Shynosaurs: A Game of Attention Dilemma

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Abstract
Shynosaurs is a game designed to harvest the full range of the natural behaviour of the eyes. On one hand, players need to use their eyes to aim where they direct the mouse, click and drop characters into a safe zone (the cuties). This is the usual behaviour of the eyes, as sensors to gather information. On the other hand, players can choose to use their eyes to stare at and intimidate the enemies (the shynosaurs) in order to slow them down and send them away. This is also a natural behaviour of the eyes, which we sometimes use as means to win a battle of wills. The Shynosaurs game is developed with eye-tracking in mind and aims to embrace the delicate balance needed to use the eyes as both sensors and controllers.

Author Keywords
Game controllers, Eye-tracking, Visual Attention

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

General Terms
Interaction Modalities

Figure 1: An idle cutie.

Figure 2: A shynosaur pretends to not be doing anything wrong when looked at.

Introduction

The eyes are good indicators of what a person's attention is focused on. They are also remarkably fast, which is another reason why they have attracted interest for their use as game controllers, in particular for people with disabilities. However, there has been extremely few games written with eye tracking as the main modality in mind, such as Isokoski's penguin shooting game [4]. Instead, eye-tracking is often used as a replacement for the original modality in pre-existing games [3], such as controlling commands in World of Warcraft [5], navigating in Mario Bros [6], orienting the camera or aiming in First-Person Shooter (FPS) games like Quake2 [7].

The eyes are one of our main sensors to comprehend the world around us and we need to move them very often in order to continuously gather visual information. In daily life, they are thus mainly used as passive sensors to bring visual information to the brain. However, we do occasionally use our eyes as ways to influence the world around us. Humans possess an awareness of when and how they are being looked at by another person and it tends to modify their behaviour depending on their personality. For example, it has been found that people behave better when they think they are being observed [1]. Using the eyes and the knowledge that one is being observed (and that one can "misbehave" while not being observed) is for example used in children's games, such as "Red light, Green light".

Another example of the effect of the eyes is the fact that a glance can be made into a stare to intimidate someone. Humans and animals alike are very sensitive to staring and reportedly feel discomfort when stared at [1]. In this light, we can see the eyes not only as sensors but also as actuators that have influence on another being. Humans are used to staring and know the effects that it can have on other people. It can thus be seen as a natural controller that we might occasionally use, for example as means of intimidation or for a battle of wills. It has been found that comfortable eye contact lasts around 1.5 to 3.6 seconds, after which the gaze becomes uncomfortable and turns into a stare [2].

Game concept

Bringing a player's stare in a gaming context has very interesting effects on gameplay. Characters can be intimidated and stared down, which may be interesting for means of immersion since the virtual characters present the same reaction that one might expect from real, living beings. However, staring down characters presents another interesting challenge: While players need to keep their eyes still, they can not gather detailed information about what is happening elsewhere on the screen. As a consequence, they also may not be able to properly click on a target with a mouse. Shynosaurs is specifically built to take advantage of this dilemma between information gathering and interaction.

We chose to embrace this duality in order to create a fast-paced, exciting game that requires users to balance how they choose to use their eyes. We wish to investigate whether players choose different strategies. In Shynosaurs, players need to save as many cuties (see Figure 1) as possible by dragging and dropping them with the mouse into a safe fenced zone. The player competes against shynosaurs (see Figure 5) that come from the woods to steal the cuties away. However, the shynosaurs are shy and easy to intimidate. If the player glances at a shynosaur, it will first stop and start to whistle (Figure 2) as if it was doing nothing wrong, as if it "feels" it is being observed. After two seconds, past the point where a glance becomes

Figure 3: When it realises it is stared at, the shynosaur becomes pale for a second.

Figure 4: An intimidated shynosaur runs away crying.

a stare, the shynosaur will turn pale (Figure 3) then run away crying (Figure 4). This means the shynosaur has been effectively intimidated by the player's stare.

The game also gradually increases in difficulty. Players have three lives in total, and lose a life when the shynosaurs have stolen more than half of the initial number of cuties. When the player is successful, a new level is loaded, with more cuties, faster shynosaurs and a smaller safe zone.

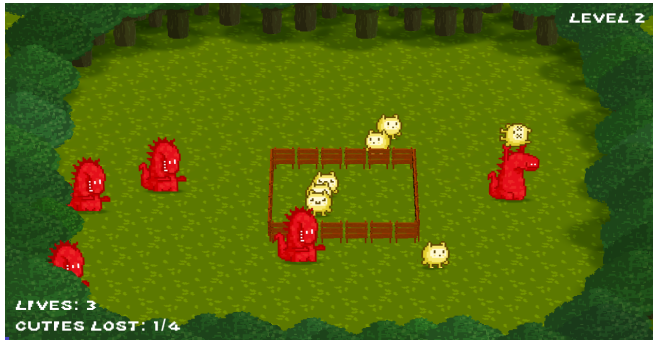

Figure 5: A screenshot of the game. Two cuties are in the safe zone, a shynosaur is being looked at and another one has captured a cutie and is carrying it away.

Implementation details
Shynosaurs was developed using Unity3D and custom graphics and sounds. The game requires an eye-tracker in order to track the player's gaze. Eye-trackers generally consist of infrared cameras pointing at the eyes. The image is then processed to extract the pupil position from the camera's point of view. A calibration of the eye-tracker is needed before playing the game, which takes only seconds. The pupil position data is then streamed to the game using custom software.

Implications

The duality of using the eyes both as sensors and actuators is the core lever of the gameplay. The fact that it will be difficult for the player to keep a shynosaur away and drag and drop a cutie in the safe zone at the same time creates a fast-paced, challenging environment. Players need to carefully manage the way they choose to use their eyes, to handle the constant stream of shynosaurs coming from the woods and take the cuties to safety at the same time.

The shrinking of the safe zone area is particularly challenging, as dragging and dropping the cuties requires more precision. In addition, players might at first be able to drop cuties in the safe zone while their eyes are busy looking at shynosaurs by using their peripheral vision, but as the safe zone becomes smaller their chances of dropping the cutie out of the safe zone increase. Players from a pilot study reported being more aware of their peripheral vision, which is used to aim the mouse at cuties and dropping them in the safe zone while they are staring at shynosaurs. We are in the process of conducting a more detailed investigation about players' strategies, perceived immersion and effect over time.

Conclusion

Shynosaurs is a fast-paced, challenging game developed around the duality of using two natural behaviours of the eyes: Sensing the environment and controlling (or, more accurately, intimidating). While there have been some games adapted for eye tracking as means of control, Shynosaurs is one of the very few games specifically developed around the possibilities and natural behaviours of the eyes. Instead of trying to work around the fact that the eyes cannot view the entire visual scene at the same

time, we aimed to create a game that takes advantage of this fact and integrate it into the gameplay.

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