



# BODY PAINT

Real-time Digital Painting with Motion Capture

Cassandra Ichniowski | Senior Design

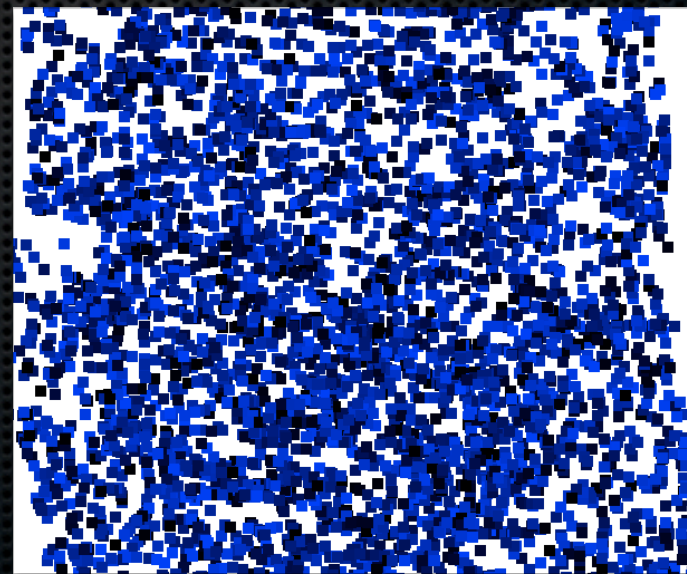
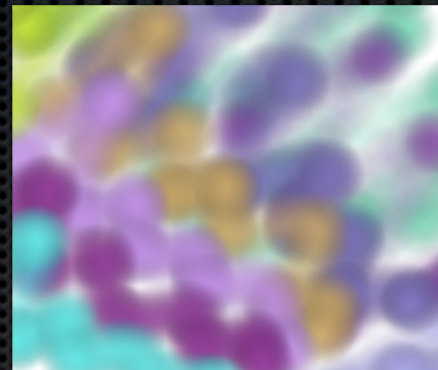
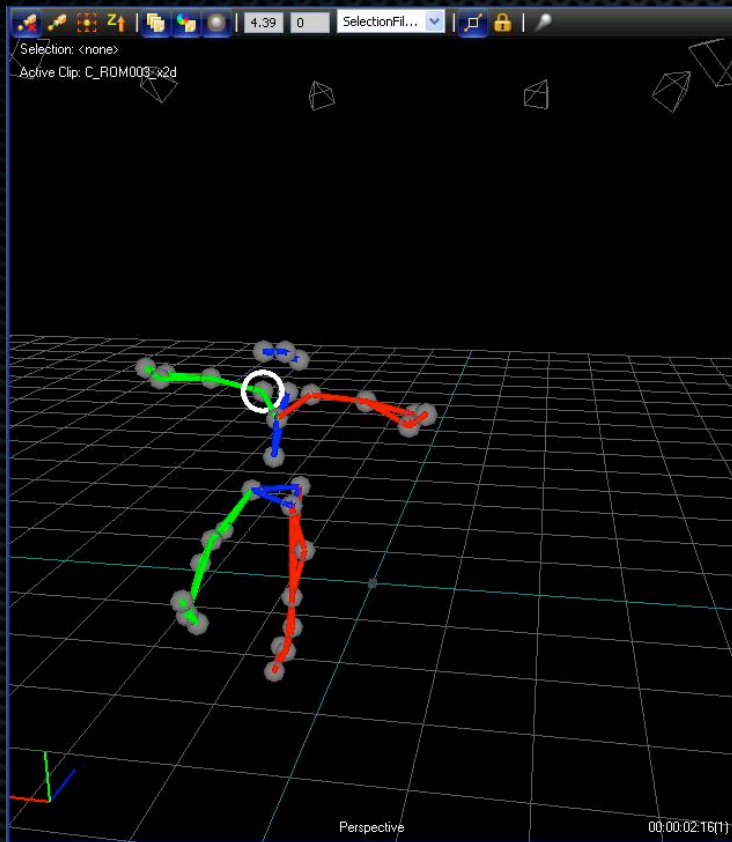


# Dance, Mo-Cap, & Graphics

- ✦ Interactively create a virtual painting in real time from dance using the Vicon motion capture system
  - ✦ Improvised performance art
  - ✦ Generating backdrops to use in later performances
  - ✦ Planning atmosphere for performance



# Overview



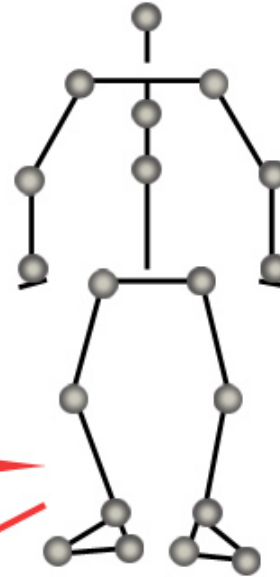


# Related Work

- 1985: San Francisco Ballet's "Pixellage" using an Aurora 100 videographics workstation, Darryl Sapien created animated backdrops relating to pieces choreographed by Betsy Erikson. Some complimented pieces, while others provided props and interacted with the live dancers.
  - F. Crow and C. Csuri, *Music and Dance Join a Fine Artist and a Paint Machine*. IEEE Computer Graphics and Application, pp. 11-13, 1985.
- DigitalBeing: an ambient intelligent environment using pressure and physiological sensors to control lighting and projected light imagery to project the dancer's arousal state
  - Magy Seif El-Nasr and Thanos Vasilakos. *DigitalBeing: an Ambient Intelligent Dance Space* .

