# SENSES AND PLACES MEDIATED BY WATER. CAN WE SENSE KINESTHESIS IN DANCE THROUGH RIPPLES IN A POND?

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## ABSTRACT

In on-going work, technology mediated embodiment experiences are induced in distant and local participants through playful interaction in live performance environments. Simple technologies have been used to sense and share movement and body data. Mediated through 3D virtual world technology a digital space synchronously creates shared presence at a distance, using both the shared data sources and video streaming. The collection and recognition of data used to create the feedback is through a computing system tailored for the particular performance space. Here we consider the practical application of literal liquid state machines in the form of small bodies of water to enhance pattern recognition that triggers feedback, with the intention that the systems automatically adapt to new performance spaces.

## INTRODUCTION AND CONTEXT

Performers and invited audience participants in remote locations meet and playfully engage kinesthetic/synesthetically with one another and a 3D virtual world environment through an ongoing dance-technology collaboration that takes a generative cross-cultural somatic approach. This reflects Thomas Hanna's 'somatic body (r)evolution', in which he presents an optimistic vision for human evolution in the passage to the twenty-first century, by countering technological dominance with a childish, playful somatization of technology. [1] A similar ambition for the system is a form of implementation of Susan Foster's concept 'choreographing empathy' in which participants become embodied by being 'similarly hooked into environments both immediate and distant, this body draws upon a 'cyber-kinesthesis' to rehearse options for making its way in the world.' [2]

Katherine Hayles' 'posthuman embodiment' perspective is taken. [3] Hayles presents thought as a broad cognitive function that has characteristics depending on the embodied form acting on it. In this way she reclaims the 'post human' from cybernetics' liberal humanism, in which thought is considered independent and transferable like a ghost in the machine. This gap between human and machine virtualizations are collapsed through Lévy's concept of 'humanization as a process of virtualization' removes a similar gap between human and machine virtualizations. [4] The present development therefore sits within a larger philosophical scope in which body and virtuality are characteristically human.

After experiencing the first use of drawing in a digital medium with SketchPAD Ivan Sutherland's team can be paraphrased, saying they did not know they could draw in this way until they tried the system they had just built. [6] While in one sense they could have been expressing the joy every child can express when first drawing a line with paint-dipped fingers or colorful chalk, something profoundly different seems to have happened. Having developed a computer system for enhanced drawing, they facilitated the capacity to draw and redraw; adjusting and refactoring engineering style drawings with greatest ease. Where, previously, drawing required: rulers, protractors, calipers and careful marks, with complete redrawing or careful erasing to make adjustment, suddenly, humans had the capacity to directly manipulate drawings which could be pulled and stretched, dragged and instantly adjusted; the system provided immediate feedback allowing reflection and adjustment and resolution of the drawing through a far more direct extension of the human into the domain of the drawing. [5]

This is perceived, in this project, as a form of embodiment that has post-human characteristics; digital technical drawing was not able to be, until embodied by this new 'man-machine communication' form. Taking a post-human perspective, collaborative environments that use simple techniques to enable playful engagement in kinesthetic/synthetically are being developed. These have been deployed in performance spaces. Over time the goal is for these environments to be open for continuous public participation. Hence, through multi-modal interaction this project considers what emerging embodied realities and culturally-specific exchanges surface through the performers and participants' involvement with their own and each other's physical bodies, video mediations, 3D virtual world avatar moves and/or bio-environmental changes.

## DEVELOPING FOR EXPERIENCES THROUGH DESIGN

Tools for enabling these experiences have been developed and grown over a number of years. First a wireless heart rate and body temperature sensor system was developed. Biometric data is mapped to a local display, providing feedback to the performer of internal body state. In a second phase, pre-recorded motion captured from performers was translated into a form that could be used to animate an avatar in a game-like 3D virtual world platform. The process of translation distorted the animations. During the captures, performers were also quite challenged as they needed to relate to emerging dismemberment and deformations of the character's body and movements caused by the involuntary obstruction of the sensor spheres attached to their joints. This became a key, though unfamiliar, somatic component (Fig. 1). A hand-held controller interface was developed that allows adjustment of the point of view in the 3D virtual world as a dancer interacts with the avatars and the digital space.

The sense of presence in the 3D virtual world was enhanced by a web camera interface that integrates participants' movement to actuate animations of their avatar in the 3D virtual world (Fig. 2).

