

To Look or Not To Look

A VR Horror Experience that utilizes Eye-Tracking

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Fig. 1. In Staring Nightmare, the player has to use his eyes to guide flashlight to find tools, solve puzzles, and escape the nightmare under the pressure of monsters and time.

Combining eye-tracking with game mechanics is almost nonexistent in game and VR industry. As a VR enthusiast, I wish to explore this topic by making a VR horror game that utilizes eye-tracking as main mechanics. To Look or Not To Look is a game that forces the players to combat their natural instinct using their eyes and hands. In an obsolete hospital, the player must survive using a light that is controlled by his eyes to find tools to fix a car to leave the building. Meanwhile, monsters in the dark will track the player down if they catch player's eye gaze. It is much difficult to make a game in VR since player has so much freedom to break things. However, I still manage to implement the full game mechanics, around 10 interactables each contribute to the gameplay loops and player interactions. In addition, this is also my first time developing a VR software so there are many things to learn.

1 INTRODUCTION

Although eye-tracking has been used in gaming for many years, there aren't many incorporation between game mechanics and this technology. These features are almost non-existent in VR gaming industry since only recently companies start to put eye-tracking into VR headsets. The Dark Pictures: Switchback VR released on March 16, 2023 is the first game that utilize eye-tracking with impressive

game mechanics. For instance, the mannequin monsters will change their posture every time the player blinks.

In our game, the player has to traverse through the building, avoid or fight monsters, find all sorts of tools, solve puzzles and escape. The player will be forced to combat his fear and complete difficult tasks while under the pressure of monsters and time. Since the player's flashlight is controlled by his eye gaze, he needs to avoid making eye contact with monsters even during close contacts. In addition, there is a sanity meter that depletes as times ticks on. Once the health point or the sanity go to zero, the player fails to escape the nightmare.

There are only 3 games like ours. "Don't Look", "Don't Look Away", and previously mentioned "The Dark Pictures: Switchback VR." These are the closest ones I could find on the market. I will discuss them in more details in Section ??

Since I only have two weeks and never made games with Unity, our novel approach is to use Unity with Quest Pro which has eye-tracking built in. In addition, Unity and Quest both provide plentiful tools and APIs to read headset & controller inputs, simulate physics, construct environment and etc. Therefore, I can focus on learning these tools, building smooth interactions, and making interesting gameplay.

Even with all the technologies and tutorials available, it still took hours to set up everything. During the process of making this game, I learned how difficult it is to make VR interactables since players have so much freedom that they can easily break the games. It was challenging to design VR game objects that are fun, intuitive, and easy to use. I also learned how to create building environment using probuilder.

1.1 Contributions

- Implemented the player action management such as head & controller tracking and animation, locomotion, camera movement.
- Built personal inventory system, in-game status menu, and game menu.
- Implemented around 10 interactables including their interactions, sound effects, visual effects and gameplay loops
- Constructed the game environment and decorated with dimming light, blood stain, dead body, broken machines and so on.
- Built the pathfinding, animation(attack, hit, chase, death), and combat system of the monsters.

2 RELATED WORK

As mentioned in the introduction, there is no game utilize the eye-tracking system with game mechanics like this project. "Don't Look", "Don't Look Away", "The Dark Pictures: Switchback VR" are the only three. The first two aren't VR game and don't have eye-tracking. "Don't Look" has a similar idea but doesn't have good gameplays judged from reviews. "Don't Look Away" is a multiplayer game which takes the opposite approach. Only the last one utilizes eye blinks with game mechanics. Thus, I think our game design is very unique.

3 METHOD

Take a broader view, this application contains four elements.

- (1) Game Mechanics
- (2) Environment design
- (3) Player/Monster/Object Interaction
- (4) Animation, Sound Effects, Visual Effects

Firstly, Game Mechanics means the steps to achieve win or lose condition. The ultimate goal is to find a wrench and fix the tire of a broken car. The process is simple but traversing through dark and going through every bed and container while avoiding enemies make this game much harder. Monsters are present at every point of interests and the pistol is only enough to take down one monster.

- (1) get weapon key(optional)
- (2) get pistol (optional)
- (3) find toolbox key
- (4) find door key
- (5) unlock door
- (6) open toolbox, get wrench
- (7) bring wrench to tire and fix
- (8) win

Secondly, environment contains maze, points of interest, monsters placement, lighting, and decoration. By putting keys on beds and in

cabinets, I make players search them intuitively. I also put empty cabinets to distract players. Leaving boxes in the end of door rooms initialize players to discover these rooms. Besides, I take away light sources from point of interests and place monsters there to force players feel scared.

