dancers in interlinked physical and virtual spaces, including real-time digital mixing of audio, light, video and computer-generated imagery controlled by the user. The architecture consists of responsive behaviours that can be modified by the user through visual and audio parameters triggered by certain expressive movement and gestures. Also, at a later stage, the interactive environment will be developed to record and playback performances as a tool for collaboration and sharing.

An intriguing further consideration will involve system behaviours which are proactive and anticipatory. Research into intelligent movement-based interfaces investigates 'environments that can observe their human inhabitants, can interpret what they know, want and do, and reactively and proactively support them in their activities' [13]. This form of artificial intelligence could provide real-time feedback as to what the user is experiencing or feeling, including pain, fatigue, frustration and irritation, by collecting and analysing data about the user's regular patterns of bodily activities.

Technology (hardware)
The interactive environment is a sensory space for sound, vision and movement. The technology employed will sense and capture movement within the space and output visual and audio back into the space.

Digital scenography, as defined by Birringer [7], is live performance architecture that incorporates analogue, digital and network dimensions, where performers are inside and outside the digital world simultaneously. Meaningful interaction between the performer and space, therefore, is crucial for the performance. The exploration of latest sensory technologies for movement will inform the design of these hybrid spaces.

The intersection of body (skill, emotion, need and experience), code (interface, interaction and environment), and technology (sensing, capture and output) is where I believe we will find the 'rich experience' that Forlizzi describes.

Related work
Artists, performers and designers have experimented with the use of networks, telecommunications and information technology as a means of broadening their creative experience for decades. *Metabody, Zero Point, Danceroom*

Spectroscopy are three current projects with goals closely related to that of the present research.

Metabody is a project financed by the European Commission which commenced in July 2013 and will run until July 2018 [12]. *Metabody* investigates cultural diversity, non-verbal communication and embodied expression by examining networks that connect institutions, organisations and people. The research aims to achieve an interactive mobile architectural structure for outdoor spaces (performances, interactive installations and immersive durational experiences). The resulting structure will include both analogue and digitally mediated environments consisting of space modules, objects modules and wearable modules, working both locally and telematically, with the possibility of connecting protagonists in different cities and countries. *Metabody* seeks to generate a new methodology for interdisciplinary research and artistic creation between this area of the arts, information and communication technologies, human science and philosophy.

Darren Johnston is a UK director, choreographer and video and sound artist with a contemporary dance background. Johnston undertook a week-long residency at the Barbican Theatre in London in March 2014 to experimentally use his own software in an interactive performance titled *Zero Point*. Using motion-sensing technology, video projections and light, he designed a performance in which shapes of light moved over a backdrop of darkness – 'it bathed the bodies of dancers with graphic texture and light.' The sensors and programming mapped and selected the dancer's body in the three-dimensional space and created a shape based on that of the detected dancer, which was then projected back onto their bodies in real time.

UK based *Danceroom Spectroscopy* is a science/art collaboration exploring languages and crossovers between physics, interactive art, performance and technology. It interprets people as energy fields, allowing them to influence both graphics and sound within the interactive environment using their movement. The technologies *Danceroom Spectroscopy* utilises in many of their installations are Max/MSP, Ableton Live and Microsoft's Kinect sensors.

Studio work
Three project (to date) form the foundational basis of my practice-led research. I will discuss in detail *Experiment.spaces no.1* and then briefly outline *Metakimosphere no.1* and *Experiment.spaces no.2 [Spheres]*. The performance installation *Metakimosphere no.1* was created from a workshop at Brunel University, London. *Experiment.spaces no.2 [Spheres]'s* application is in its very early stages of prototyping and testing.

Experiment.spaces no.1 - Choreography
This initial project laid the foundation for collaboration between choreographer (Seeta Indrani) and designer (myself), and by extension how we will collaborate with

the performers. Indrani and I started by discussing how to better understand and explore the possibilities that technology holds for the performance.

