

Learning Analytics and Player Fluency in Open-world, Non-competitive Video Games

Mario Ezekiel Hernandez, Applied Mathematics and Studio Art

Department of Mathematics, College of Natural Science, Texas State University

Emmett & Miriam
McCoy
College of Business Administration

Introduction

Video games require an array of complex cognitive skills. The implicit learning goals in unstructured digital play environments, also known as video game “sandboxes,” can provide a powerful medium for interactive learning.

How can we develop learning assessment tools that are sensitive to a variety of diverse and potentially unknown learning pathways?

This project presents an exploratory analysis of player behaviors in a non-competitive drawing video game.

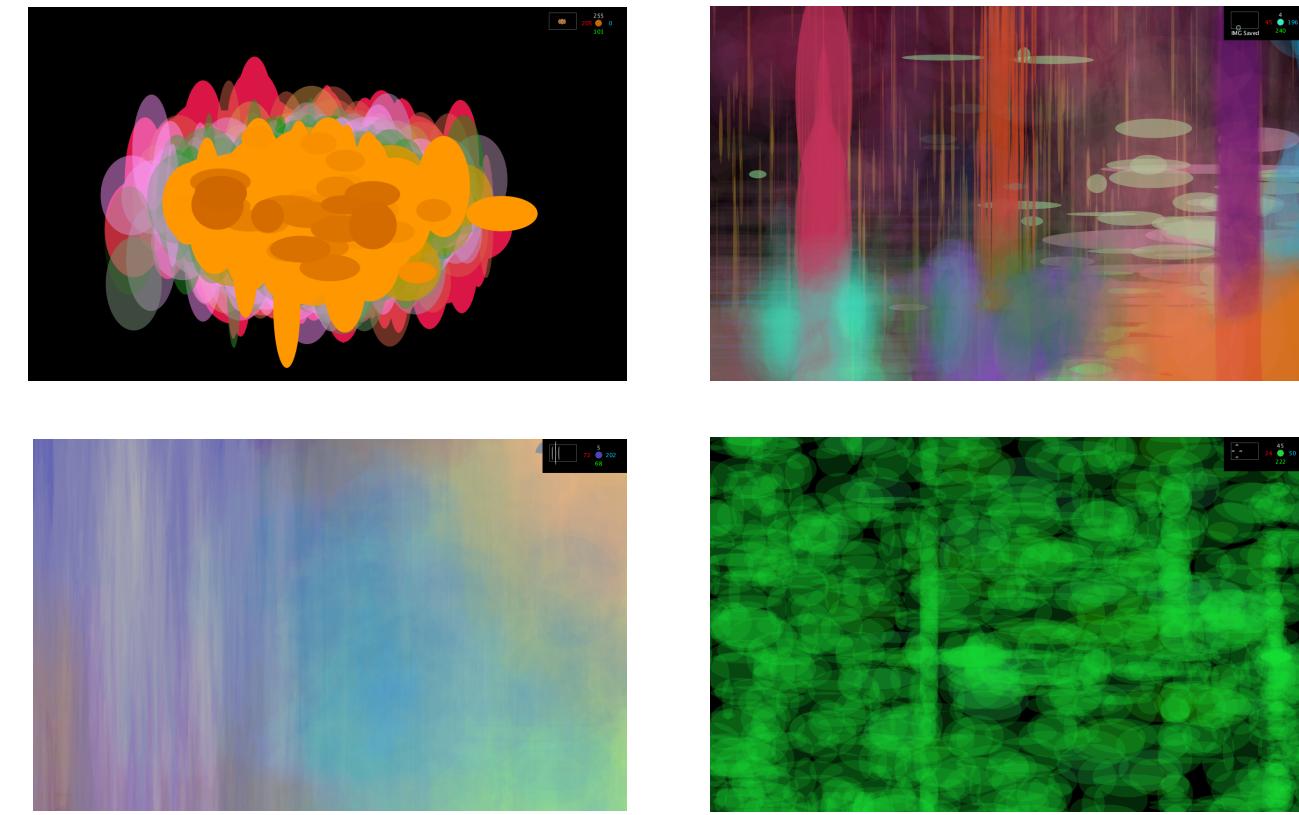
Background

In order to collect the necessary biometric data, existing game software was adapted to capture the required behavioral dimensions.