Thirdly, interaction has to be intuitive, smooth, and fun. For instance, metal doors suppose to move slower compare to wooden doors. Drawers and cabinet doors should only be grabable by pulling handles. Providing visual cues is crucial to guide players while not breaking the immersion. I make several holographic icons to hint missing puzzle pieces. I also make particle effects as well as sound cues/effects to tell player when things happen.

Finally, animation, visual effects(VFX) and sound effects(SFX) add immersion and are obvious cues for players to understand what happen. The monster has move, attack, is hit, and death animation as well as sound effects. Doors and cabinets have squeaking, open, unlock SFX. Guns have shot, shell drop, and out of ammo SFX. All of these lead to the player to believe that this world is responsive to his action.

There were many challenges. For example, I later add personal inventory system to help players store tools they collect because keep holding objects cause many issues. It prevents players from interacting with other objects. They may also accidentally drop the objects and require to pick up. These lead to unsatisfied and annoying game experience.

4 IMPLEMENTATION DETAILS

The hardware and software that I used are Quest Pro and Unity. I connect my Unity on my PC with Quest Pro thorough Quest Link. XR Interaction Toolkit contains many useful tools to handle headset & controllers input and make objects VR interactable. In addition, Eye Tracking for Movement SDK make it possible to directly read eye tracking information from the headset to Unity.

I learned most basic things through various YouTube tutorials. To setup the player action system, I followed several episodes of VR tutorials on YouTube[2]. It took me some times but are these tutorials are fairly straightforward. For object grab interaction, I mainly used XR Grab Interactable with Rigidbody. The inventory system uses a similar XR Socket Interactor. For doors and cabinets, I implemented Hinge Joint along with XR Grab Interactable for the handles. Most of these objects also have Audio Source and audio clips attached to them for SFX[3]. For monster animation, we used Mixamo. I learned from this tutorial ways to make simple animation[5]. For monster navigation, we baked NavMesh and attached NavAgent to the monsters so they can path find to the player.

5 EVALUATION OF RESULTS

We accomplished our goal of implementing the game on an Quest Pro. Alpha testers think this game is very scary, and the gameplay is novel, fun, and stressed in a good way. Players rate most of the interactions and animations smooth and intuitive. They also think our SFX and VFX help to understand what happened and add tons of horror elements.

However, the player gets confused on the types of keys due to their lack of characteristics. Although each key looks different visually,

players don't know which key corresponds to which box. There are also rare cases when objects collide with player's hands and get pushed under the ground. Besides, I didn't have time to make a tutorial. It is tough for new VR players to learn the control and the inventory system under scary environments.

6 DISCUSSION OF BENEFITS AND LIMITATIONS

By only lighting where the eyes look at, I eliminate the potential VR motion sickness brought by the peripheral vision. This is a huge advantage.

7 FUTURE WORK

This is your chance to predict what the community should work on next. If you had a clear failure case, then speculate how you might resolve it. If your algorithm is lacking in performance, talk about what changes might improve it. Even if you have "breakthrough" results, then you can still comment on what new work your contribution will motivate. If you found a trend in a user study, then you could comment on what design changes developers should make to apply the your conclusions.

From the user testing, future works can focus on the following tasks. Firstly, adding variation of monsters and object/monster interactions. For example, the player uses a crowbar to smash a window to attract sound detection monsters, or throws a flashbang to stun vision only monsters. These interactions can also happen for puzzle dedicated objects like keys. Players can use keys as weapons though dealing small damages. Secondly, adding more tools and advanced

puzzles will enhance the gameplay. For instance, the player has to find all four pieces to make a lever and rotate it several times while hiding from a monster. Thirdly, environment design that utilizes positional tracking. Making player crouch through vent, under desk or hide into lockers may lead to more immersion. Fourthly, fine tuning interactions such as grab, trigger and movement can add more immersive to the gameplay. Currently, the player grabs everything by holding the entire grab button. Future works can add more resistance to grab gun than to take a key. Adding resistance to trigger button for gun triggers will also be helpful.

8 CONCLUSION

I think my approach is really unique in VR gaming industry. With only a few weeks, the game is already at a enjoyable state. However, there are still many improvements that we can adjust to make the game more smooth and fun.

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