Eye Tracking Race and Cultural Difference in Videogames

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Introduction

Background
The gaming industry is presently one of the fastest developing industries. The number of games and consequently video game players are growing. Any new developments in this medium has the potential of affecting millions of people – both young and old alike.

Our Focus
How do players of contemporary video game perceive and process race-based information as part of their gaming experience?

Understanding this can serve to create awareness in gamers and can potentially cultivate new understandings and revelations for race and cultural difference in today's and the future's society.

Game Choice

- BioShock Infinite
- Never Alone

BioShock Infinite contains instances of racial discrimination along with controversial readings and depictions.

Never Alone is based on a traditional Iñupiaq tale. The game lets the user experience the narrative and full environment on the Iñupiaq's cultural beliefs.

Aim

The aim of this project is to discover how race-based information can affect in-game decisions. Such interactions may come from:

- Characters
- Readings/depictions
- Narratives
- Actions

Their effects can range from map navigation to important in-game decisions.

We want to see in particular, the following:

- Prolonged fixations or lack thereof on objects that identify as our areas of interest. These would include characters, readings, or objects found in-game.
- Shape patterns in eye movement. When fixating on two or three objects, the eye could make a line or a triangle, indicating a scenario of concentration.
- Specific attention on certain areas of gameplay. In these games, we have pinpointed areas of interest where it is crucial to gather such data.

Methodology

Hardware
We used the Tobii Eye Tracker 4C for our research purposes. This tracker provides us:

- Eye coordinates
- Time

Software
To make the analyzing stage more efficient and meaningful, we used the following software:

- Open Broadcaster Software (OBS)
- Tobii Gaze Overlay
- Tobii Core SDK
- Visual Studio
- Matlab

Process
By recording with the Open Broadcaster Software, we are able to access its timestamps. Paired with it, we can see where the user is looking at with Tobii's Gaze Overlay[1].

With the OBS and the time extracted form the eye tracker, we are able to synchronize the data.

DataGrabber
We have implemented a Windows Form Application in Visual Studio called DataGrabber to expedite the data retrieval process and make it user-friendly. With intuitive controls, the data can be:

- Stopped/paused
- Exported in CSV format
- Rewritten
- Segmented

With DataGrabber, data retrieval and recording can start simultaneously.

[1] Tobii's Gaze Overlay lets us see where the user is looking at.

To better visualize where the user is looking, we have this tracker on recorded sessions.

The tracker has a "trail" behind It when the user's gaze is moving.

Depending on how fast the eye is moving, the trail will be slimmer (fast movement) or fatter (slow movement).

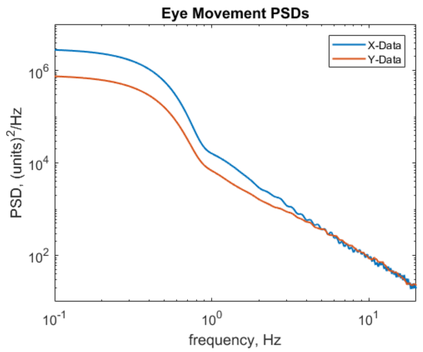
Data Visualizations

Analyzing
To better understand the eye movements, we kept track of two key movements:

- Saccades
- Fixations

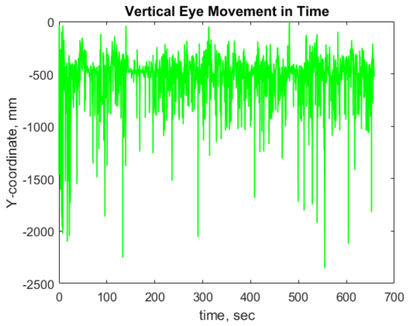
Saccades are moments when the eye is "blind" or moving. This can be interpreted as "noisy" data points. Fixations are when the eye is fixated and almost unmoving.

The following plots show interesting information that can be obtained with just a few seconds of data. This data was captured with the user was fighting enemies, around a 10 minute recording session.



This plot shows the frequency with which the eye moves from the mean position, or the dominant frequency range of eye movements.

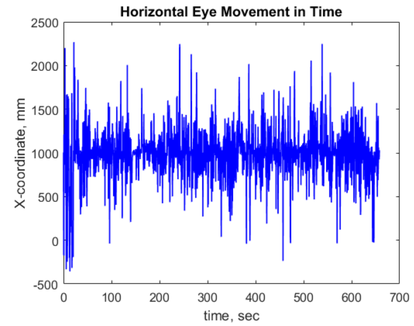
In a physical sense, we can read this plot as the player's eye moves only in low frequencies and rarely shifts from the main position.

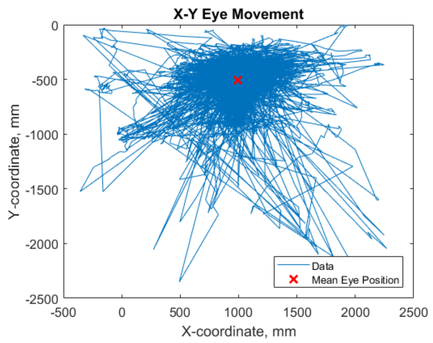


The player's intense focus is only on the upper third part of the screen.

This is because the gun/ hand occupies the lower half of the screen. Enemies and interactable objects only appear at the top half.

This moment in the beginning happened to have been a massive influx of enemies running about everywhere.





Since this data is from a fight scene, it makes sense that the average position would be in the horizontal center.

Conclusions/Future Work

Overall, our research has come to great lengths to obtain this information.

- With only a couple hours of recorded gameplay, I can see this is truly the way we can know for sure if race-based information and cultural difference affects decisions in-game.

We have yet to put a close to this research, however. There are many different things we can do with our capabilities and knowledge now that we have taken this path. In particular:

- In the future, I hope to see this project evolve with what may be a machine learning approach to detect these instances when a human cannot.

Acknowledgments

I would like to thank Dr. Byrd and Dr. Grosser with letting me spearhead their research for these 10 weeks. This is an amazing research project, one I would gladly do all over again.

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