Game Description

Gamepad Gaussians is a digital art sandbox for exploring cause and effect relationships through the use of a video game controller and open-world environment.

Players explore the game by creating abstract images which respond to the manipulation of variables such as color, size, position and dispersion.

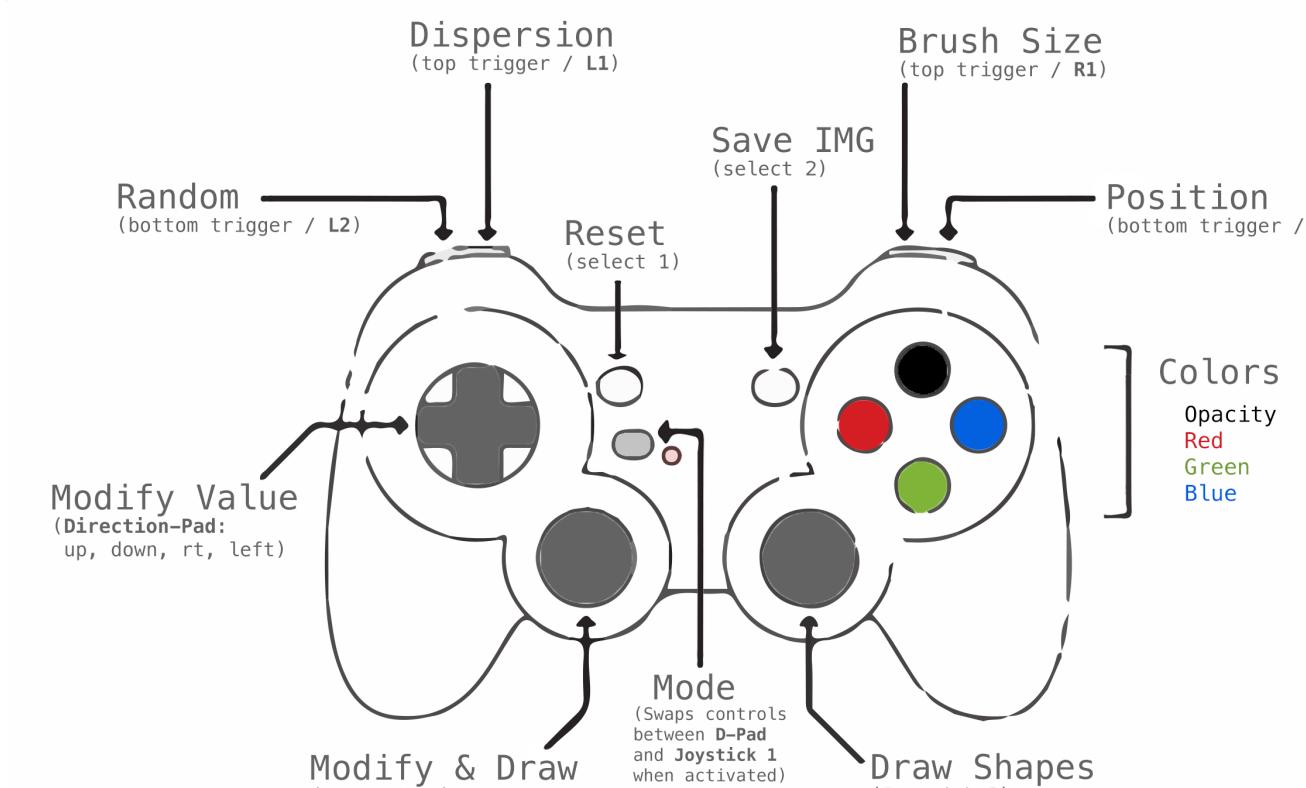


Motivation

Developing methods to facilitate pattern recognition in high resolution behavioral data has the potential to positively impact fields such as **information security**, **user research**, and **education**.



