Reactive

Daniel Shiffman*
Interactive Telecommunications Program, New York University

1 Overview

Can an image *behave*? In other words, if a digital image is a visual representation of colors (i.e. pixels) on a grid (i.e. screen or piece of paper), what if each element of this grid were able to act on its own? A series of experiments in answering these questions led me to create *Reactive*, a live video installation that amplifies a user's movements with exploding particle systems in a virtual space. Inspired by Karl Sims' *Particle Dreams*[1], each pixel of the image captured by a video camera is represented as a set of particles with each particle *reacting* to the movements of the viewer.

2 Image Processing in Three Dimensions

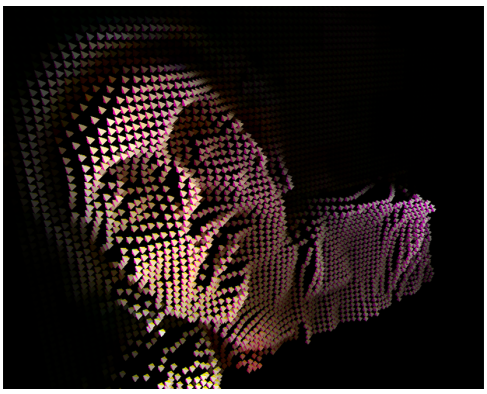

Fig. 1: 2D image represented in 3D space.

Reactive began as an experiment in taking a digital image and mapping each pixel in a three-dimensional space. Figure 1 shows an early experiment created with openGL. A low-resolution image (80x60 pixels) is mapped to a grid of 2400 pyramid shapes, each colored according to RGB values from the source image, and each with a "z-axis" position according to that color's brightness. Suddenly, this still image manifests itself as a floating particle system with a one-to-one relationship between pixels and particles. *Reactive* resulted from mapping full motion video onto a particle system like the one above, and applying various behaviors to each particle according to changes in color values over time.

3 Particle Mirror

The term "particle system" was coined in 1983 by William T. Reeves as he worked to create the "Genesis" effect at the end of the movie, *Star Trek II: The Wrath of Khan.* "A particle system is a collection of many many minute particles that together represent a fuzzy object. Over a period of time, particles are generated into a system, move and change from within the system, and die from the system." [2]

In *Particle Dreams*, Sims modeled complex phenomena, such as snowstorms, waterfalls, and a "Self-Breathing Head," by applying behavior rules to thousands of tiny particles. My goal with *Reactive* was to create a similar effect in real-time by building a viewer's image out of particles and to allow the viewer's actions to control the individual behaviors of each particle.

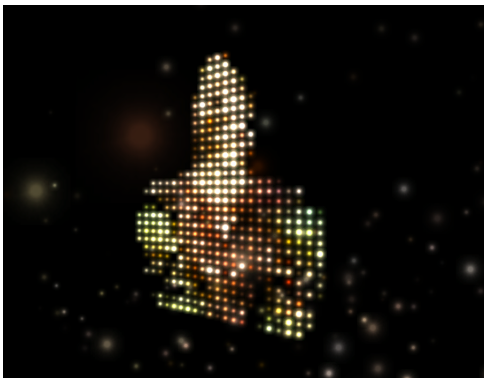

Fig. 2: *Reactive* screenshot – still viewer.

The resulting artwork is a real-time, interactive experience that questions how we define, deconstruct, and display digital images. In Figure 1 above, the viewer's image is represented as a low-resolution grid of particles (each pixel is displayed as 10 particles layered on top of each other).

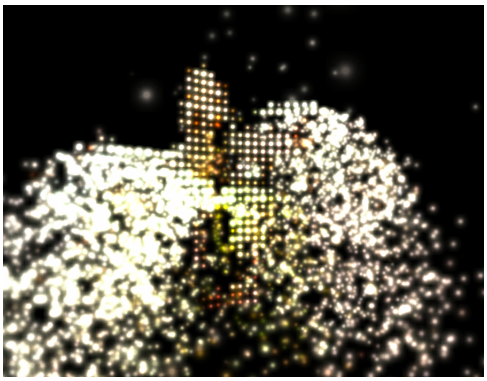

Fig. 3: *Reactive* screenshot – viewer in motion.

As the viewer moves, particles are released from their original orientation according to the viewer's actions. Each particle flies towards the viewer, and the sensation is that of wiping away one's image (see Fig. 3).

* daniel@shiffman.net, http://www.shiffman.net

[1] SIMS, K. 1990. Particle Animation and Rendering Using Data Parallel Computation. In *Computer Graphics (Proceedings of ACM SIGGRAPH 90)*, *24*, 4, ACM, 405-413.

[2] REEVES, W.T. 1983. Particle Systems: Technique for Modeling a Class of Fuzzy Objects. In *Computer Graphics (Proceedings of ACM SIGGRAPH 83)*, *17*, 3, ACM, 359-376.