As a creative device, we employed 'Chance Operation' as a methodology for the performance and design of the interactive environment. From the Dadaists (Jean Erp), Cornelius Cardew, John Cage to Merce Cunningham, this technique has been used to employ non-predetermined and unpredictable elements that cause an event to have a certain result. Merce Cunningham introduced Chance Operations into contemporary dance and it quickly evolved to become an important compositional device. Cunningham was a leading American dancer and choreographer and is considered one of the most important choreographers of our time. He describes Chance Operation as a device, 'when I choreograph a piece by tossing pennies - by chance, that is - I am finding my resources in that play, which is not the product of my will, but which is an energy and a law which I too obey' [14].

Seeta Indrani graduated as a dancer from the London Contemporary Dance School. She made her stage debut as Cassandra in the original London production of Andrew Lloyd-Webber's *CATS*. Indrani describes the choreography concept: 'Relinquishing control to the randomness of the software is almost an existential approach. Unlike many works I'd created in the past this was not to be an organic journey of the emotions, characters, stories or instinct. We felt chance or randomness was a good fit. We knew we wanted elements of the computer or the software taking control and vice versa – the dancers triggering the computer software in real time.'

The choreographer's starting point was very simple 4 x 32 count phrases to be performed in a random order, with the computer determining the structure. These phrases would form the basis of all of the choreographic content. To fulfil these requires it was evident a gesture-controlled user interface would be needed.

Experiment.spaces no.1 - Technology

A great deal of research has gone into investigating the available software and hardware that best suit the project's requirements. We needed hardware to sense and capture movement, software to translate motion into data and additional software with a programming language to utilise the data to control or manipulate the environment via gestures, both visual and audio. The criteria was to find hardware which was cost effective, accessible and easy to set up.

After two months of researching and testing various applications, and investigating similar projects in London, we decided on the Microsoft Kinect motion sensor and a combination of applications and programming framework; Synapse, Syphon, Particle Warfare, Max 6 and Quartz Composer [Figure 1].

The Microsoft Kinect is a reasonably accurate motion sensor with a range of about 5 metres. Synapse is a piece of open source software designed by Ryan Challinor for the Kinect to send joint positions and hit events via Open

Sound Control (OSC), a protocol for communication among computers. The software captured the user's movement via the sensor, which is then represented as a red skeleton or wireframe. Each point of the wireframe (10 of them; Head, Torso, Elbow (L), Elbow (R), Hand (L), Hand (R), Knee (L), Knee (R), Feet (L), Foot (L)) is measured and mapped as constant streaming X, Y, Z positions. This data is then fed into other applications that can receive OSC events. Both Max 6 and Quartz Composer can receive OSC events.

Max 6 by Cycling 74 is a visual programming language used by a variety of new media artists, musicians and programmers for interaction, moving image and sound. In this project it will be used to receive data from Synapse/Kinect and create a series of small applications called Patches, which will create the audiovisual contents of the responsive environment. Max 6 primarily handles the X, Y, Z position data from the Kinect sensor. Using these coordinates, hotspots in the environment (3D space) were created via a Patch based on a hand gesture. This triggered the random Patch, which selects a video at random from the database to be displayed in the background of the projection via Syphon (application-to-application communication) to Quartz Composer. Quartz Composer by Apple is also a visual programming language, but its strengths are processing and rendering graphical data. Therefore, all the visual elements of the environment are controlled by Quartz composer.
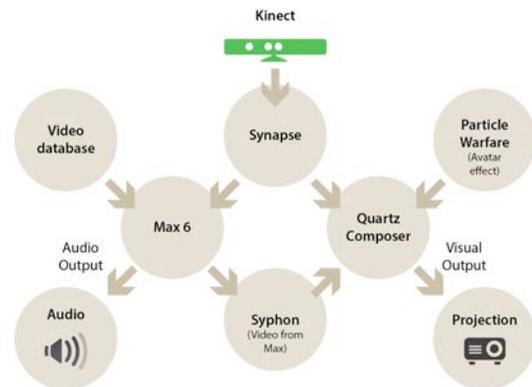

Figure 1. Applications and their relationship: Synapse, Syphon, Particle Warfare, Max 6 and Quartz Composer