Gameplay Data



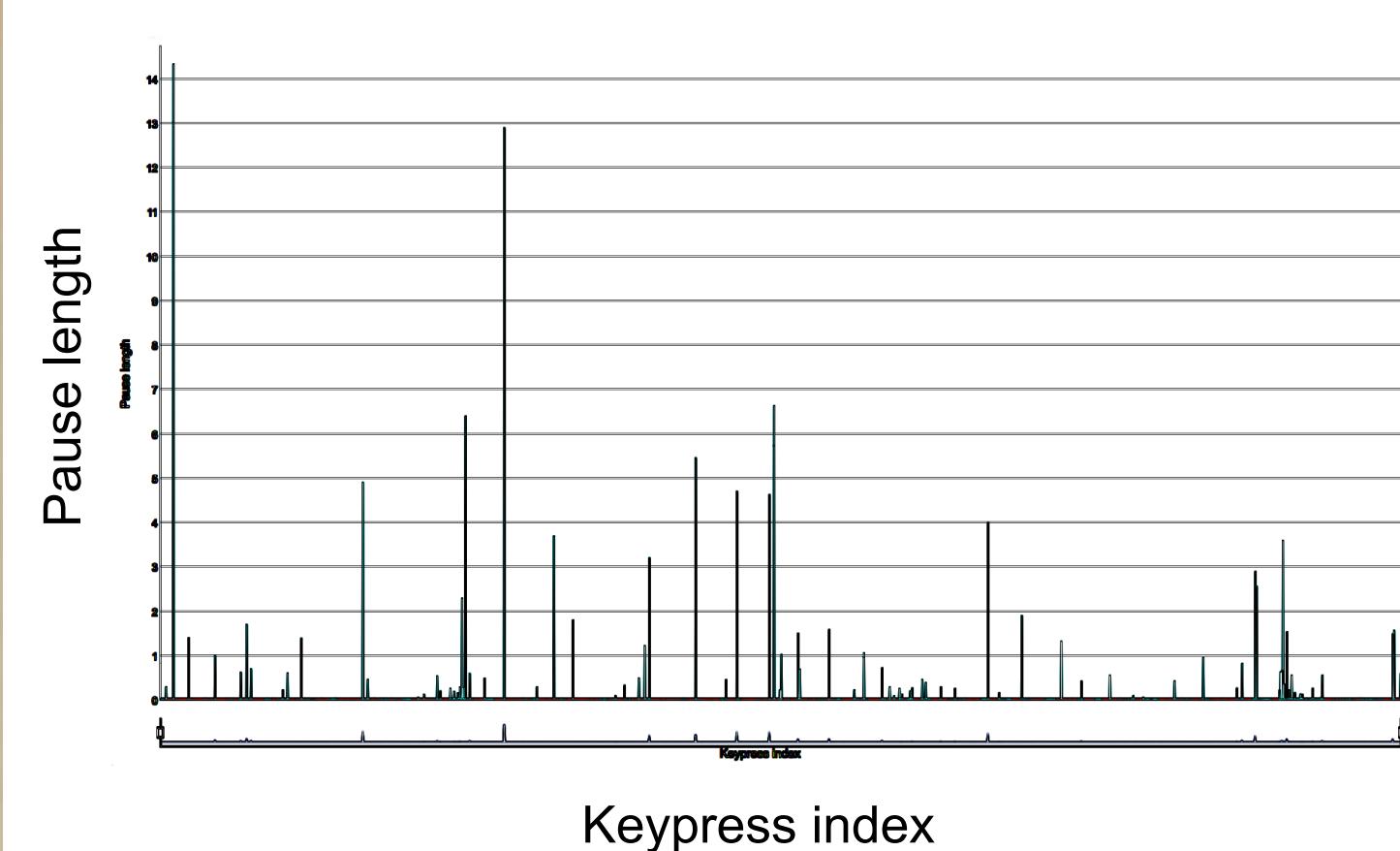
Players were given a download link and asked to spend a minimum of ten minutes playing the game. No maximum was imposed.

Transactional keypress data was collected at a rate of 30 frames per second along with a timestamp for each game-state observation. Every observation indicates the activation-state of all available buttons and joysticks as well as the numerical values for each of the drawing variables.

