

Swarm

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1 Overview

Swarm is an interactive video installation that implements the pattern of flocking birds (using Craig Reynold's "Boids" model) as a constantly moving brush stroke. Taking inspiration from Jackson Pollack's "drip and splash" technique of pouring a continuous stream of paint onto a canvas, *Swarm* smears colors captured from live video input, producing an organic painterly effect in real-time.

2 Action Painting

Before the 19th century, visual artists, as exemplified by the "Old Masters," worked painstakingly to create dramatic three-dimensional illusions underneath the flat surface of a canvas, allowing the viewer's eye to travel inside the picture. The age of photography and the ability to easily reproduce photorealistic imagery opened doors for modernist painting, which rebelled against the tenants of the Old Masters and treated the flat surface as its greatest asset, its one element that makes pictorial art unique from any other form.

In the 1950s and 60s, abstract and conceptual artists went one step further and rejected figurative or narrative work entirely, making the process of generating the art itself primary. Harold Rosenberg, in his essay "The American Action Painters" writes, "At a certain moment the canvas began to appear to one American painter after another as an arena in which to act--rather than as a space in which to reproduce, re-design, analyze, or "express" an object, actual or imagined. What was to go on the canvas was not a picture but an event."¹

Research in the field of computer graphics has followed a similar path. Just as the Old Masters created 3D illusions, computer generated imagery in video games and cinema is often almost indistinguishable from photos taken in nature. "The driving force behind computer graphics for the past 35 years has been photorealism. The quality of images created using a computer is judged by how closely they resemble a photograph. Images are rendered by running a physics-simulation which emulates the behavior of light inside the modeled scene. The term photorealistic rendering is used to describe this type of computer graphics technique."²

Non-photorealistic rendering ("NPR"), however, is a new field of computer graphics research which attempts to apply the techniques of visual artists to computer generated imagery. "In NPR images are instead judged by how effectively they communicate. . . NPR involves stylization and communication, usually driven by human perception. Knowledge and techniques long used by artists are now being applied to computer graphics to emphasize specific features of a scene, expose subtle attributes, and omit extraneous information to give rise to a new field."³

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¹ ROSENBERG, H. 1952. The American Action Painters, *Artnews*. In *Modern Art in the USA*, 150-53.

² GOOCH, B. and GOOCH, A. 2001. *Non-Photorealistic Rendering*. A.K. Peters, 1.

I developed *Swarm* out of a desire to build my own simple NPR system, one that could run in real-time, rendering 30 frames per second of live video. Rather than simply create a new image processing filter, I wanted the interactive system to emulate the techniques of American Action painters, and make visible the generative process itself. To do this, I needed to find a generative system of motion to "paint" colors on the screen that had an organic, life-like quality. The system I chose was Craig Reynold's "Boids" system.

2 Flocking Painters

A flock of birds, swarm of bees, or school of fish all exhibit intriguing and beautiful group behaviors. At first, these systems appear to be centralized with members of the group following one leader creature. Instead they come to life via each individual following simple rules for local interaction. Craig Reynold's system is a model for implementing these rules computationally for computer animation. "The aggregate motion of the simulated flock is created by a distributed behavioral model much like that at work in a natural flock; the birds choose their own course. Each simulated bird is implemented as an independent actor that navigates according to its local perception of the dynamic environment, the laws of simulated physics that rule its motion, and a set of behaviors programmed into it by the "animator." The aggregate motion of the simulated flock is the result of the dense interaction of the relatively simple behaviors of the individual simulated birds."⁴



Screenshot of Swarm

Swarm is implemented as a system of 120 boids following the rules outlined by Reynolds. In my system, each boid looks up an RGB color from its corresponding pixel location in the live video stream. If the viewer stands still, his or her image will be slowly revealed over time as the flock makes its way around the entire screen. If the viewer chooses to move during the process of painting more abstract shapes and colors can be generated.

³ GOOCH, B. and GOOCH, A., 1-2.

⁴ REYNOLDS, C. W. 1987. Flocks, Herds, and Schools: A Distributed Behavioral Model. In *Computer Graphics (Proceedings of ACM SIGGRAPH 87)*, 21, 4, ACM, 25-34.