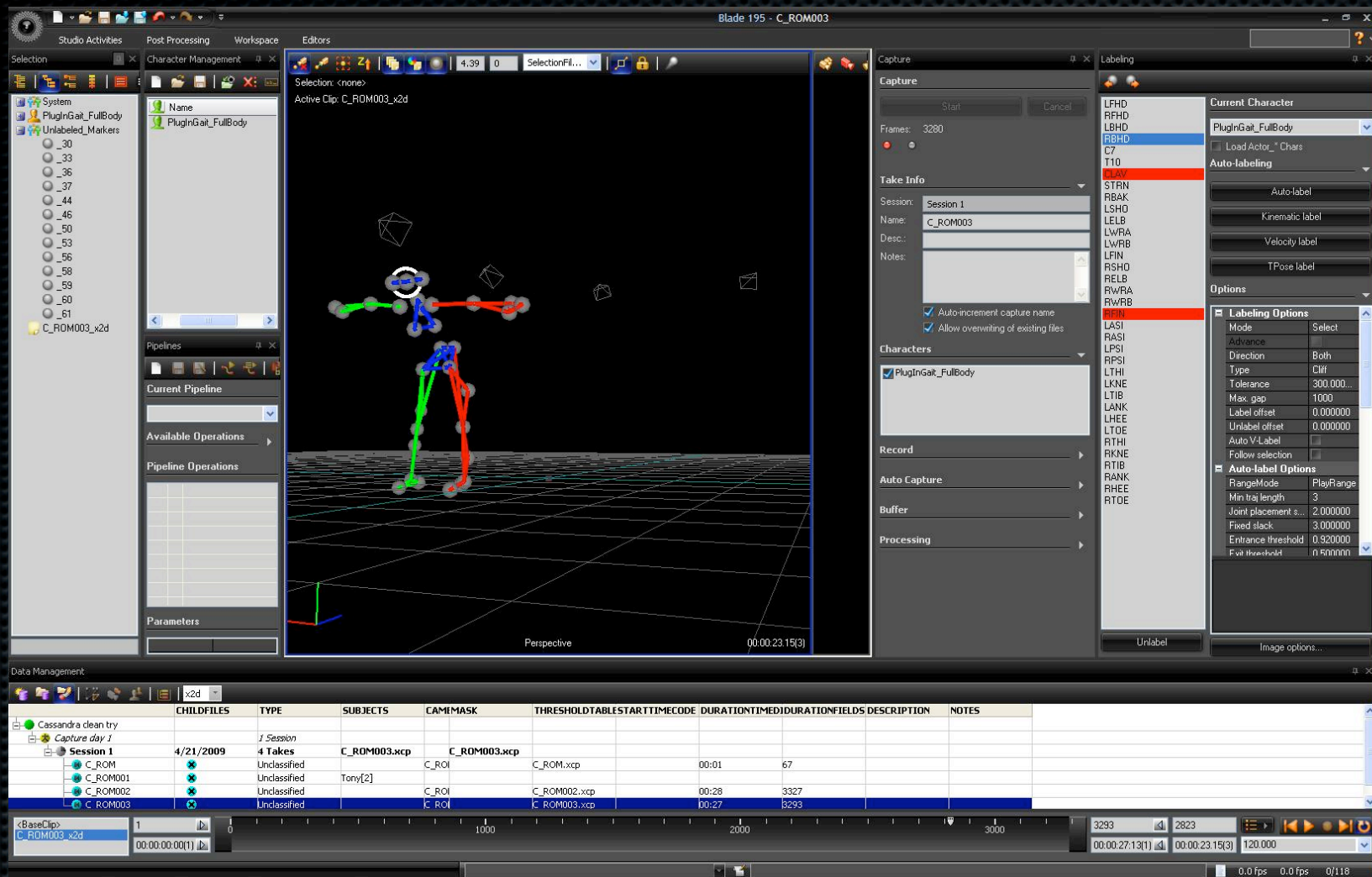


# OVERVIEW



5	-554.4143	20.64133
6	-596.244	49.57842
7	-430.8454	-20.91483
8	-374.684	-60.96157
9	-628.6105	-39.1553
10	-446.8915	154.9754
11	-442.9143	271.4127
12	-451.0745	311.3223
13	-462.3891	317.7682
14	-409.9991	204.2796
15	-461.8405	342.2488
16	-486.0468	267.6412
17	-555.4429	-138.7922
18	-627.4448	-210.8626
19	-687.7206	-238.7719
20	-709.5269	-250.2236
21	-620.7932	220.8743





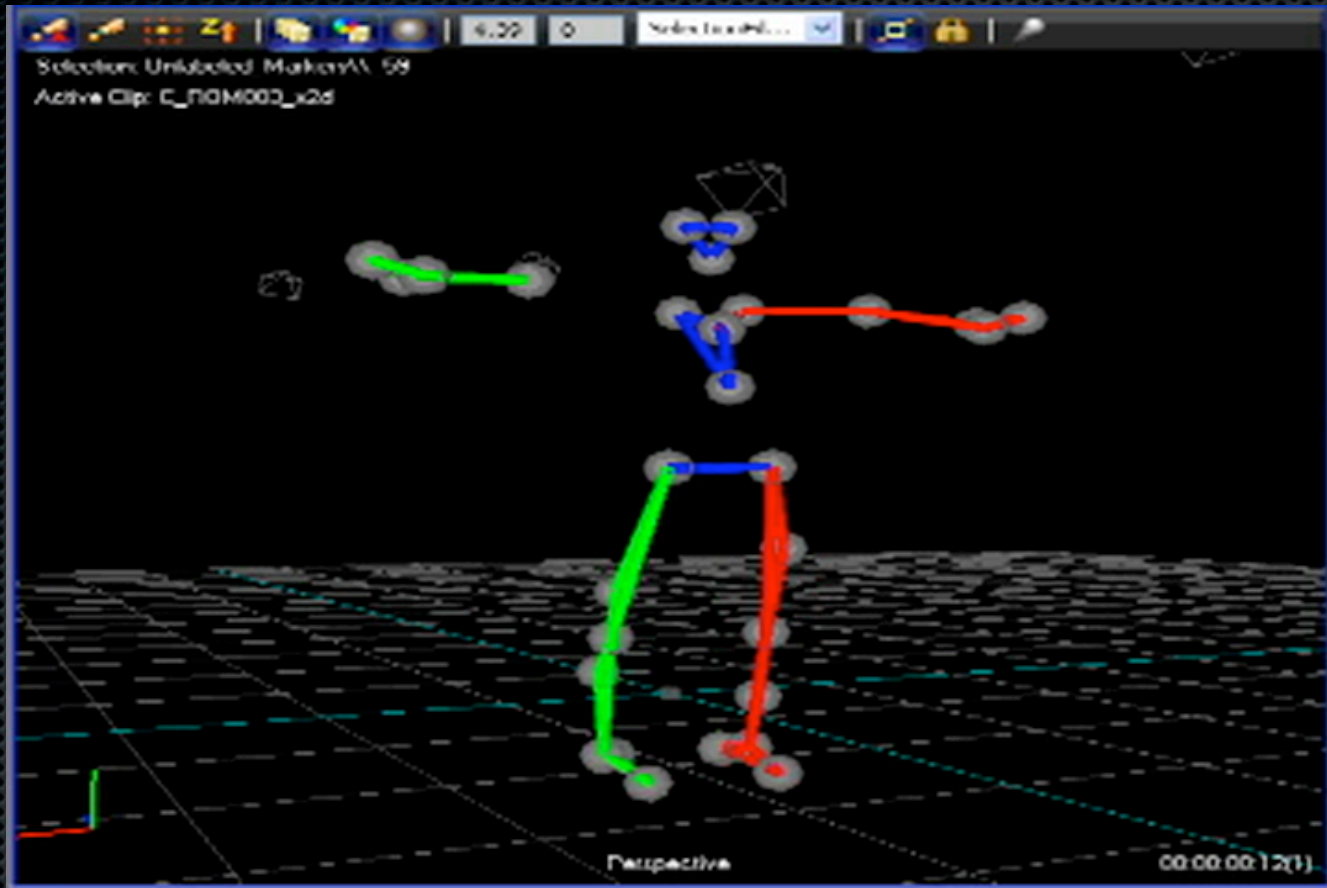
# Vicon Blade



# Real Time Engine

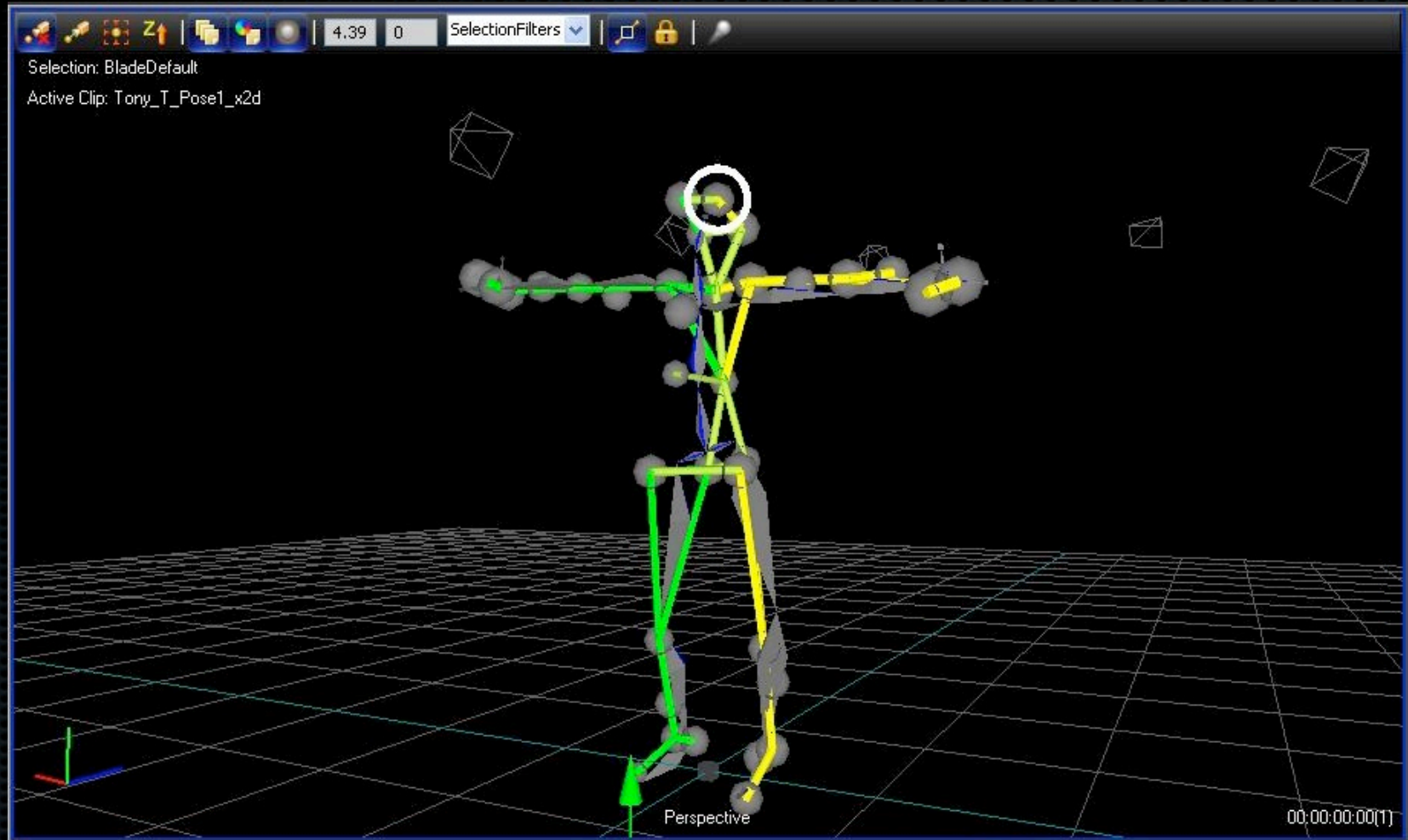
- Blade has a built-in RTE which outputs marker positions and joint angles in real time
  - Configure a skeleton to a captured ROM
  - Turn on RTE and change to solve data
  - Connect to RTE on port 801\* using altered ExampleClient
  - Request data from RTE
  - MoCap data is stored in markerPositions and bodyPositions vectors
  - Use data in your application!





Range of Motion





# Processing ROM

Constraint RIHAND\_R\_Wrist has no parameters. Its offset will not be altered by calibration.



# Character Calibration

- The character calibration operation determines the following information based on the .vst file:
  - the length of the bones of the actor
  - the constraint offsets of the markers (determines where the markers are actually placed on the actor)
  - the preferred pose of the bones
  - the joint range of the bones
  - the marker covariance

from "Calibrate a VSK File for an Actor" in Vicon Blade Help 1.5.195



# Vicon Issues

- ✦ Flickering or lost markers even with increased strobe intensity
- ✦ Bad automatic labeling and solving
- ✦ Errors loading skeletons - only loads BladeDefault
- ✦ Errors calibrating characters
- ✦ Errors receiving packet and packet type when requesting Info from RT Server