Experiment.spaces no.1 - Practical work

In February 2014 we trialled this model in a London studio with a contemporary dancer and a martial artist. The aim was to test the responsiveness and range of the Kinect and software, and also to flag any potential issues the applications might have. The hardware setup included the Kinect sensor, a laptop computer and a projector. We created an environment where specific gestures triggered sounds and audio changes. The studio was 5mx7m and the sensor was placed at the front, with the user's wireframe or skeleton projected onto the main white wall. The visualisation was smooth and immediate, but the audio was

hit and miss. Three issues became evident. First, when the user moved too fast the wireframe was lost and the data, X, Y, Z positions, stopped feeding the OSC events. The second, range was less than 5 meters. At times we lost the wireframe and needed to recalibrate. The third, the sensor seemed to be confused when one performer crossed in front of another.

In August 2014 we started to conceptualise a performance, seeking to simulate two spaces networked together within the one performance area. The choreographed performance structure would be informed by the application randomly selecting the order of 4 x 32 count phrases in real time. The random patch would be triggered by the dancers via a particular gesture. The interactive environment was designed and developed over a two month period.

In October 2014, in my role as designer and developer, I entered the studio with two dance graduates from the Victorian College Of The Arts, Rachel Heller-Wagner and Louis Matthews, and the choreographer, Seeta Indrani. In this stage of the project I wanted to work closely with the users and the choreographer, utilising a participatory design approach to develop the interactive environment application and performance to a point ready for a public rehearsal. The choreography would play an important role in designing the interactive environment and the development of the programming.

For this initial studio work, I divided an image capture studio space located at MADA (Monash Art design and Architecture) into two sections [Figure 2]. The two halves would not be technically networked environments, but I wanted to use a technically simple division to allow communication between the dancers and the applications without too many IT issues. This helped me observe the non-verbal communication between the dancers and choreographer and better understand what will be required when we proceed to the next stage, linking two spaces separated by distance. Although the dancers were physically in the space together, the choreographer, Seeta Indrani, was collaborating via Skype. This provided an interesting insight as Indrani highlights, 'I was aware I was missing nuance, moments which might organically grow, take us off in other directions. Unspoken vibes.'
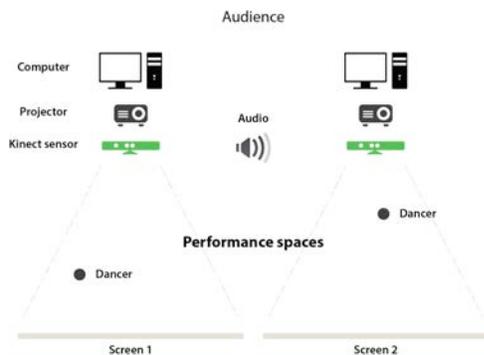

Figure 2. *Experiment.spaces no.1* performance spaces and the technology layout.

Working directly with the dancers and choreographer at this early stage in the development of the interactive environment's programming, I discovered new opportunities to refine the process that I would not have contemplated alone. From my professional experience as a web designer, understanding the user is key to building successful online systems. As Elizabeth B.-N. Sanders, PhD Experimental Psychology from Ohio State University's design department, notes, 'the roles of the designer and researcher blur and the user becomes a critical part of the process', and she continues, 'if we can access people's experiences (past, current and potential), then we can make user experience the source of inspiration and ideation for design' [9].

The public rehearsal was performed to a small audience and lasted eight minutes. The structure was divided into three parts; choreographed introduction with small solo performances, then followed by the Chance Operation approach where the order of the 32 count phrases were determined by the computer, and then final part had the dancers perform the phrases in unison in a predetermined order to finish the piece. A video sample of the public rehearsal can be view on Vimeo (vimeo.com/mashuprealities) [Figure 3].

Figure 3. Screen grabs from *Experiment.spaces no.1's* public rehearsal video documentation.

Experiment.spaces no.1 - Feedback
I asked for feedback from the choreographer, a dancer and an audience member regarding their experience of the project and the public rehearsal. This feedback was not

designed to measure experience, but simply to improve future studio work collaboration. Feedback questionnaires alone are not sufficient to evaluate experience. A combination of documentation (video), observation, experimentation, interviews, questionnaires and research, will provide valuable ways to measure these experiences.