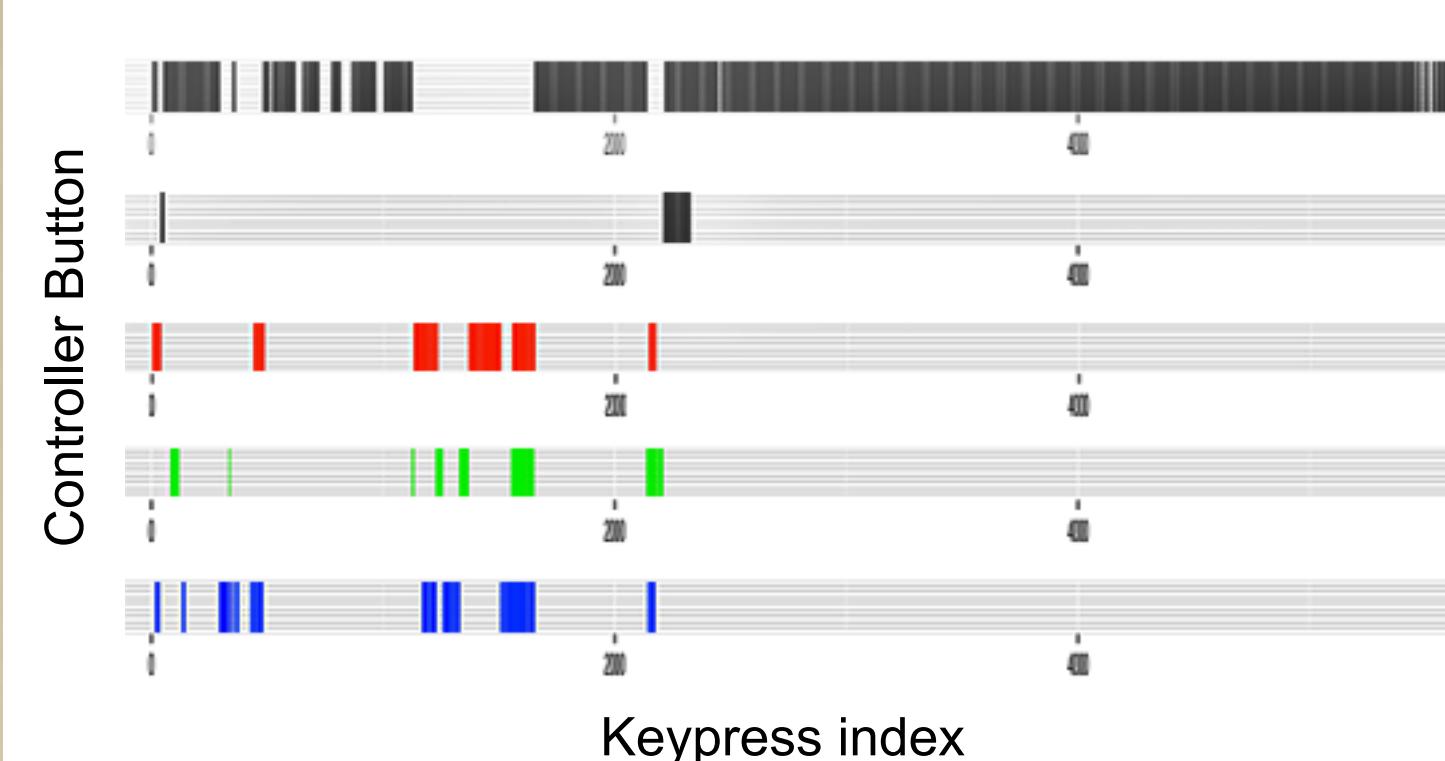
The data allow for a realtime replay of player behaviors at the full game resolution as well as the ability to export screenshots with millisecond precision.

