

Research Design II

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I. INTRODUCTION, POSITIONING, RESEARCH ONION

Computer games are programs that allow a user to interact with a virtual gaming world for amusement and fun. Computer games consists of multiple sections, but to sum up there are mainly two types, which are fast-paced and slow-paced games. In this study the main research topic are Computer games, and how different types of game paces can impact the player's experience.

A. Description of Theme and Topic Rationale

1) *Description of Theme:* The theme behind this study focuses on utilizing computer vision and eye gaze tracking technology in computer games, with the main objective to understand and analyse the user behavior in fast-paced and slow-paced gaming environments. The study researches the combination of artificial intelligence, computer vision, and gaming, especially how these technologies could potentially be applied to improve user experience and engagement.

2) *Topic Rationale:* Computer games are developing into detailed virtual environments that provide users with a wide variety of experiences. The distinction between fast-paced and slow-paced games has become recognized as an important category in the world of gaming. Meanwhile, improvements to artificial intelligence, particularly computer vision, allowed machines to evaluate visual data with good precision. By integrating computer vision techniques such as eye gaze tracking into gaming user interfaces, researchers aim to explore into user engagement analysis across different game paces. The rationale for this study is the possibility to apply computer vision technologies to investigate and enhance user experiences in gaming environments. Researchers may gather important insights into how users interact with different-paced games by tracking their eye gaze movements and behavior.

B. Positioning

This study positions itself at the intersection of computer vision research and the gaming industry by researching the use of eye gaze tracking technology in both fast-paced and slow-paced computer games. By emphasizing on user behavior and engagement factors, the study aims to address the increasing demand for more tailored and immersive gaming experiences. Furthermore, the study is consistent with broader trends in human-computer interaction research, highlighting the value of user-centered design and personalized interactions in digital

environments. By analyzing how computer vision technologies can be integrated into game interfaces in order to better understand and respond to user behavior, this study contributes to determining the future of gaming as an interactive experience.

C. Research Onion

1) *Research Philosophy:* This study takes a positivist philosophical approach, seeking to develop knowledge through empirical observation and quantitative analysis. The study's purpose is to gain independent understanding into the relationship between game pace and user behavior by collecting and evaluating empirical data acquired during gameplay. Furthermore, the study uses an objectivist approach, suggesting that there are observable realities associated with user behavior and gaze tracking data. It acknowledges that user behavior and gaze patterns may be observed and studied empirically, regardless of personal interpretations or opinions.

2) *Research Approach & Research Strategy:* The research approach and the chosen strategy is to conduct an Experimental Design. By conducting controlled experiments, the study aims to systematically manipulate variables such as game pace to observe their effects on user behavior. This strategy allows for comprehensive testing of hypotheses and the finding of causal relationships between game pace and user responses.

3) *Choice of Methodology :* The methodology chosen for the study combines quantitative and qualitative methodologies to thoroughly investigate the research problem. Quantitative methods are used to examine gaze tracking data mathematically, whilst qualitative methods are used to gain insights from user interviews and to understand the player's personal observations.

4) *Time Horizon:* In terms of time frames, data is gathered at a single point in time throughout gameplay sessions using a longitudinal method. This method captures immediate user responses to varied game paces and enables for easy comparison of situations. Furthermore, the study evaluates changes in gaze tracking data over time during gameplay sessions, taking a longitudinal approach. The study learns about the dynamics of interaction between game tempo and user involvement by investigating how user behavior varies during gameplay.

5) *Techniques & Procedures:* In terms of techniques and procedures, gaze tracking technologies, web cams, and prototype software are utilized to record user eye movements

and behavior during games. The technique allows for real-time tracking of gaze patterns and interactions with game elements. Python is used for analysis, coupled with libraries like CV2, dlib, and numpy. Quantitative analysis techniques are used on gaze tracking data to detect trends and correlations, whereas qualitative research comprises thematic coding of interview transcripts to uncover repeating themes and insights. Finally, statistical approaches are used to analyze gaze tracking data in order to detect significant differences in eye movement patterns between game paces. Quantitative data can be analyzed using descriptive statistics, predictive tests, and analysis of variance. Qualitative data, on the other hand, is analyzed conceptually using thematic coding and interpretation, providing insights into the subjective components of user interaction with games at varied speeds. This complete methodology framework directs the methodical exploration of the relationship between game tempo and user behavior, bringing together philosophical perspectives, research design principles, data collection approaches, and analytical tools.

D. Background to this research theme

1) *Fast-Paced vs Slow-Paced Games:* Fast-paced computer games are highly advantageous to players compared to slower-paced ones. Gaming influences cognitive behavior both directly and indirectly due to the adaptability of the human cognitive system, which allows for learning and adaptation according to [1]. Games provide mental stimulation via their diverse activities. The game's components require high levels of mindful synchronization, both visually and physically. Playing fast-paced games improves problem-solving and critical thinking. Open-world, mission-based, and multi-level games are designed as complicated puzzles that can take hours to master [2] mentioned.

