

Recording Kinect-Based Choreography

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The motivation for our project is to provide choreographers with a new software and hardware tool for composing and recording multi-dancer choreographies from a single dancer. We use a Microsoft Kinect camera/sensor to record 3D point-cloud sequences of a dancer in motion. In a 3D point-cloud, or *sequence*, a grid of 640x480 infrared dots are projected by the Kinect sensor, and a sensor records the position of these points in space and the (x, y, z) coordinates of each point are computed and recorded 30 times a second in a movie. The body of a dancer intersecting with the projected infrared dots create a 3D moving in space. When viewing this human surface on the computer, the viewing point can be chosen to be different from the point where the original kinect stood during the recording.

The sequences can be merged with live captures to create a multi-dancer choreographic effects, or even reversed while merged. The beginning and end of the merging action is totally under the control of the user. This is a powerful tool for choreographers, as it allows them better control over the timing and sequencing of various parts of their choreography, and even allows them to reverse recorded sequences for a rewind-effect. Furthermore, the 3D point-cloud captured by the Kinect sensor allows choreographers to view their piece from almost any view point, including impossible view points (such as from under the stage). This, in effect, creates a glass stage. Furthermore, tagging the different points of a sequence when merged with another sequence allows the software to generate different effects for different dancers, as illustrated in Figure 1.



Figure 1: Separate visual effects for merging of two different sequences.

Our code is based on Daniel Shiffman's Processing application [1], which generates real-time point-clouds captured by a Kinect sensor. While other researchers have used the Kinect sensor in the world of dancing. Alexiadis *et al.* [2], for example, uses Kinect to compare live performances to a recorded one used as gold standard, or Essid *et al.* [3] uses Kinect to record dancers and create avatars of the dancers that evolve live in a virtual worlds, our research focuses on capturing dance movement and creating artistic movies that can be replayed from any virtual viewpoint, either by themselves, or with live dancers performing in front of the movie shown as backdrop.

Then latest developments in the project have focused on providing an effective and friendly GUI for the user, mostly allowing them to easily record and play back Kinect videos. Our code also supports the concatenation, trimming, and overlapping of videos sequences, and individual frames can be tagged as "starting points" to mark the beginning of an overlap of sequences. Through the merging of individual sequences, the 3D information – including location and the video source of the sequence – is maintained, so that the virtual view-point can be manipulated by the user on the resulting sequence. Moreover, live feed from the Kinect can be merged in real time over prerecorded choreography, allowing dancers to interact with previously recorded movies of themselves.

The first version of this tool was used to create an abstract dance film (<http://tinyurl.com/inky2012>). It combines real-time shots with technologically generated choreography. This film was selected for screening at the FRAMEWORKS dance film series in New York City in February 2012. Work on this project is continuing, primarily in the development of our GUI.

References:

- [1] Daniel Shiffman, Getting started with Kinect and Processing, from <http://www.shiffman.net/p5/kinect/>, captured 2/16/12.
- [2] Alexiadis *et al.*, Evaluating a dancer's performance using kinect-based skeleton tracking, in *Proc. 29th ACM Int'l Conf. Multimedia*, New York, NY, 2011.
- [3] Essid S., *et al.*, A multi-modal dance corpus for research into interaction between humans in virtual environments, *J. Multimodal User Interfaces*, March 2013, V. 7, N 1-2.