Analytical Methodology

Pause Analysis

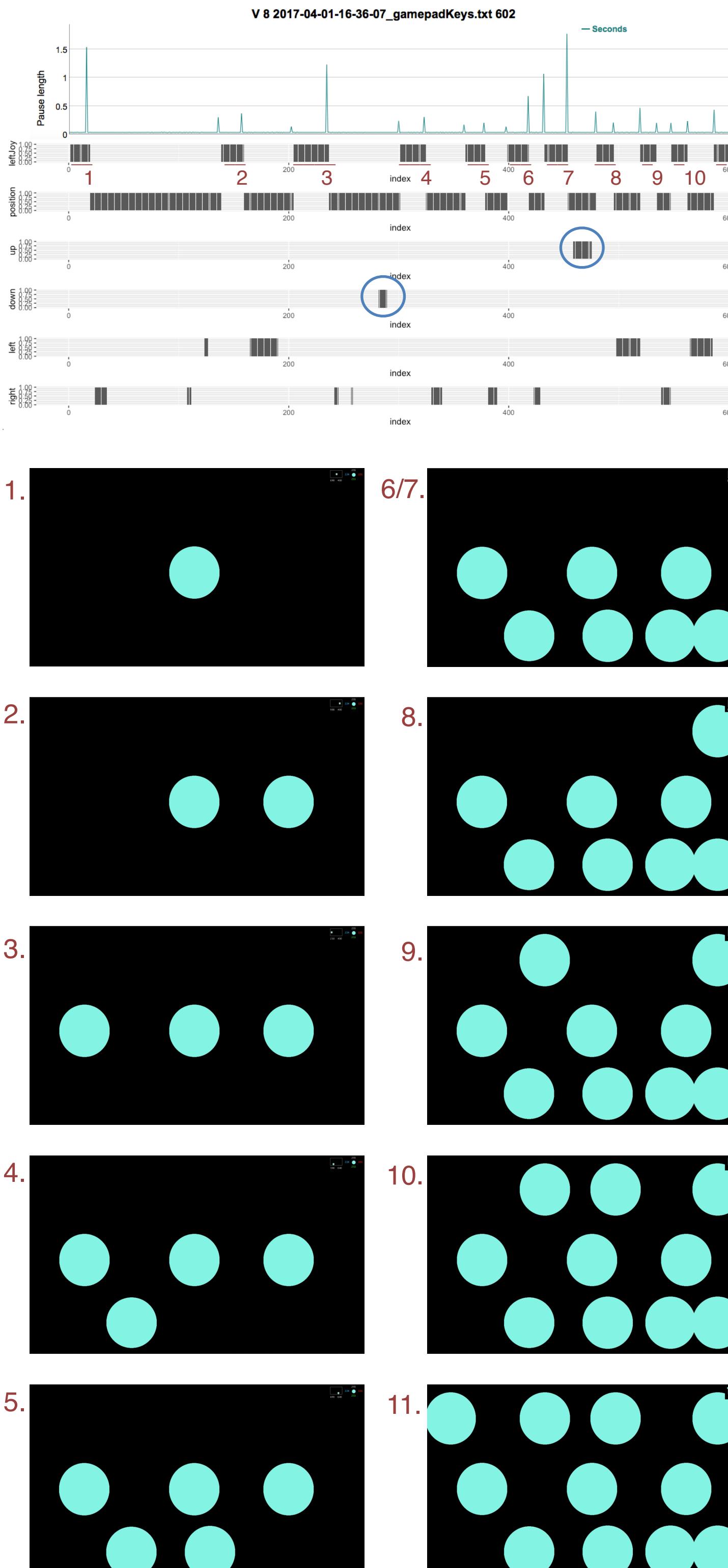


Keypress Associations



Case Study

A targeted exploration of the position variable using keypress associations and pause analysis.



> global_associations

```
items      support
[1] {position} 0.64119601
[2] {leftJoy} 0.35714286
[3] {left} 0.11960133
[4] {position, left} 0.11960133
[5] {right} 0.08970100
[6] {position, right} 0.08970100
[7] {up} 0.02823920
[8] {position, up} 0.02823920
[9] {down} 0.01328904
[10] {position, down} 0.01328904
[11] {reset} 0.00166113
```