Seeta Indrani, choreographer, was not physically present during the studio performance in Melbourne. She is a London based choreographer, actress and director. We linked up with her via Skype. The setup had the camera pointing towards the performance space and the audio running through the speaker system, so Indrani could view the dancers and communicate directly with them.

"There is no substitute for being in the space together. I was aware I was missing nuance, moments which might organically grow, take us off in other directions. Unspoken vibes. All the reasons why we congregate in a rehearsal space in the first place. However, Chris and I have a strong working language and the dancers were very open with their suggestions and feedback which allowed the collaboration to move forward," Indrani.

Indrani's comments highlight the importance of how movement, both subtle and expressive, is communicated over the internet. In this case, 'unspoken vibes', or small movements which were significant to the collaboration and choreography, were lost during the Skype linkup.

Despite this, the collaboration in the studio between the dancers, choreographer and myself presented new ideas and opportunities to better design the interactive environment for the performance.

"I enjoyed discovering what the technology could offer the movement. The dancers were very free in playing in the studios throwing out ideas, which usually then set Chris quite impossible tasks – but this was part of the experiment. How can it best serve the performance," Indrani.

Rachel Heller-Wagner and Louis Matthews, graduates from the Victorian College Of The Arts, are very skilled contemporary dancers and brought a lot of their own ideas to the collaboration.

"Alongside new challenges and learning to work in alternative ways, I felt that the structure of the project facilitated creativity and thus allowed positive outcomes to occur... i.e. having a programmer able to explain and change things as you go, another dancer to bounce info and movement off etc," Matthews.

For the dancers this was the first time they collaborated on a project where the technology played a large part in the choreography. This highlighted how important instant feedback and communication was to the process. Specifically, how quickly the environment responded to movement, real-time feedback, during the rehearsals was crucial.

"I found the motion sensors / projection component the most impressive and responsive part of this collaboration. Being able to see the visual programming of the project alongside a realised image behind was great to work with," Matthews.

Most importantly, as a designer, collaborating directly with users meant I could start to observe and interpret the project from other viewpoints. Their insight into performance and how the technology could facilitate and extend it meant I had a new scope of ideas to take on board in refining and optimising design.

"I would really like to see some alternative objects/technology used i.e. rear projection screen, projection screens in non-conventional locations i.e. movement tunnel, suspended at angle from ceiling. I think that this could really aid to the interactivity of the project and start to separate it from the traditional 'action - viewer' experience. I expect all of these can be explored in future arenas where time and resources permit," Matthews.

Tony Gillan, is a fellow designer and developer, attended the performance as an audience member. The observation Gillan made was about the gesture which randomly changed the video backgrounds wasn't evident.

"The wide sweeping movements of the dancers seemed to mesh well with the backgrounds and the feedback light effects produced by the application. Combined with the music, the effect was quite hypnotic. The two dancers and various sequences were harmonious, but I believe there could have been more interaction or cross-over between the 2 dancers and backgrounds, if the technology allowed. Also I didn't realise that the dancers themselves were changing the backgrounds until it was explained after the performance," Gillan.

Metakimosphere no.1, MetaSeminar Digital Technologies Lab project, Brunel University

The performance installation *Metakimosphere no.1*, by Azzie McCutcheon, Martina Reynolds, Helenna Ren, Seeta Indrani, Cameron McKirdy, Yoko Ishiguro, Johannes Birringer and myself was born of an eight week long *MetaSeminar Digital Technologies* workshop at Brunel University, London, facilitated by Johannes Birringer. The workshop was constituted of technologists, designers, dancers, musicians and artists, who all contributed to the installation.

Figure 4. *Metakimosphere no.1*'s dancers inside the gauze structure with particles projected onto their bodies.

The installation was created with hung and draped gauze in a circular formation with projections of particle effects from four sides, angled into and through the structure. The dancers were located in the centre with gauze draped over their bodies to form a single body within the structure. A Kinect sensor was placed inside the structure, so that each of the dancers' movements directly influenced the behaviour of the particles. As the dancers increased the frequency and speed of movement, so the movement of the particles would intensify and multiply. The audience was able to walk around and into the structure [Figure 4 and 5].

