Blind New World: Enhancing Immersive Environments through Information Filtering Design

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ABSTRACT

This pictorial explores the process and methods for multi-player, immersive environment design, which is inspired by Aldous Huxley’s dystopian novel, “Brave New World”, where information is entirely controlled by a dominant authority. With the almighty recommendation system thriving, we find ourselves precariously balanced on the edge of “filtered or inefficient” information system.

In this pictorial, we document the stages of designing, prototyping and testing, including the quantitative and qualitative results of a study in 11 persons to evaluate the design. Our work not only presents an approachable method for emulating the data filtration process in a communal immersive space through the use of filtered eyewear and tangible devices, but it also contemplates the philosophical aspects of information consumption. It investigates the intricate relationship between the necessity for data optimization and the preservation of human autonomy.

Each submission will be assigned a DOI string to be included here.

INTRODUCTION

Throughout history, humans have experienced the world through unfiltered sensory impressions. However, with the advent and spread of social media, there has been an information explosion, meticulously curated by algorithms that prioritize personalized preferences and relevancy over objective truth, enhancing efficiency in the process. Aldous Huxley envisioned a society in "Brave New World" where information dissemination was strictly controlled according to one's societal standing. Individuals were classified into several groups, each carrying out distinct social responsibilities to ensure the seamless functioning of society, with people living mechanistic lives. Our world is in the rapid evolution toward Huxley's vision.

In addition, the rising adoption of immersive environments and human-centric approaches in computational design is well-chronicled, aiding designers in crafting virtual realities. Hence, our exploration centers on immersive experience design for information filtering, with the aim of raising awareness and providing accessible methodologies for designing multi-user, tangible immersive environments. As such, we've developed "Blind New World," using immersive technology to simulate the process of information filtering. We've created accessible tools designed to foster a personalized, immersive experience within a communal space.

