Computational Model of Human Creativity in Dance Choreography

Abstract

Dance choreography is a system of techniques used to create new dances. Creating a new dance requires choreographer/dancers to engage with inner motivations to express feelings as well as to dialogue with the external environment, whether that be visual, aural, tactile, or kinesthetic environmental stimulus on a stage or in a laboratory. The choreographer devises body movements using internal and external cues to express feelings and concepts, from the most abstract ideas to very concrete human situations in a highly creative manner. Choreography is simultaneously deeply abstract and physical. Imagine a moment when a dancer enters into a 3D tele-immersive (3DTI) room surrounded by multiple 3D digital cameras and displays, where internal and external cues for creative movements come not only from physical objects in the 3DTI room, but also from a remote dancer who is placed in geographically-remote 3DTI room and appears in a joint virtual space with our dancer. Suddenly the choreographer has exponentially more options to create new body movements in the new dance since the 3DTI technology offers an array of visual stimulations called *Digital Options* which influence this movement making process. Random, nondeterministic behaviors found within this new dance-making process interact with the distributed 3DTI system initiating different functional and data configurations and compositions; a creative interactive feedback loop between the expressive art of making dances and the more dynamic capabilities of the Information Technology allows the unexpected, random, at least non-deterministic (behaviors as the distributed 3DTI system changes and works with different functional and data configurations and compositions.

In this work we investigate (a) how to map and represent one aspect of a dance choreographer's creativity in relationship to the 3DTI technology, and (b) how the computational and compositional framework within the 3DTI digital system itself will react to the dance choreographer's creativity with a set of creative and dynamic compositions and configurations. This response consists of new and different functional and data elements that inject their own level of "creativity" by returning visual/acoustic clues to the dance choreographers.

The mapping process of dance creativity into the 3DTI technology is based on the system of *Laban/Bartenieff Movement Analysis (LMA)*. The major principles of LMA rely on the belief that the human body moves through the space in dynamic constantly changing patterns. Through the use of a series of complex symbols, which represent the major principles within the system, a dancer utilizing LMA can record and analyze dance movements, developmental movement patterns, gestures, postural shifts, etc. It is a systematic method for describing qualitative changes in movement and body adaptation within space.

We investigate *computational models of LMA inside the 3DTI system* in the form of geometric point clouds and subsequently extracted geometric features and dynamic motion models so that then the manipulation of LMA symbols and the overall internal IT creativity process can occur inside the 3DTI system. The 3DTI system offers the dance choreographer digital options, e.g., changing a virtual space background, enabling flying artificial objects through the virtual space, or scaling some of the dancers to small or very large size, in the common virtual space which will allow the dance creator to either stay in the same movement sequence, or change the flow of the dance. The digital options within the 3DTI system will represent control points for the dance choreographer to interact with non-deterministically. The challenges of creating computational models for LMA are (a) creation of geometric/spatial configurations and dynamic motion models/representations in real time via point clouds collected from multiple 3D cameras, and (b) manipulation and updates of geometric/spatial configurations and motion models as the speed of the dance changes. The internal IT creativity process, executed through instantiation of digital options, will be modeled via the *compositional framework.*

In summary, in this project we 1) explore the creative process of dance choreography through LMA representation via computation models in the 3DTI technology, 2) explore a compositional framework in the geographically distributed multi-stream, multi-party 3DTI environment, and 3) evaluate and measure the creativity via the analysis of the graph(s) created in terms of the LMA symbols and their connectivity(pathways), as well as the underlying functional and resource compositional graphs. The LMA-corresponding computational models and the compositional framework are the foundation for the 3DTI system to create its own "creative execution" via dynamically configured functional and data sets, guided by choreographers via digital options. We are conducting extensive user studies to validate the overall creative intelligent system for supporting human creativity in dance choreography.