Slow-paced computer games are another important aspect of computer gaming. Slow-paced games, unlike fast-paced games, do not need quick reactions, decision-making, or time constraints. They usually include more relaxing and calm game play, allowing players to take their time and enjoy the experience at their own speed. Slow-paced games might be useful for players and help release stress. It also provides prizes that can stimulate the release of stress stated [3].

2) *The Use of Computer Vision in Computer Games:* Computer vision has the potential to be a powerful computer interface due to its ability to detect body position, head orientation, direction of gaze, pointing commands, and gestures. Furthermore, computer vision is a field of artificial intelligence (AI) that focuses on enabling machines to understand visual input from the outside environment. It can be applied in computer games in a variety of ways to improve the overall gaming experience, declared [4]. Computer vision in games can represent a variety of AI functions, including gesture recognition, facial identification, object detection, player tracking, visual effects, and accessibility. Computer vision can assist games in interpreting actions performed by players using their body or hands. This can be used to control characters in-game, perform actions or abilities, and browse through game

menus. Computer vision can be used to detect a player's emotional state and facial expressions, allowing games to adapt their gameplay or story based on the player's emotional state. Using a camera or other sensors, computer vision can allow games to recognize and incorporate real-world objects into gameplay.

3) *Gaze Tracking in computer games:* According to [5], gaze tracking can be used for offline analysis of player behavior. Gaze trackers have also been used as video game controllers, allowing players to interact with video games by simply looking at them. To begin, there are several techniques for monitoring player performance that include gaze tracking technology, which can greatly assist game developers in collecting feedback almost immediately. Gaze tracking can provide details on how players interact with a game, such as where they look on the screen, how long they stare at different game items, and how they shift their gaze around the screen. This information can help game developers better understand how players perceive and interact with their game, and it can be used to improve the overall user experience. Furthermore, gaze tracking can indicate a player's visual preferences, such as what they look at or concentrate on while playing. This can help developers determine which components of the game players find visually appealing or intriguing as well as inform decisions about game art, animations, and visual effects.

E. Hypothesis

The objective of this research is to gain insight into the application of computer vision and eye gaze tracking in computer games, particularly in investigating user behavior in fast and slow-paced games. The main dependent variable is the user's engagement with the game pace, whereas the primary independent variable is the user's eye gaze tracking accuracy from the trained data set. Hence the hypothesis of this study is that using eye gaze tracking as a computer vision technology, it is possible to accurately identify an eye gaze and be able to tracking the user looking direction, while playing two different paces of computer games.

F. Research Aim and Purpose statement

The aim of the study is to conduct research investigating the use of computer vision technologies, specifically eye gaze tracking, in fast-paced and slow-paced computer games. The goal of this study is to obtain insight into user behavior and engagement dynamics across various game pacing styles by evaluating eye movement patterns and interactions during gameplay. The study's empirical research aims to assess the viability and effectiveness of utilizing eye gaze tracking as a tool for understanding user engagement and enhancing gaming experiences. Finally, the study seeks to contribute to the growth of computer vision research and gaming applications, with practical benefits for game developers looking to create more immersive and user-centric gaming experiences.

II. REVIEW OF RESEARCH METHODOLOGIES

A. Literature review about the methodologies used in other studies

B. Analyzing Sources: Academic vs. Non-Academic Perspectives

C. Peer-Reviewed Sources Recommendations & Integrated Literature Research Material

D. Key Perspectives and Debates in Literature

III. LITERATURE MAP

IV. REFLECTION ON THE CHOSEN METHODOLOGY

Paces of Computer Games.

A. Clarification of Research Questions

B. Definition of research objectives.

C. Comprehension of Research Philosophies, Methodologies, and Key Paradigms

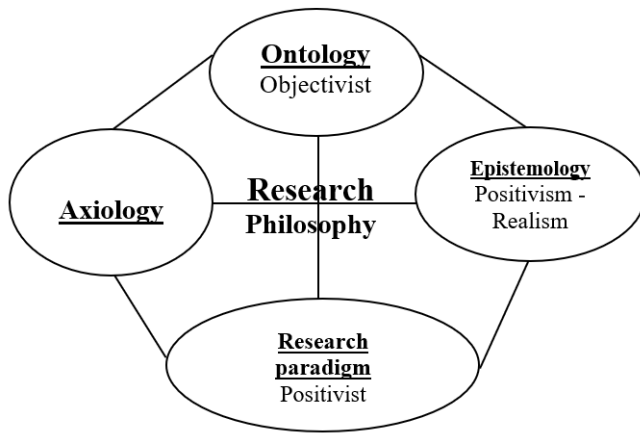


Fig. 1. Research Philosophy

G. Considerations of Validity and Reliability

H. Study's Ethical Considerations

V. RESULTS, ANALYSIS AND DISCUSSION

A. Overview of Results

B. Interview Results

C. Summary of Analysis

VI. CONCLUSION

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D. Research approaches and Key Paradigms

- 1) Epistemology:
- 2) Ontology:
- 3) Axiology:
- 4) Research Paradigm:

E. Approached Research Methodology

F. Overview of the Research Methodology

- 1) Experimental Design:
- 2) Analysis Approach:
- 3) Alignment with Research Objectives: