EyePlay: Applications for Gaze in Games

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Abstract

What new challenges does the combination of games and eye-tracking present? The *EyePlay* workshop brings together researchers and industry specialists from the fields of eye-tracking and games to address this question. Eye-tracking been investigated extensively in a variety of domains in human-computer Interaction, but little attention has been given to its application for gaming. As eye-tracking technology is now an affordable commodity, its appeal as a sensing technology for games is set to become the driving force for novel methods of player-computer interaction and games evaluation. This workshop presents a forum for eye-based gaming research, with a focus on identifying the opportunities that eye-tracking brings to games design and research, on plotting the landscape of the work in this area, and on formalising a research agenda for EyePlay as a field. Possible topics are, but not limited to, novel interaction techniques and game mechanics, usability and evaluation, accessibility, learning, and serious games contexts.

Author Keywords
Gaze Interaction; Eye-tracking; Games;

ACM Classification Keywords
H.5.2 [Information Interfaces and Presentation]: User Interfaces–input devices and strategies.

Introduction

Within the world of games, novel sensing technologies such as motion and depth sensing have brought new gaming peripherals, mechanics, and experiences into the hands of designers and players. Now, eye-tracking hardware is on the cusp of becoming a commodity and has started to pique the interest of independent games developers. *Son of Nor*[1], a Kickstarter funded game due for release this year, will support Tobii's 'EyeX' consumer orientated eye-tracker[2]. As adoption grows, the demand for new experiences and practical applications will follow. This brings with it the opportunity for focused research that pushes the field into unexplored territory.

Eye-tracking research has given rise to new interaction techniques, user experiences (UX), and usability insights in the field of human-computer interaction (HCI) both in desktop [14] and pervasive environments [12]. Eye-based player-computer interaction (PCI), however, remains relatively unexplored. The focus of this workshop is to explore the use of eye-tracking as an input modality for gaming, and its use as a games research tool. We aim to bring together eye-tracking and games specialists to identify possible avenues of research that arise at the intersection of these two fields.

The fundamental question we ask is *What new challenges does the combination of games and eye-tracking present?* Given a future where eye-tracking is robust and pervasive, what new compelling experiences could be designed? what are the benefits and drawbacks of eye-based games design? and what can we learn about players from their eyes to improve and develop experiences?

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[1]http://sonofnor.com
[2]http://www.tobii.com/en/eye-experience

Previous work has explored different mechanics for eye-based games [11]. The eyes naturally indicate users' point-of-regard. This can be explored both by simplifying or adding complexity to the gaming experience. On one hand, for example, in the arcade classic *Breakout*, players must control a paddle to hit a ball. By assigning the control of the paddle to the gaze point, just by following the ball with the eyes, the paddle automatically hits the ball [3]. On the other hand, by designing mechanics that lure the player's gaze point away, we can include new additional obstacles and interface mastery challenges for players. Other control mechanisms have enabled multimodal [1] and eyes-only [10] navigation in virtual environments.

Games can also benefit from the natural behaviour of the eyes to increase immersion and to monitor attention. For example, by tracking players' point-of-regard, 3D game engines can render a matching depth-of-field blur, creating an effect similar to real life perception [4]. Moreover, by using gaze to estimate where attention is directed, games can adapt their storyline [9], use appropriate cues to reengage inattentive players [2], or predict player behaviour [8].

Eye-tracking can be used as research tool to inform game design. The analysis of players eye behaviour has revealed distinct gaze patterns in players of varying skill and gender, resulting in new considerations for future design in serious games [6]. Similarly, common areas-of-interest in *Guitar Hero* were used to develop an accessible version of the game, controlled by the eyes alone [13]. These types of analyses have also been applied to games for learning [7] and to encourage games designers to consider gaze as a usability measure to inform future design [5].

The work presented here has motivated this workshop, and given the growth of the eye-tracking community and its broad range of applications, we believe there is great potential for beneficial and exciting research in this space. We welcome position papers from PhD Students, academics, and industry with an interest in the use of eye-tracking within games. The scope of submissions is intentionally broad to allow exploration of the many possible facets of this new field. We provide an outline below to instigate interesting directions for submissions:

- Eye-tracking as input for games for PC, consoles and mobiles (interaction and experiences)

- Application and evaluation of existing eye-based interaction techniques in a games context

- Multi-modal/Multi-sensor input (Gaze + Manual input, physiological input, GPS, etc.)

- Eye-tracking as an evaluation and research tool (e.g., Methods, Case studies)

- Gaze in serious games for learning, simulation, and health

Goals

This workshop is designed to create a community of academic and industry experts around the use of eye-tracking in games. We structure the day to allow participants to share their contributions and viewpoints on how game design, development and research can benefit from eye-tracking and use these to create a research agenda for the topic. We will use the following research questions as a starting point:

- **What new challenges does the combination of games and eye-tracking present?** How could this new modality enrich existing games? How can eye-based games design be approached from the ground up?

- **How can existing eye-tracking research be applied in a games context?** What has been shown for input and usability evaluation? What were the lessons learned, and what are the implications when findings are applied to games?

- **What are the big questions?** In which direction should we be heading to reach a vision of eye-enriched gaming?

Plan

Pre-Workshop
We will distribute the call for papers through mailing lists, social media, special interest groups and through the workshop's website. We will invite 2-4 page position papers from industry and academia, which will be reviewed along with the authors' short bio by our organisation committee. We will select participants with well-argued views and contributions to the field.

Workshop Plan
The workshop will be divided into three activities:

1. **Paper presentations.** Participants will have a 10-minute slot to present their position papers and answer questions from the audience in two 90-minute sessions, with an interval in between.

2. **Brainstorming.** A session involving all workshop participants, to identify open research questions and

challenges to build a research agenda for the use of the eyes in games development and research. Throughout the activity, the organisers will document participants' ideas using a mind-map or similar tool.

3. **Breakout activity.** In groups, participants will develop a design that addresses a challenge from those identified in the previous session. We will bring 10 Tobii EyeX eye-trackers for them to experiment their ideas.

We will conclude the day with the presentations of the group designs.

Outcome

The results of the workshop, including the position papers, slides, photos, mind-maps and the group designs will be published on the workshop's website. We plan to turn the research agenda created in the workshop into a magazine article and invite accepted submissions to revise and extend their papers for a special issue on eye-tracking in games in a journal or magazine to be discussed during the workshop.

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