Subtle Attention Guidance for a New Virtual Reality Game

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***Abstract*—Gaze and attention guidance is the most important challenge in virtual reality (VR) games because they affect comprehension, playability and immersion in the interactive environment. In this work, we propose an intuitive game-design approach to subtly guide the user's attention in a new custom VR game. The results of the survey show the potential of this approach to enhance the VR experience that leading to a high rate of comprehension and focus on game mechanics.**

***Index Terms*—Video Game, Virtual Reality, Attention Guidance, User Interaction.**

I. Introduction

VR gave a new twist to the video game experience by allowing users a 360° immersion in virtual scenes. Viewers can thus interact with any objects and gaze all around the 3D environment. As a result, important narrative elements could be missed or certain Points of Interest (PoI) defined by the content designer maybe not be seen, leading to more constraints and challenges in VR games production [1]. Under such conditions, how can game designers guide users' attention to the crucial elements and ensure a playable level ?

In this demo paper, we propose an intuitive approach that subtly embeds multiple design elements (visual clues, colors & environment aspects, game mechanics, etc.) to facilitate the game's objectives and attract the user's focus and attention. This approach is illustrated through a fully 3D immersive VR-based game called *CELESTRAIL*.

II. Design-based Approach

A. Brief-description

Our game is developed using Unity3D and Oculus Quest and can be downloaded for free [1]. In *CELESTRAIL*, the player embodies an archer and confronts a series of puzzles that must be solved using a bow and arrows. The arrows can bounce on any surface (Target, Wall, Switch etc.), see Fig. 1. All targets must be destroyed to progress within the game levels which last 10 minutes.

B. Level Progression

Our game is composed of three levels, each with its own architecture and several situations. The experience was first introduced through an informal level that aims to train the players on the game's objectives and actions ensuring that all the mechanisms are learned and understood. To avoid scattering puzzles everywhere, the levels evolve with the players progress. They can thus only concentrate and interact with the elements present in their situation. This is expected to avoid their distraction and disorientation while increasing their curiosity, motivation and involvement within the game.

[1]https://isart-digital.itch.io/celestrail

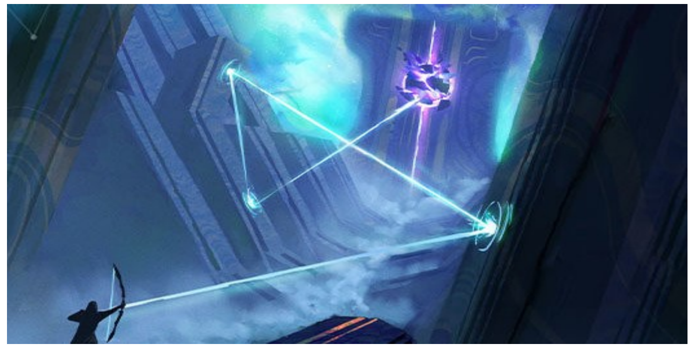
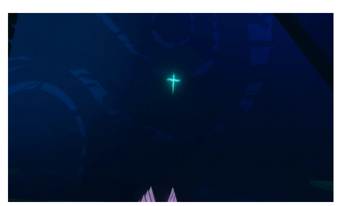


Fig. 1: The virtual environment

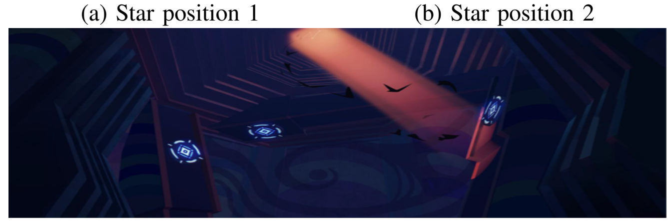
C. Visual Effects and Environment Design

The interface uses graphical indications instead of text to make the control learning more visual. The important elements are highlighted with visual cues in order to direct the user's focus to the PoI. Figures 2a-b depict a moving star that indicates the PoI. In addition, implicit elements are used in the scene to subtly drive the attention toward the puzzle being solved [2]. Figure 2c shows a light appeal that points out where the user should gaze to advance through the scene.



(a) Star position 1

(b) Star position 2



(c) Implicit light appealing

Fig. 2: Visual cues used in the environment

To enhance the user's perception, a color contrast is created between the orange glow and the blue-purplish tint of the environment. Also, the universe is designed as an abstract media that offers a calm ambiance allowing users to fill in the plot details on their own without using any verbal or textual narration (Fig. 3).

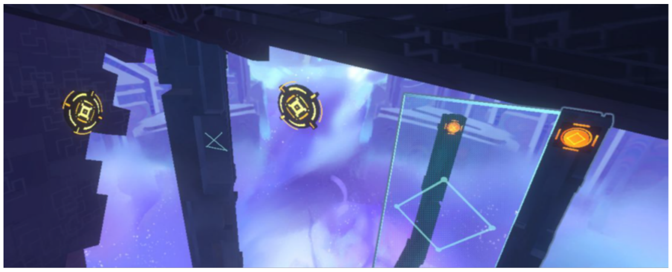


Fig. 3: The colors and 3D environment design

D. Trajectory Visualization

The arrow's trajectory is simulated by a realistic curved path. The arrow's speed depends on the force with which the player pulls the bowstring. The bow has light elements that change color according to the player's actions. The red color indicates that the arrow is fully loaded (Fig. 4a) whereas the blue color shows that the arrow is partially charged and can increase to the maximum load (Figs. 4b-c).

A shot preview system is designed to predict the arrow trajectory. It aims to inform players whether their shot will be fired or released. When the trajectory overlaps with a target element, it becomes green, indicating to the players the success of the shot (see Fig. 4a). Figure 4c shows the opposite case.

(a) Fully charged bow and arrow

(b) Start charging bow

(c) Partially charged bow

Fig. 4: The bow's illumination with the path preview system

III. RESULTS & DISCUSSION

The proposed approach was assessed through a survey carried out on 16 participants. They had an average level of expertise in VR and puzzle games. The questionnaire was designed to evaluate the comprehension rate, visual impact, and user experience. The results are summarized as follows:

Comprehension rate: 90% of users directly understand the objectives of the levels while 86.7%, 100% and 87% have no difficulty handling and manipulating the switch, targets, and connected targets, respectively.

Visual impact: 80% of users feel that something directs their gaze. 86% note sufficient variation in architecture between levels.

User experience: 66% are satisfied when they complete a level. 83.3% have the sensation that the bow's response is proportional to the strength with which the bowstring is pulled. 71.4% find that the music is consistent with the experience.

Despite the medium expertise level of the users, the first results show that the game objectives are clear. The functioning of the interactive gameplay elements (switch, targets, etc.) was well-understood thanks to the intuitive design and the shot preview. The included visual cues were perceived by the users. It can be noted that these cues have somehow contributed to make the VR game easier by explicitly and implicitly eliciting the users' attention and focus.

The user experience responses show that the bow trajectory system is highly appreciated by providing a plausible game feel. Despite the physical trajectory simulation, the game session remains fluid and therefore offers an engaging, satisfying, and entertaining immersive experience.

IV. CONCLUSION & FUTURE PERSPECTIVE

In this work, a VR-based game was developed that unobtrusively guides the user's attention using subtle game-design elements based on visual cues, environment aspects and level progression. The results demonstrated user satisfaction in accomplishing the game's objectives, which aimed to offer an intuitive, appealing and enjoyable interactive experience.

In the next step, we plan to evaluate the capability our design approach to improve the attentional performance of children with cognitive impairments such as Autism Spectrum and Attention Deficit Hyperactivity Disorders [3].

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