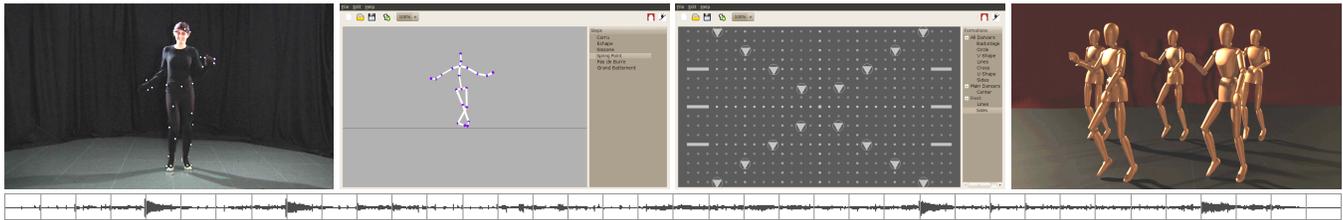# ChoreoGraphics: An Authoring Environment for Dance Shows

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1 Motivation

Novel graphics technologies have had a great impact on the movie industry, allowing the combination of real actors with virtual ones that are synthesized from captured performances. Although applications of these resources in other media have so far been little explored, recent trends indicates that artists will soon begin to use them creatively to produce new visual effects in dance shows, concerts, musicals and other spectacles. An important research direction that will allow this revolution to, in fact, take place is the development of authoring environments that serve as a bridge between artists and the emerging technologies.

The intention of this work is to adapt existing methods for leveraging MoCap data to the context of creating dance content from artistic input and propose an authoring and collaboration platform for dance shows that integrates the creative elements that compose a choreography. In this way, we indicate how graphics technologies can be used not only to facilitate creation but also to suggest new forms of artistic expressions.

2 Overview

We propose a platform for designing content of dance shows which covers all elements of the creative process and promotes the interaction of dancers, musicians and choreographers.

The dancer's movements are acquired from a MoCap setup and organized in a variation of a motion graph [Kovar et al. 2002], which is *structured* and *measure-synchronous*. We create a *measure-synchronous* graph by capturing the movement of the dancers while they perform to specific music pieces and by using the synchronization between music and dance to segment the motion data according to the melodic phases. We then annotate the motion segments according to the dance steps they represent to create a *structured* graph (this can be done manually or using one of the many existent automatic methods). Although the purpose of this segmentation is to facilitate the combination of motion sequences in an application that makes extensive use of musical references, this structure can also be explored for motion editing. In this work, we take advantage of this structure for interpolating movements, for combining upper and lower body motions, for allowing rotations, and for inserting amplitude variations and time warpings to make the group dance more natural.

While the music's rhythm determines the duration of the steps and guides the segmentation of the motion, its melody is used to determine control signals that should be synchronized with motion events. These signals can either be extracted from a selected music and used as a reference to guide the dance or can be iteratively edited by both the musician and the choreographer in a scenario where the show is designed in a collaborative effort of both artists.

We propose an intuitive interface for choreographers that integrates the contributions of the dancers and the musicians. The interface is based on a timeline which describes the musical measures and events. The choreographers can thus determine both the combination of the dance steps for each performer and the group motions, i.e, the way the dancers move on stage creating formations and following trajectories. Group motions can be specified in three ways: still formations (shape and pattern specifications), boundaries (initial and final formations that are matched following an optimization rule with collision control), and evolution rules (an initial position followed by a specification of consecutive movements). Evolution rules can be declarative (e.g., a sketch of a trajectory on stage) or based on simulation and control mechanisms. In this work we explore behavioral animation methods [Reynolds 1999] that allow dancers to follow attraction/repulsion forces, avoid neighbors and obstacles, spread out on the stage, etc. An interesting aspect of the latter approach is that we can use musical events to guide the procedural control signals, creating effects that would not be trivially specified by a declarative method.

3 Discussion

We propose an authoring environment that can both be used as a mechanism to synthesize virtual performances and as a tool to assist the planning of dance shows, allowing design and visualization of full motion sequences. Though it is highly applicable in conventional shows, guiding the artists through conception, production and execution, it also suggests a new paradigm for creation. In offering an integrated platform, this work promotes a new form of collaboration between the artists, allowing the show to naturally evolve from iterative contributions of dancers, musicians and choreographers. Future direction of this research should also integrate the contributions of the art director, such as staging and lighting.

Other interesting applications of this framework and its extensions are "on stage" productions and improvisations, which would join efforts from choreographers, dancers and musicians in real time. An example of this would be a performance that combines live and virtual dancers projected on stage, whose movements are guided by the combination of different artistic inputs. In such scenarios, the artists would be able to influence not only the virtual dancers' movements, but also one another through a framework of instant feedback.

References

Kovar, L., Gleicher, M., and Pighin, F. 2002. Motion graphs. In *SIGGRAPH '02*, ACM, New York, NY, USA.

Reynolds, C. 1999. Steering behaviors for autonomous characters. In *Game Developers Conference*.