# Basic Brushes

Pencil



Calligraphy



Chalk





# Advanced Brushes

Ink



Airbrush



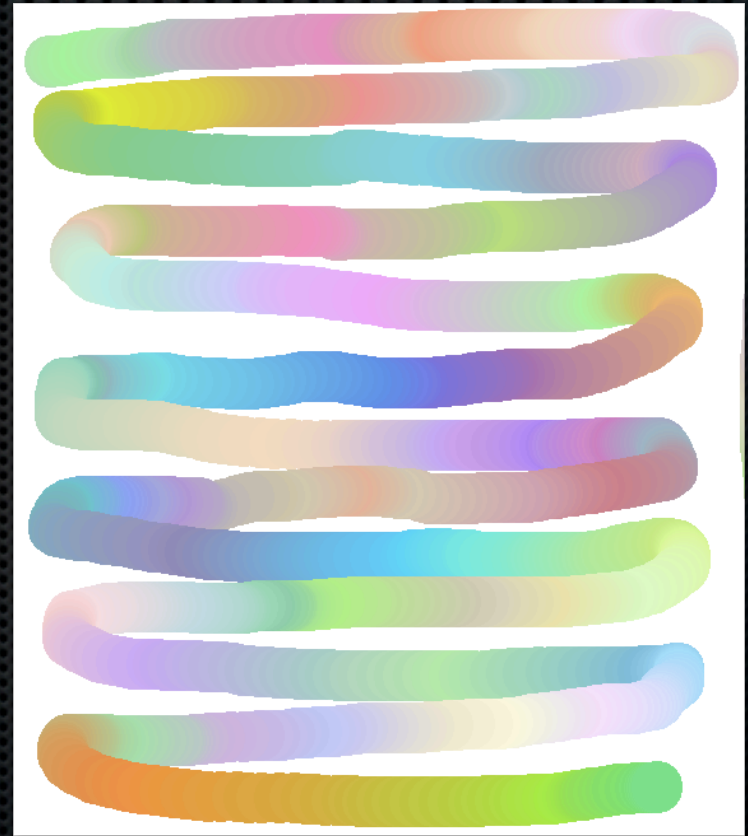
Pointillism





# Color Variance

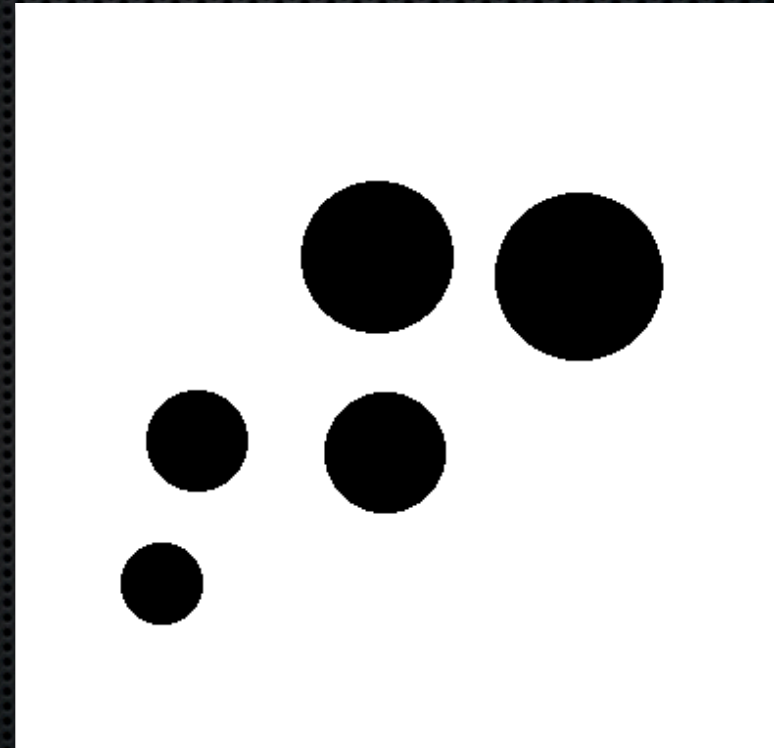
Randomly selects next color  
Increments or decrements  
RGB values until reaches  
next color





