Body Paint

Real-time Interactive MoCap software to paint graphical images with dance and body movement

CIS 499 SENIOR PROJECT DESIGN DOCUMENT

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PROJECT ABSTRACT

Over the last couple decades, many dancers, graphics artists, and computer scientists have explored some of the potential applications of computer graphics and animation to the creation, education and performance of dance. Body Paint is a real-time interactive motion-capture program where a dancer will get immediate "feedback" on her movements in the form of a 2-dimensional virtual "painting." The dancer has a variety of options: the quality of the stroke (oil paints, charcoals, or ink, etc.), the view of the "painting," and the way the mapping is generated. Other factors, such as color and weight of the stroke, will be interpreted by the algorithm and based solely on her movement. When performing with Body Paint, not only will the dancer's movement influence the developing image, but the image will in turn influence how the dancer continues moving and uses the performance space.

Project blog:
http://cassandrai.wordpress.com

1. INTRODUCTION

Body Paint will interactively create a virtual painting based on the physical properties (path, velocity, acceleration, and angular velocity) of the movements of the dancer. The default process will do a "conventional" painting – movements will map to a "canvas" at the front of the space. Ideally, there will be two other mappings: a painted "forest" where the motions will be traced and marked in place, with strokes applied, and a moveable cross-section will be projected; and a footwork painting, which only paints from the motion of the footsteps on the ground. These strokes will be selected at the beginning of the piece from a small group: oil paintbrush, ink/calligraphy, and charcoal/pastel. These may also be changed in the resulting painting after the fact. The color of the medium will be interpreted based solely on these properties, although the spectrum can be limited t the dancer's specifications.

1.1. Significance of Problem or Production/Development Need

Body Paint is an ultimately artistic tool helping choreographers and dancers intelligently create an ambiance or setting for a piece, rather than imposing an atmosphere. It can be used in performance, choreographed or improvised; or, the dancer can create a painted backdrop to be used for future performances elsewhere.

1.2. Technology

Vicon Motion Systems, C++, OpenGL, projection system, and possibly some windowing/GUI system as yet undecided.

1.3. Design Goals

Our project will address what.

1.3.1 Target Audience

Dance performances generally include some sort of performance environment, with lighting, scrims, painted flats, and occasionally set pieces. Body Paint is a tool for choreographers or solo dancers to create an interesting 2D backdrop for their piece. It can be created during the performance (in theory), recorded to play later, or used as a planning tool for creating the atmosphere (eg, projections and lighting).

1.3.2 User goals and objectives

Users will suit up in the MoCap suit and perform a pre-choreographed or improvised piece. They have control over the style of mapping (conventional, “forest,” or footwork) and the style of the stroke (paintbrush, ink, or pastel). They can alter the staging or choreography of their piece based on the movement or simply allow the algorithm to interpret the pre-choreographed piece.

1.3.3 Project features and functionality

The dancer has the following options, which have been mentioned before:

- Style of mapping (conventional, “forest,” or footwork)
    - Within the painted forest option, cross-sectional view plane
- Style of the stroke (paintbrush, ink/calligraphic, or pastel/charcoal)
- Subspectrum of colors included in painting

2. Prior Work

As early as 1985 in the San Francisco Ballet’s “Pixellage,” computer graphics have been used to generate backdrops for dance performances. Using an Aurora 100 videographics workstation, Darryl Sapien created animated backdrops relating to the

pieces choreographed by Betsy Erikson. Some complimented pieces, but others provided props and interacted with the live dancers. [1]

3. PROJECT DEVELOPMENT APPROACH

3.1. Algorithm Details

Algorithms used will predominantly be related to creating various strokes (I realize now I have failed to properly investigate this area. Ideally, more by Sunday.) These strokes will be fairly standard (e.g. paint brushstroke, ink/calligraphic, charcoal/pastel) however, I may try to tweak them some to belie more naturalistic layering. I am still investigating the literature on this topic.

3.2. Target Platforms

3.2.1 Hardware

Vicon Motion Capture system, projection display

3.2.2 Software

OS: Windows (whatever the MoCap and projector are hooked up to)

3.3. Project Versions

3.3.1. Project Milestone Report (Alpha Version)

- A couple of stroke algorithms in full working condition
- A working piece or two of stroke applied to motion data as conventional painting and graphic forest
- A working introduction and prior work review for the final paper
- Color algorithm relating qualities of motion to hues

3.3.2. Project Final Deliverables

- Fully operable real-time rendered 2D “graphical” painting from MoCap data software
- Several viewing planes, including: conventional “painting” view where all motion is traced to the “front” of the area and layered based on time, like in real world painting; a painted “forest” where motions are tracked with lines with the strokes applied to them; and, time willing, a footwork view, optimized to showoff and use information from the footsteps to create a more pointillist piece.

- User Interface allowing choice of stroke, switching between the aforementioned views, navigating among the painted forest, and more control over colors.