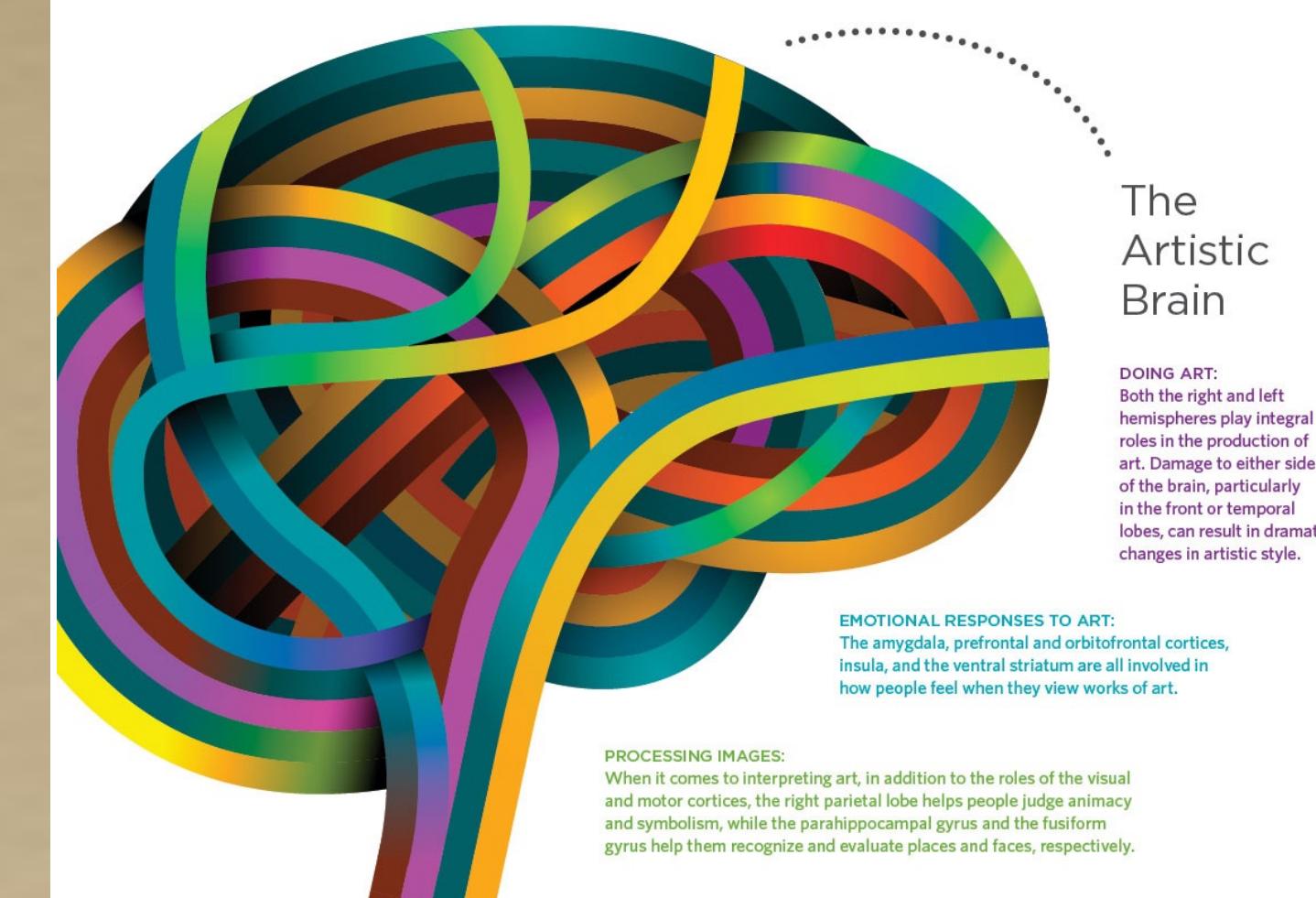
Summary

All players exhibited episodes of “targeted exploration” in which they chose a limited number of variables to manipulate. The episodes are often bracketed by extended pauses which may indicate an increase in cognitive load associated with changes in decision making.

The case study to the left shows extended pauses before the player decides to change the vertical position and draw a new row of ellipses (see images 3 and 7).

Further Research

Determining **pause thresholds** for identifying cognitive shifts is the next step toward the development of learning metrics for unstructured digital play environments.



References

- Hershman, Anneli. “They’re having fun... but are they learning?” <https://www.media.mit.edu/posts/they-re-having-fun-but-are-they-learning/>
- Journal of Writing Research. <http://www.jowr.org>
- Ponne, Anita. “The Artistic Brain.” <https://www.shutterstock.com/g/Anita+Ponne>
- Gamepad Gaussians. <http://gamepad.studio>

Acknowledgments

This presentation is done as part of a project for QMST 4373C Data Analytics, which is supervised by Dr. Tahir Ekin. We also acknowledge the support of Brandon Dee Roberts Professorship.

TEXAS STATE
UNIVERSITY[®]

The rising STAR of Texas