Tour Jeté, Pirouette: Dance Choreographing by Computers

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Abstract. This project is a "proof of concept" exercise intended to demonstrate the workability and usefulness of computer-generated choreography. We have developed a framework that represents dancers as individualized computer objects that can choose dance steps and move about on a rectangular dance floor. The effort begins with the creation of an agent-based model with the Swarm simulation toolkit. The individualistic behaviors of the computer agents can create a variety of dances, the movements and positions of which can be collected and animated with the Life Forms software. While there are certainly many additional elements of dance that could be integrated into this approach, the initial effort stands as evidence that interesting, useful insights into the development of dances can result from an integration of agent-based models and computerized animation of dances.

1 Introduction

Dance might be one of the most egoistic art forms ever created. This is partly due to the fact that human bodies are highly unique. Moreover, it is very difficult to record dance movements in precise details, no matter what method one uses. As a result, dances are frequently associated with the name of their choreographers, who not only create but also teach and deliver these art forms with ultimate authority. Such tight bonds between a dance and its creator gives the impression that dance is an art that can only be created by humans.

Indeed, creativity is one of the human traits that set us apart from other organisms. Random House Unabridged Dictionary defines creativity as "*the ability to transcend traditional ideas, rules, patterns, relationships or the like, and to create meaningful new ideas, forms, methods, interpretations, etc.*," With the ability to create, humans

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carry out the creation process in many different ways. One avenue is trial-and-error. It starts with an original idea and imagination. Through the process of repeated trying and learning from the failure, those that are unknown previously can be discovered and new things created.

Is creativity a quality that belongs to humans only? Do computers have the ability to create? We approach this question in two steps. First, can computers have original ideas and imagination? Second, can computers carry out the creation process?

Ideas and imagination seem to be something come and go on their own that no one has control over. Frequently, we heard artists discussing about where they *find* their ideas and what can *simulate* their imagination. What is computers' source of ideas and imagination? One answer is "randomness"; computers can be programmed to generate as many random numbers as needed. Such random numbers can be mapped into new possibilities of doing things, hence a source of ideas and imagination.

Creation process is very diverse in that different people have different approaches. For example, some dance choreographers like to work out the whole piece first and then teach them to their dancers. Others prefer working with their dancers to generate new ideas. Which style of creation process that computers can have? One answer is trial-and-error; computers can be programmed to repeat an operation as many times as needed. By applying such repetition to new/old ways of doing things, new possibilities can be discovered.

When equipped with a source of ideas and a process of creation, computers seem to become creative. This also suggests that computers might be able to create the art forms of dance. We are interested in computer-generated choreography and the possibility of incorporating that with human dancers to create a new kind of stage production. This paper describes the project and reports the progress we have made so far.

We started the project with a conversation with professional dancers and choreographers about their views of computer-generated choreography. Based on the discussion, we selected two computer tools (Swarm and Life Forms) for the project. We then implemented the "randomness" and "trial-and-error" abilities in the Swarm computer software to generate a sequence of dance steps. The music for this dance is then considered and selected. With a small degree of improvisation (according to the rhythm of the music), we put the dance sequences in animation. The initial results are then shown to a dance company's artistic director. The feedback is very encouraging, although the piece needs more work to be able to put into production. All of these lead us to conclude that computer-generated choreography can produce interesting movements that might lead to a new type of stage production.

The Swarm code: http://lark.cc.ku.edu/~pauljohn/Swarm/MySwarmCode/Dancer. The Life Forms dance animiation: http://www.improvise.ws/Dance.mov.zip.