4. WORK PLAN

I'm doing a solo project, so I will be working on everything. 4.1/4.2 and 4.3 seem slightly redundant when also considering 3.3, so 4.1 and 4.2 are repeats of 3.3

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4.3 Project timeline

I. Additional Research
1. Graphical renderings of strokes: ink/calligraphy, oil paintbrush, charcoal, etc.
2. Continue reading dance + computer graphics papers, esp. ones with MoCap or ones using graphics as environment/ambiance for performance
3. Familiarize myself with interpretation of MoCap data and physical data (i.e., velocity, acceleration and angular velocity)

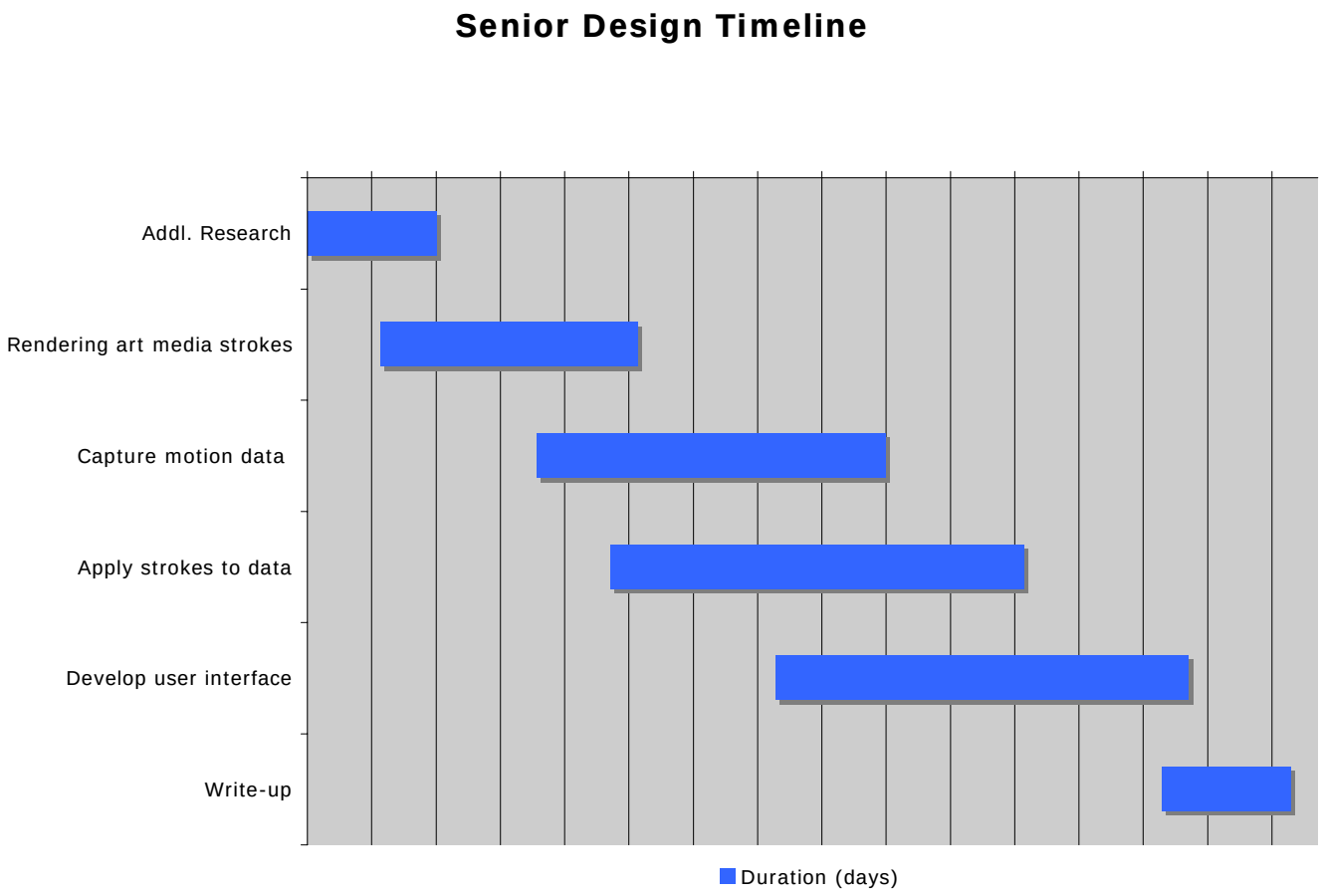
II. Rendering art media strokes
1. Implement algorithms on adapting strokes
2. Potentially modify to give a more realistic, layered appearance

III. Capturing motion data
1. Capture a variety of sequences in a motion capture suit
2. Begin applying "tracers" on the movement to consider where user has been
3. Develop algorithm based on speed/quality of movement to output a color value

IV. Applying strokes to data
1. Apply stroke algorithms to tracers

V. Develop User Interface
    1. Develop camera movement system
VI. Write-up

4.4 Gantt Chart



5. REFERENCES

[1] 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.

[2] El-Nasr, Magy Seif and Thanos Vasilakos. “DigitalBeing: an Ambient Intelligent Dance Space,”

[3] Meador, W. Scott, Timothy J. Rogers, Kevin O’Neal, Eric Kurt, and Carol Cunningham. “Mixing Dance Realities: Collaborative Development of Live-Motion Capture In a Performing Arts Environment.” ACM Computers in Entertainment, Volume 2, Number 2, April 2004.