# Ink

Dynamically adjust  
brush radius as a  
function of velocity







Detail from *Bambus* by Hsü Wei



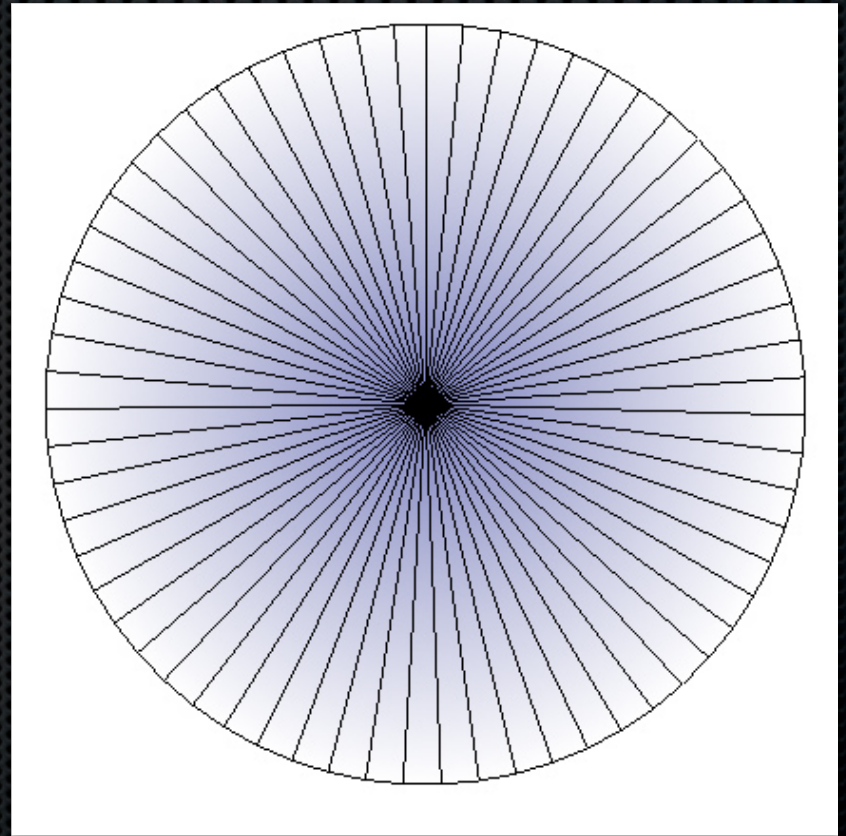
# Ink

Dynamically resize brush with velocity



# Airbrush

Draws a triangle fan  
with alpha channel .3 in  
center and 0 at edges



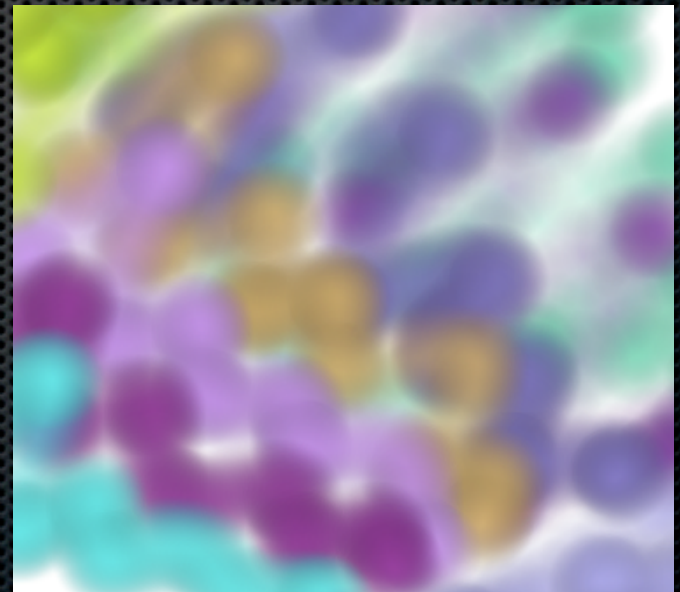
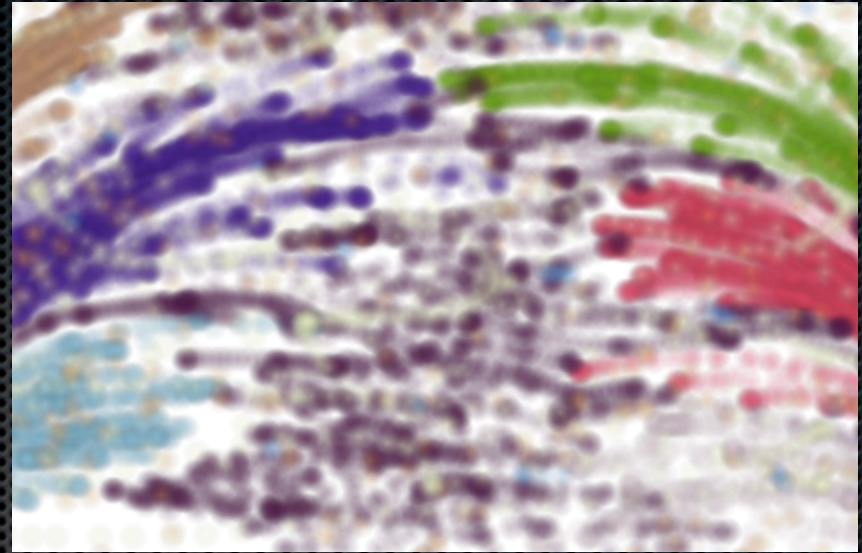




[http://cache1.bigcartel.com/product\\_images/1763304/Etsv8.jpg](http://cache1.bigcartel.com/product_images/1763304/Etsv8.jpg)

