BLENDING ART AND SCIENCE TO CREATE *COLLAPSE (SUDDENLY FALLING DOWN)*

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Abstract

Understanding the collapse of natural and social systems is a key artistic and scientific endeavor. By collaborating on a multimedia dance-theatre production, we contributed individual approaches, techniques, and insights to a performance that captured both cultural and scientific aspects of collapse in an aesthetically meaningful way.
Keywords: LiDAR, dance, collapse, motion capture

The multimedia dance-theatre production *Collapse (suddenly falling down)* [1] emerged from collaborations among scientists and artists exploring the collapse of systems. It began with parallel discussions about creating a work addressing social and ecological collapse, and exploring how 3D visualization techniques could be used for artistic purposes. A commission from the Mondavi Center for the Performing Arts for the Sideshow Physical Theatre company provided an opportunity for these nascent collaborations to see fruition in production. The commission was part of the UCDavis Creativity Project exploring the nature of human creativity and included a week-long residency by the Merce Cunningham Dance Company.

Much like the work of Cunningham, diverse elements of *Collapse* were developed largely in isolation, including T-LiDAR [2] imagery of disasters, a motion capture-based interaction system, music, sound and lighting designs, dance vocabulary and spoken text. A pre-show piece coupled visual representations of chaotic attractors and sound [3]. The dynamic set design echoed the theme of collapse, with a tree that slid across the stage, a reconfigurable island stage, and a wall of two foot white boxes that tumbled down during performance. Breaking with the Cunningham tradition, the artists and scientists used ten intense days of tech rehearsal to integrate these diverse elements into a cohesive whole.

Three art-science collaboration themes emerged during the production: 1) theatre-scale display of 2D and 3D images; 2) aesthetic exploration of natural hazard T-LiDAR data sets; and 3) integration of optical tracking for interaction between performers and visualizations in a Theatre-scale display.

Theatre-scale Display

Shared artistic and scientific goals for *Collapse* were to fill the audience's visual field with scientific imagery, some of it in 3D. Two high-power projectors, a 16' x 9' polarizing preserving screen, and polarized glasses for the audience provided a 3D display environment. Because the screen did not fill the audience's visual field, two additional projectors were used to extend 3D images in 2D across the rest of the stage, using the stacked white boxes as a screen. This provided a total image that was approximately 60' x 20'.

T-LiDAR Projections

T-LiDAR data represent point reflections from a laser precisely located in 3D space. We visualize each reflection as a small placard [4]. When viewed from a distance, objects appear solid, but they break into a cloud of individual placards when viewed closely, yielding a pointillist effect. The scans also contain holes where foreground objects cast laser shadows on the objects behind. This fractured feel contributed significantly to the aesthetic of *Collapse*. Specific T-LiDAR scenes were chosen from USGS studies of collapsing of natural systems.

Movement enlivens the 3D nature of the scenes, providing stunning visual design. Camera "fly-throughs" of each scene were choreographed to highlight key elements, provide insights into collapse and match the desired emotional and aesthetic feel for their positioning in the production. These fly-throughs were co-designed by artists and scientists, and the scientists were struck with how artistic views of their data changed their understanding of the scenes.

Interaction

Scientific work in KeckCAVES [4] has revealed that real-time interaction with data promotes insights that would be otherwise missed. To share this with the audience and to provide a tangible connection between performers and the visualizations, an optical motion tracking system was developed for real-time interaction [5]. It tracked markers held by performers in two scenes.

In the first scene, a dancer walked out to the front of the stage and opened her hands to reveal a reflective marker in each. These allowed her to control a T-LiDAR image of Waikiki Beach. Moving them in unison panned the scene, and moving them around each other rotated the scene. Slowly, she lifted the scan of Waikiki Beach showing the front half-shell of a lone bather. Gently she rotated the scene back and forth, gradually building to a frenetic dervish dance, spinning the entire beach around the silhouetted woman, creating a dizzying sixty foot wide display across the theatre (Figure 1). The second interactive scene provided a moment of stillness. A dancer used a marker attached to his hand to draw a house and tree on the 3D projection screen behind him, echoing key motifs in the show.

Fig. 1. A dancer manipulates visualized LiDAR scans. (© Michael Neff.)

Conclusion

Collapse was a complex production and bringing various elements together required collaboration, goodwill and understanding from all involved. In turn, it showed how scientific insights could be used to strengthen artistic ends without dominating them. It also led both the scientists and artists involved to understand their work in new ways.

References and Notes

1. Collapse received the 2009 Isadora Duncan Award for Visual Design. Videos of the performance are available at http://youtube.com/collapseucd

2. T-LiDAR (Tripod-Light Detection and Ranging) is a ground-based laser ranging that creates a three-dimensional image of a scanned area.

3. Crutchfield, J.P., D.D. Dunn, and E. Puckett, companion paper.

4. Kreylos, O., G.W. Bawden, and L.H. Kellogg, 2008. Immersive Visualization and Analysis of LiDAR Data, Lecture Notes in Computer Science, Proceedings of ISVC08. Kreylos, O., 2008. Environment-Independent VR Development, LNCS, ISVC08. Software available at http://keckcaves.org

5. Twelve Vicon MX 40+ cameras were used for motion capture. A driver developed for the show passed marker locations to the visualization software and filtered spurious data.