

Computational Model of Human Creativity in Dance Choreography



<http://cairo.cs.uiuc.edu/teleimmersion/>



<http://teleimmersion.citris-uc.org/>

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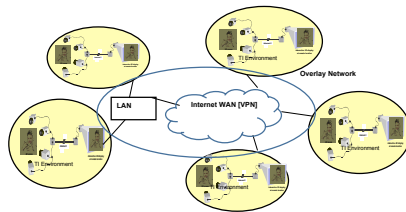
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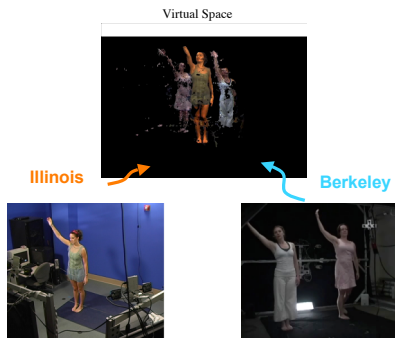
The Tele-immersive System Overview

3DTI environments are rooms with collaborative technologies where full bodies are immersed in real time into the 3D tele-immersive space. Integration and interactions with any other 3D data either synthetic or real 3D images are possible, and the body is free of typical virtual reality sensors and gear allowing the body to have full agency in the space.

The 3DTI room is created by a network of cameras that enable us to capture and reconstruct in real-time the three dimensional (3D) representation of the dancers within and between different rooms (Bajcsy and Jung, 2006). The network of cameras is connected via Gigabit Ethernet, and between individual rooms, the cameras are connected via Internet2 to move the 3D streams between the sites and allow dancers to meet in a 3DTI space (Yang et al. 2006) It is important to note that in the real system, each sender is also a receiver, hence dancers at each remote site not only produce video streams of themselves, but also receive video streams of the remote dancer, and see themselves in the same cyberspace (as projected onto a large screen) with the other dancer. This is referred to as the virtual meeting point.



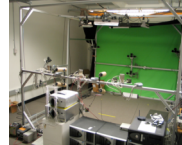
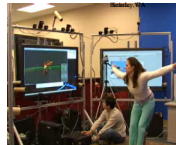
The Tele-immersive Lab Set Up



It is difficult to grasp the potential for tele-immersion without visually understanding the lab set up and how the participants are communicating in a virtual room.

TI in UIUC (Prof. Nahrstedt)

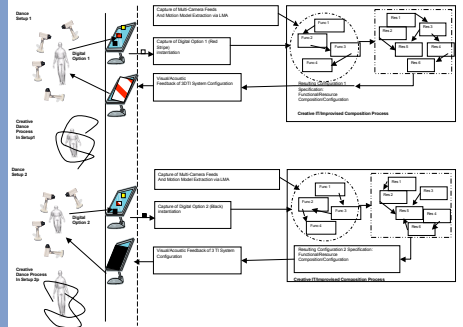
TI in UC Berkeley (Prof. Bajcsy)



Internet 2

Symbiotic Creativity Framework

We are presenting a Symbiotic Creative Framework, based on computational models of human creativity that consist of the creative process generated by the dancer, and the creative process that happens inside of the 3DTI system in response to the dancer and based upon available resources.

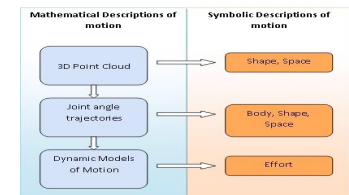


Modeling Dance Creativity

The fundamental element of the symbiotic creative framework is the computational model that strongly depends on the user dance modeling and motion analysis. The challenge of creating a symbiotic creativity feedback loop between the user and the computer is the ultimate goal in our long-term projected research.

Motion Analysis

The LMA movements of the dancer need to be recognized to drive the computational FSA. To achieve this goal, we use motion analysis in each 3DTI system. The fundamental assumption of the 3DTI system is that all sites are working in the same coordinate system. Furthermore, our geometric representation is centered on the dancer. On this data we apply kinematic analysis and dynamic motion models to automatically annotate the dancer's movements according to the LMA system. We fit a skeleton to the 3D point cloud representation of the dancer. The extraction of the skeleton provides us with raw kinematics data (position of the limbs, joint angles) which can then be used to extract higher-level features related to the LMA elements. Currently, we are experimenting with capturing the subtle element of LMA Effort life, which reflects the dynamic qualities of the movement and the inner attitude towards exertion. We use a dynamic motion model that allows us to model the control forces and torques exerted by the human body.



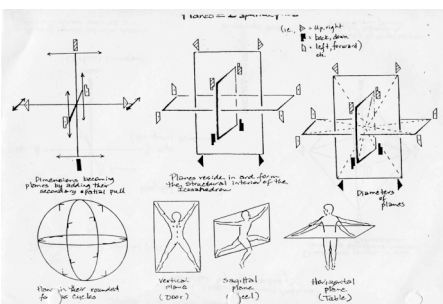
Funding Agency

This work was supported by the NSF IIS 0724464 grant 'Interactive Choreography in Tele-Immersive Spaces'.

Laban Movement Analysis (LMA)

Laban Movement Analysis (LMA) is a system used in the creative process of making dance and consists of four main categories. LMA offers a universally accepted and codified language that can be used analytically and prescriptively for all human movement. Broadly categorized into Body, Effort, Shape, and Space, LMA covers the full spectrum of human movement shapes, qualities, dynamics, and the communicative associations inferred by movement. Because LMA analyzes movement at multiple levels, the combination of different elements gives us a rich description of movement.

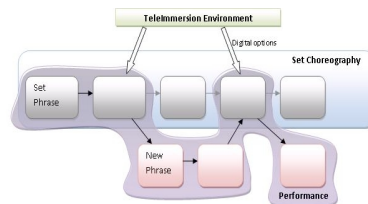
Body Effort Space Shape



The following diagrams from the notes of Irmgard Bartenieff depict the LMA Space Category and the Coordinate System in which LMA occurs.

LMA Based Computational Model

The choreography used within this project consists of a series of composed dance phrases. Each phrase represents three temporal states: the beginning is characterized by the initial body shape and relationship of the body in the 3D space; the middle is characterized by the body in motion; the end is characterized by the final body shape and relationship of the body in the 3D space. While the beginning and the end phrases consist of states representing body location and shape, the middle state is represented by motion equation/transformation. The computational representation of choreography is a finite state diagram (FSA) which seamlessly cycles from beginning, middle, to end. Ultimately, the digital options which are invoked will dynamically change the resulting dance phrases.



Digital Options

We experiment with different digital options that support and influence the creative process of dance making. The digital options are functions, enable at a certain point, that modify the virtual space and the dancers within it.