# Airbrush

Fading to transparent using alpha channels

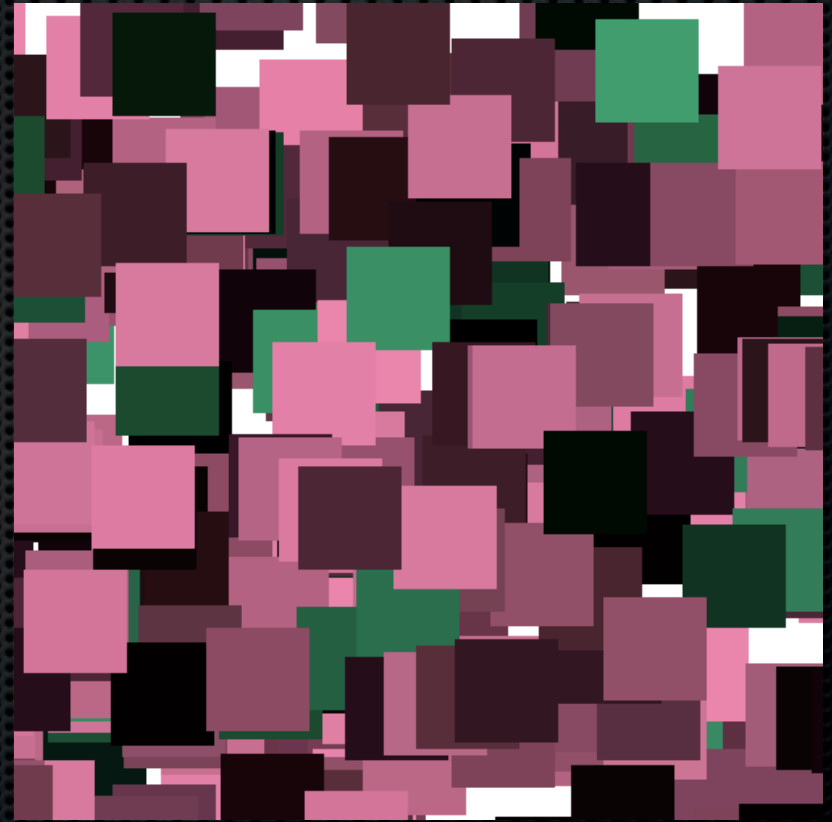




# Pointillism

Draws random-value square at a random location within the radius

Draws complementary color as well for 1/5 of the squares



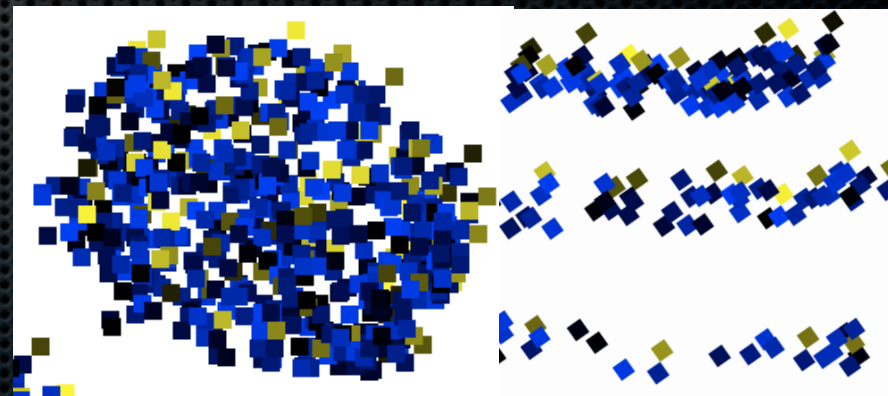
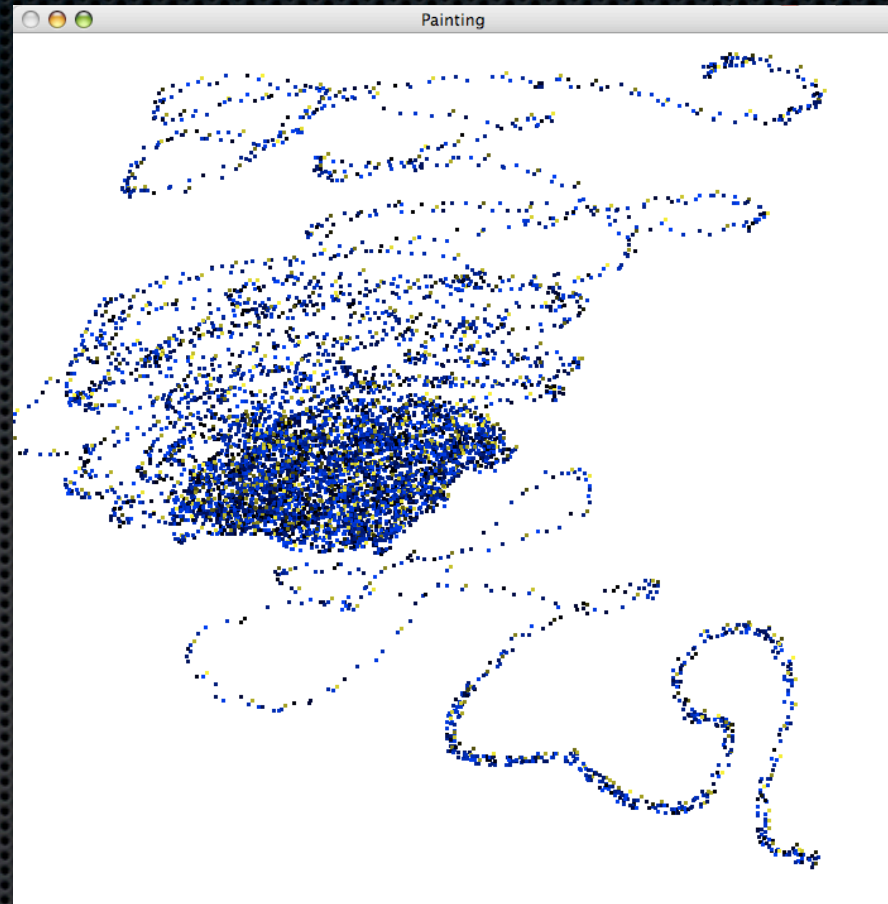




