
Method to explore visual design and their influence on players' performance

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Abstract

We describe a design research method to explore visual designs in a game and the effects designs have on player's performance. We address the merits of this approach through a case study involving the creation of a new design tool, evaluation and verification by expert game designers, and a follow-up user study. The study evaluates the effects of visual designs by analyzing play and eye performance in addition to a workload assessment survey.

Keywords

Game Design, Visual Composition, Visual Attention, Cognitive Load, Eye Tracking, User Research

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI), K.8.0 Games, B.8.2 Performance Analysis and Design Aid

General Terms

Measurement, Performance, Design, Human Factors

Introduction

Video games are a mainstream form of entertainment. There are games now for every age and every demographic, with seventy-six percent of all games

sold in 2010 rated for everyone, teens, and everyone over 10 years of age [1]. As demand increases and audiences become more diverse, new methods are needed in their design and evaluation. Many in the game design field discuss the importance of accessible designs [2] thereby retaining investment [3], [4]. Our area of interest is on the accessibility of visual designs and their effects on player's experience.

Visual design is a difficult topic in games because there are many competing elements on screen at once. Every second, elements on screen and on the user interface compete for player's attention [5], [6]. As a subset of visual design, our focus is on *visual motion*, which we define as the visual attributes of motion such as speed, trajectory, shape, etc. Many games layer attributes of motion as a means to highlight targets, among distractions or ambient effects, while providing feedback from player interactions. In our previous study, we uncovered accessibility problems when these layers occur all at once [7]. Since there are many attributes of motion and experimental setups to explore this topic, we developed a tool that allows designers to define patterns of visual motion suitable for different abilities. Rather than iteration by trial and error, we believe game designers have unique insights on this topic and can benefit from a formal method to understand the effects of visual motion on player's performance. This approach is novel to games research yet there is much scientific evidence from information visualization [8–10] on this topic concluding different visual stimuli has an affect on task performance.

Existing HCI methods analyze users' performance, i.e. score, time on task, etc. [11–13], however our interest investigates the attributes of visual motion associated

to game elements, followed by their effects on player's performance. To understand the implications on accessibility, we use two validated instruments to measure cognitive workload, 1) eye pupil dilation [14] and a cognitive workload assessment [15] surveying mental, physical, and temporal demand, feelings of success, effort, and frustration.

Methodology and Method

Our approach takes a 2 part mixed method methodological stance, specifically following an instrument development model [16]. We chose a mixed approach, incorporating qualitative and quantitative data, as this is the best stance to include expert designer's feedback on the topic and evaluate the effects of visual motion designs on players. We first allowed expert game designers to use our tool congruent with the Zupko's [17] toolset for interactive lighting in games whereby 1) experts interact with the tool, 2) followed by a semi-structured interview. The outputs of part 1 are attributes of motion suitable for different skillsets and design patterns of visual motion. Part 2 uses designer's quantitative selections using the tool in a railed-shooter game. Using game user research methods and instrumentation to measure cognitive workload our aim is to evaluate player's performance in regards to the visual motion designs.

Case Study and Conclusion

Our approach included 8 game design experts in the tool evaluation. We allowed designers to manipulate the appearance of 3 game elements in a railed shooting game, targets, non-targets, and visual feedback. The elements are tied to 3 variables: *speed*, *size*, and *density*. Figures 1 and 2 illustrate the tool and how the appearance changes. This method enabled research in

designers encoding of visual motion followed by a formal user study involving 105 participants.

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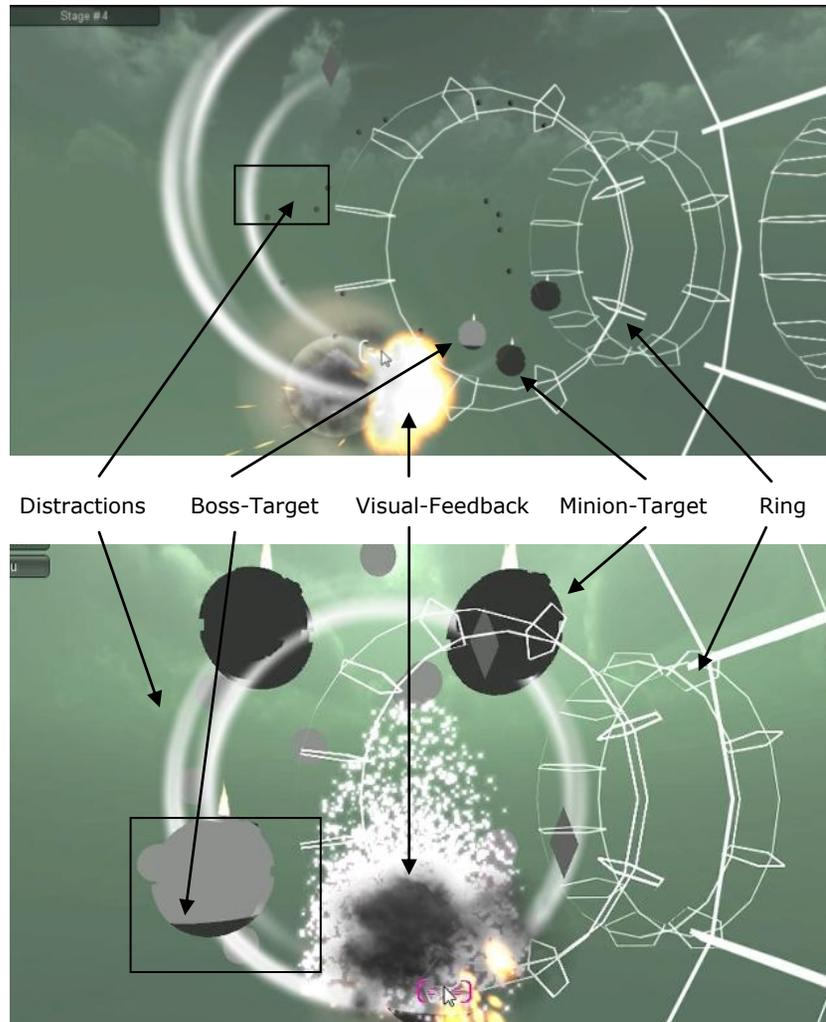


Figure 1. Adapting the visual hierarchy of game elements



Figure 2: Screenshot of tool