Figure 5. *Metakimosphere no.1,* a dancer moves in front of the Kinect sensor.

McCutcheon, Ren and Ishiguro have danced on a number of interactive digital performances, while for Heller-Wagner and Matthews from *Experiment.spaces no.1*, it was their first time. This performance installation gave some insight into how these experienced dancers interacted with the environment. They are much more aware of their surroundings and how their movement translates to the projections and images. The sense that the environment was an extension of their bodies was very evident in this project.

Experiment.spaces no.2 [Spheres]
This project is currently in the prototype stage, but was successfully tested during the *MetaSeminar Digital Technologies Lab* workshop. *Experiment.spaces no.2 [Spheres]* is an application which allows dancers to interact and guide virtual forms, in the shape of spheres, inside an online virtual space. Another dancer in a different location can also access this same virtual space over the internet and interact with the spheres [Figure 6].

Experiment.spaces no.2 [Spheres] is created from Max 6, which connects two computers directly using their IP addresses. Similar to *Experiment.spaces no.1,* the coordinates of the hands are tracked via the Kinect sensor and fed into Max 6. The coordinates are used to position and guide the spheres. In addition, the spheres and the virtual space have their own behaviours; the spheres respond in a similar fashion to a rubber ball and the environment simulates gravity. We are investigating how this application can be incorporated into a networked

performance. From a UX design viewpoint, the aim here is to address slow internet speeds, delays, tolerance of error and loss of quality of movement over the internet and how these impact on user experience.
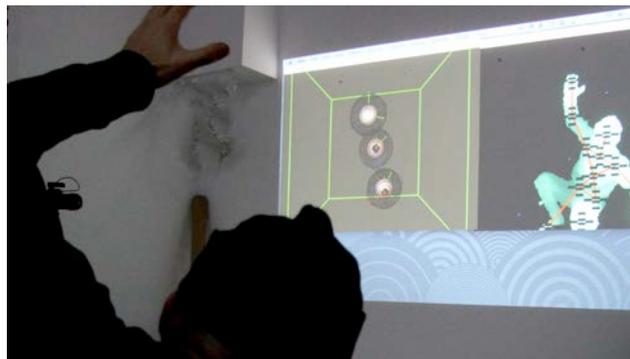

Figure 6. *Experiment.spaces no.2 [Spheres]* prototype testing.

Conclusion

My research is motivated towards providing artists in remote Australia with a set of tools to enhance their ability to collaborate online, assist the creation of interactive works and promote further development of performance in regional Australia. As expressed by Trinidad and Broadley: 'By connecting to the outside world it allows the outside world to view the value of the community. By bring the outside world into these communities allows the people to feel a sense of pride and importance in their cultural context' [15].

From the course of studio research investigated to date, we identified several aspects that were relevant to the user experience supporting non-verbal online communication. Based on these aspects we deduced the beginning of design criteria for the movement-based interaction. As the research continues to develop, criteria for effective system design will undoubtedly grow and these identified aspects will be refined:

- Three dimensional interactive space, both physical and virtual
- Cost effective, accessible and easy to setup technologies
- Low bandwidth streaming technologies
- Gesture interface controlling visual and audio outputs
- Communicate subtle and expressive movement
- Real-time immediate feedback

Formative studio work has revealed that a participatory design approach was beneficial for the development of the application, identifying processes that support and guide users, and towards a 'rich experience' for the user. While we are still at a very early stage in the development of the project, preliminary findings have indicated that subsequent design will benefit from building upon existing UX design principles and adopting flow theory to better understand users' embodied experiences.

The series of prototyping projects, outlined in this paper, informs the direction of *Mashup Realities*. It forms a critical and valuable stage in the research as we work towards the final project in which an Australian and a European dance school will participate in an online live dance networked performance. It is the ambition of the *Mashup Realities* project for geographically remote participants to dance, choreograph and rehearse together without leaving their home countries. The end result will be two simultaneous live performances, which will be combined online to create a single dance piece in a shared virtual space.

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