Detail from *La Parade* by Georges Seurat

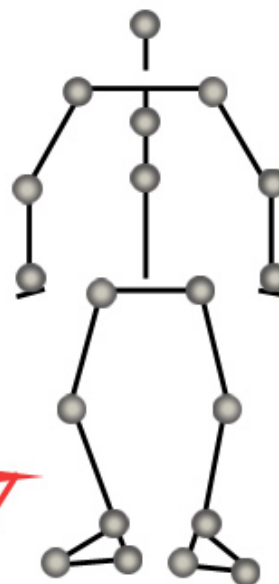
# Pointillism

Randomized hue and location within radius and occasional complementary colors

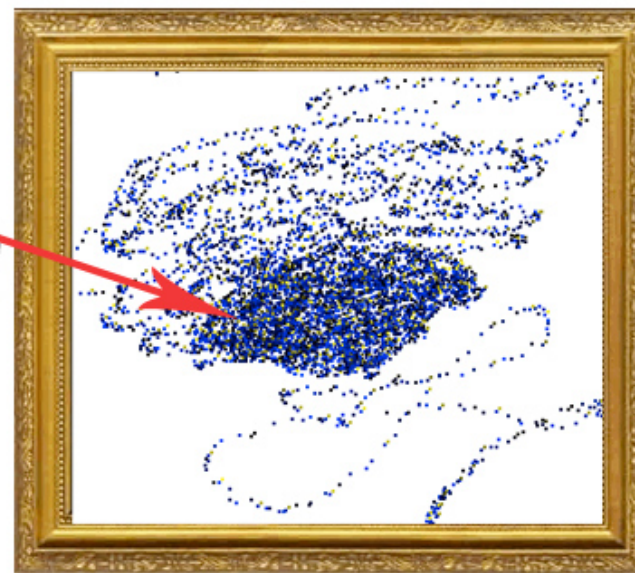
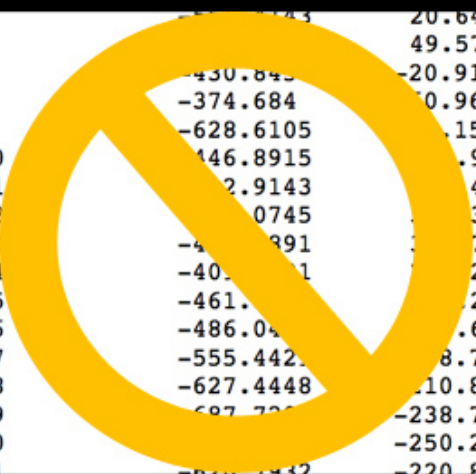




# CURRENT STATUS



5		20.64053
6		49.57842
7	-430.845	-20.91483
8	-374.684	0.96157
9	-628.6105	.1553
10	146.8915	.9754
11	2.9143	.4127
12	.0745	.3223
13	-.991	.7682
14	-40.1	.2796
15	-461.	.2488
16	-486.04	.6412
17	-555.442	.8.7922
18	-627.4448	.10.8626
19	687.72	-.238.7719
20		-.250.2236
21		.220.8743





# Contributions

- ✦ Troubleshooting Vicon/Blade problems
- ✦ Captured Range of Motion
- ✦ Progress on connecting to Vicon in Real-Time
- ✦ Painting program with various brushstrokes
- ✦ Color variance and interpolation



# Future Work

## ✦ Vicon Blade

- Get a skeleton to map and calibrate to subject correctly
- Create a new, simpler end-effector skeleton; load and calibrate correctly

## ✦ Real Time Engine

- Continue troubleshooting bad type and packet from received data

## ✦ Painting

- Restructure to take in (x,y) from real-time marker data
- Intelligently adjust color based on input velocity: cool colors for slower motion; warm colors for faster motion



# Tools & Languages

- Vicon Motion Capture Systems
  - Blade and Real Time Engine
- C++, OpenGL, GLUT



# Live Demo of Painting





# Questions?

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