During performances data was queued and transmitted into the performance space, controlling colored lights and a smoke machine, while simultaneously causing effects in the 3D virtual environment (Fig. 3). In an additional mode video streams were captured at different simultaneous sites and streamed into the shared 3D virtual world, while participants engaged with live video projection of the virtual space (Fig. 4)

Fig. 1. Screen shot of deformation from motion captured session with two dancers.

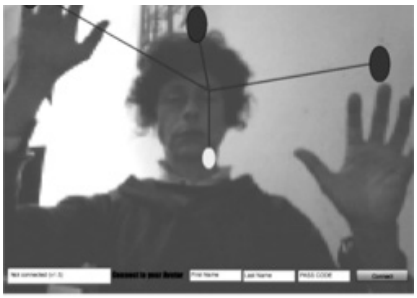

Fig. 2. Web camera interface actuating distorted movement in avatars.

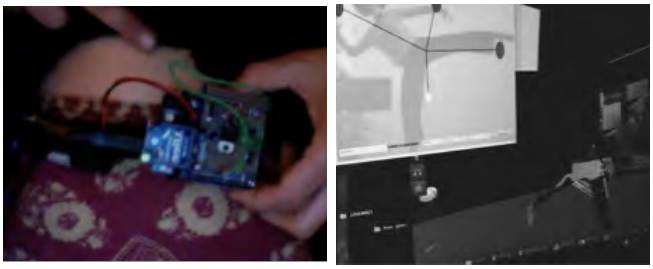

Fig. 3. Web camera interface actuating distorted movement in avatars.

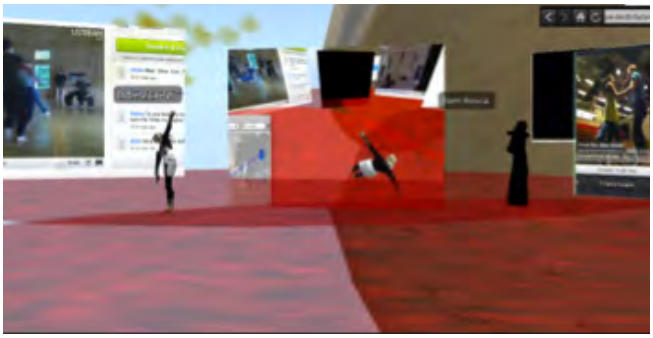

Fig. 4. Performance streams from three physical sites of practice, from within the virtual world.

Can we sense kinesthesis in dance through ripples in a pond? Following the previous modes we consider how we might sense kinaesthesis and integrate that sensing back in the accumulated experiences within the context of potential post human embodiments. Our thinking about kinaesthesis starts from a dance perspective by considering a person's sense of themselves in space, location and in relation to others as they go about daily activities. Kinesthesis is extended to a person's body or presence expressed in media, including both dynamic media such as presence in 3D virtual worlds and in terms of the artifacts they produce and manipulate.

Ways to sense people and places are in two broad categories: attaching sensors to the subject or through remote sensing. In both cases the data collected is subject to variation in conditions that are inherent in human movement and expression and the environments through which we move. For example, humidity effects galvanic readings, a person's body temperature range may change from hour to hour that being effected by the work they are doing, their natural cycles and the external environment. Hence we considered potential smart ways to deal with this variation. That led to exploring the potential of simple algorithmic systems that have the capacity to produce consistent results when the sampled data can undertake variation through pattern recognition. Once such system is the "perceptron algorithm" described by Frank Rosenblatt in 1957, a simple form of simulated neuron as cited by many, for example Ibraheem Al-Dhamari. [7] Such systems produce consistent results, however there is still a rigidity in them. Much later research has been working on recurrent networks that provide a context based on the current situation and historical situations, the liquid state machine (LSM) described in [8] is such a system. The behavior of the LSM is similar to water – having a large number of self-regulating and self-referencing, recurrently propagated and self-learned information. Since programming an LSM can potentially be computationally high and because water appears to behave like an LSM, Chrisantha Fernando and Sampsa Sojakka produced a pattern recognition system that included a bucket of water as a preprocessor for an array of perceptrons. The system was then trained to recognize spoken words. [8] When the water was included in the system the rate of successful recognition went from 60% to 80%.

We propose to reproduce the "pattern recognition in a bucket" experiment for sensed data, where pools of water provide a way to sense place allowing for contextual information to be integrated into the sensing of data from people and locations. A current and proposed embodied experience environment is depicted in figure 5. In the proposed system water or simulated water is used as a preprocessor for a system trained for a sensing a range of data. "Simulated water" is treated as a form a Monte Carlo approach allowing for a LSM effect using graphical animation software developed to give the appearance of water. In figure 6 we represent the simulated water as a kitten,

acknowledging Sergey Chikuyonok's implementation of Neil Wallis' system. The simulated water can be integrated into all existing systems. [9], Figure 7 depicts water as a direct sensor as an LSM equivalent, to produce a contextualized sensing system for movement into perceptron arrays trained to sense kinaesthesia. The ripples on the water are imaged following the approach taken in, effectively producing an image of an interference-like pattern. [8] The best way to train these open water pools is yet to be determined. We have a set of standard movements that we propose a dancer use as a starting point. However, it has been pointed out that a system that allows everyday people to train the system may produce more normative results.

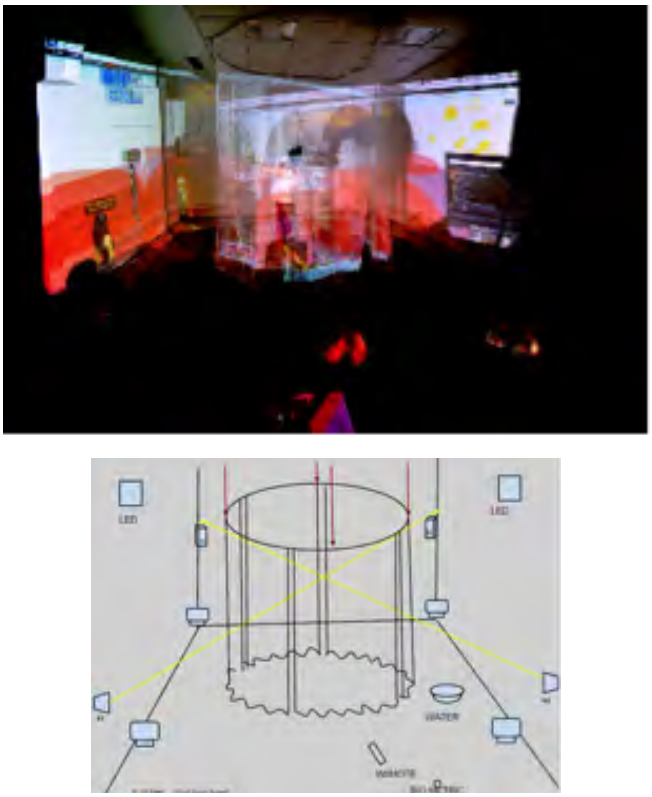

Fig. 5. A current environment and a depiction of a proposed embodied experience environment.


Fig. 6. Integrating simulated water with existing systems.

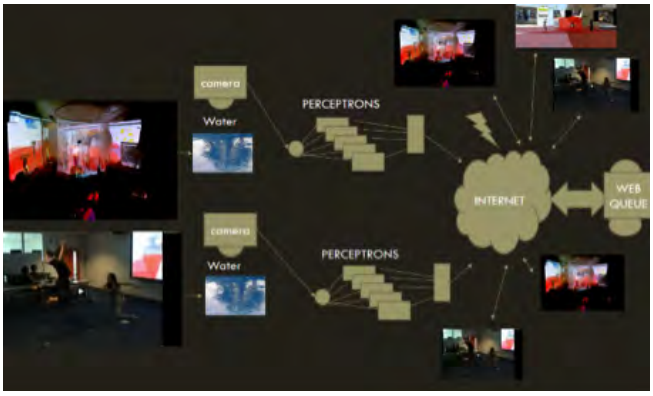


Fig. 7. Physical water as a direct sensing as LSM equivalent.

## SUMMARY AND CONCLUSION

Choreographed to encourage physical and perceptive awareness while interacting with other participants playing with avatars, these Senses Places environments aim to allow participants to engage with one or more interfaces at a time depending on their experience with game gadgets and mediation in general, as well as subjective factors. Thus, the physical-virtual convergence of bodies/senses and places is activated and altered by the participants' engagement through a combination of the interface systems. Meeting remotely to perform together in a more in-depth relationship with/through the interfaces, participants elaborate scores or structured improvisations, attuning with one another's images and/or avatars, places and times and emphasizing visual-somatic poetics.

Following and responding to each other's physicality, virtualities and environments, the performers' playful deconstructive dance is mediated from each node, also serving as an instigator and facilitator of physical and/or virtual audience participation, thereby enhancing opportunities to experience post human corporeality.Through these processes and their development we explore and develop systems that sense body movement and continue to pioneer ways to enhance our understanding of kinaesthetic sensing.

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