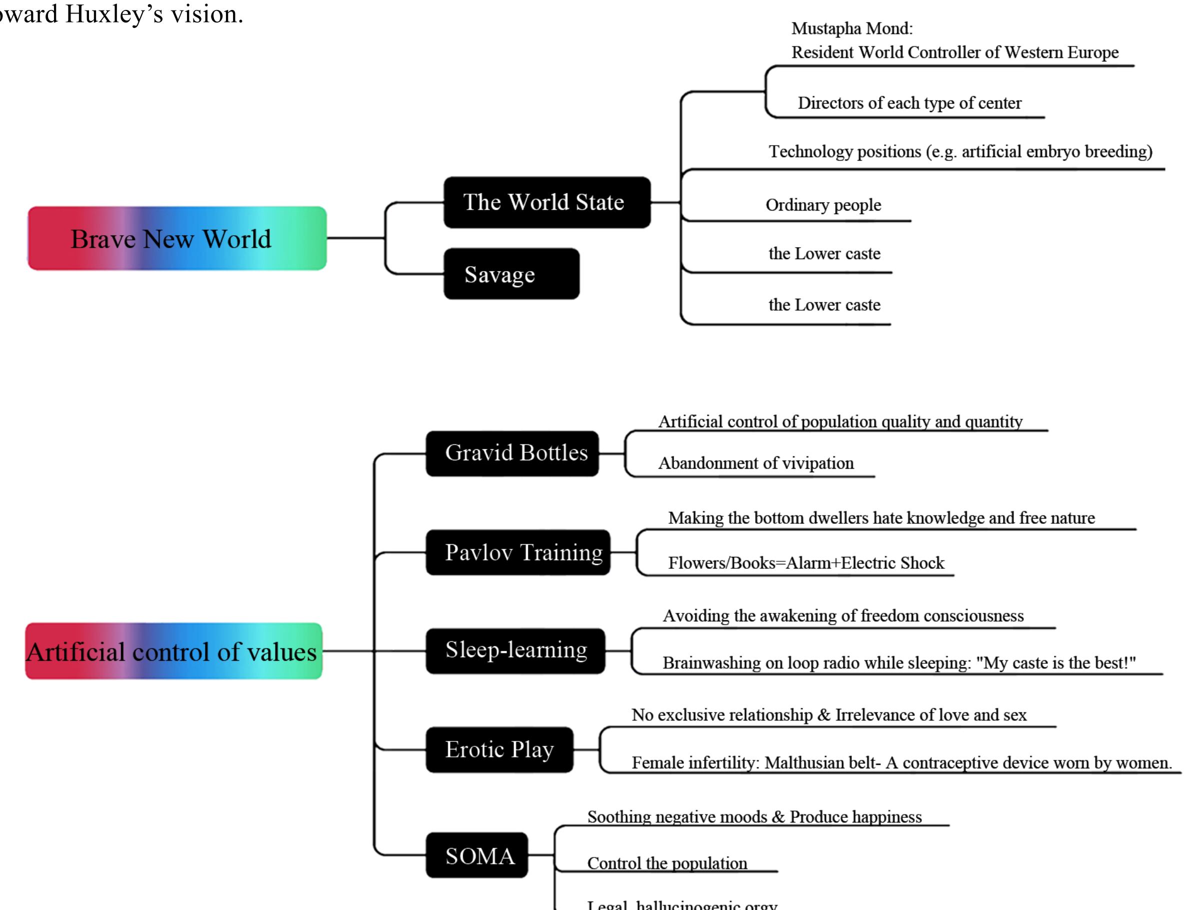


Figure 1: Mindmap from Brave New World

Related Works

Shared screens and projection environments have been identified as key components in amplifying the visual immersion of multiple participants, particularly in situations incorporating stereoscopic visualization [1]. These tools have been essential in enabling interactions with heritage artifacts [2] and supporting comprehensive, multi-user systems for interactive gaming [3]. While recent studies have investigated gesture interaction methods for multi-user interactive tools utilizing smartphones for user input segmentation [4], limited focus has been placed on the segregation of feedback data in the environment to facilitate personalized user experiences.

Embodied feedback, such as haptic interaction, serves as an effective means to provide individuals with distinct and personalized information, thereby significantly enhancing the immersion of virtual environments. [5]. While researchers endeavor to make the virtual world more lifelike, for instance, through the recreation of physical entities in virtual settings [6], the application of this approach to differential feedback systems for shared information in multi-user virtual environments remains relatively limited.

Our hypothesis suggests that integrating simple wearable and tangible tools within the interactive environment can provide individuals with personalized information augmentation, thereby enhancing the immersive experience of information filtering.

From Novel Brave New World

Structure and mechanism of the society in the novel are referred and adapted to the installation(Figure 1), giving participants an immersive story background to make them feeling easier to fit in. Cognitive differentiation according to different castes is guided by two parts: brainwashing-like education in artificial environment before adulthood, and circulation between working (in info-filtered environment) and entertainment (with happiness-producing drug SOMA) after adulthood. It's all about building a highly standardized world satisfying everyone without pain.

METHOD

Interaction Process Design

Drawing from the storyline, players are divided into three categories: Alpha, Gamma, and Epsilon, and are provided filter glasses and a tangible bubble-like controller, as corresponding devices at the entry point. Each group navigates their distinct informational tracks and experiences while retaining the ability to remove their filter glasses and alter their information viewing state.

Composition of the Installation

The installation is divided into two zones: the Work Zone, which focuses on personal information interaction based on corresponding devices, and the Rewading Zone, where participants remove their filter glasses and set aside the controller to experience public and shared information.

Prelude

Basic rules and background information are introduced along the entrance pathways to engage users, who then enter the main interactive zone. During the process, each will acquire their ID devices and listen to the instruction to learn what to do next as a citizen in their group.

Circulation between two interaction zone

Users will fluidly transition between the work zone and the entertainment zone during the information interaction mode, alternating between personalized information interaction and experiencing public and shared information. This back-and-forth interaction continues until users conclude their experience and leave the installation.

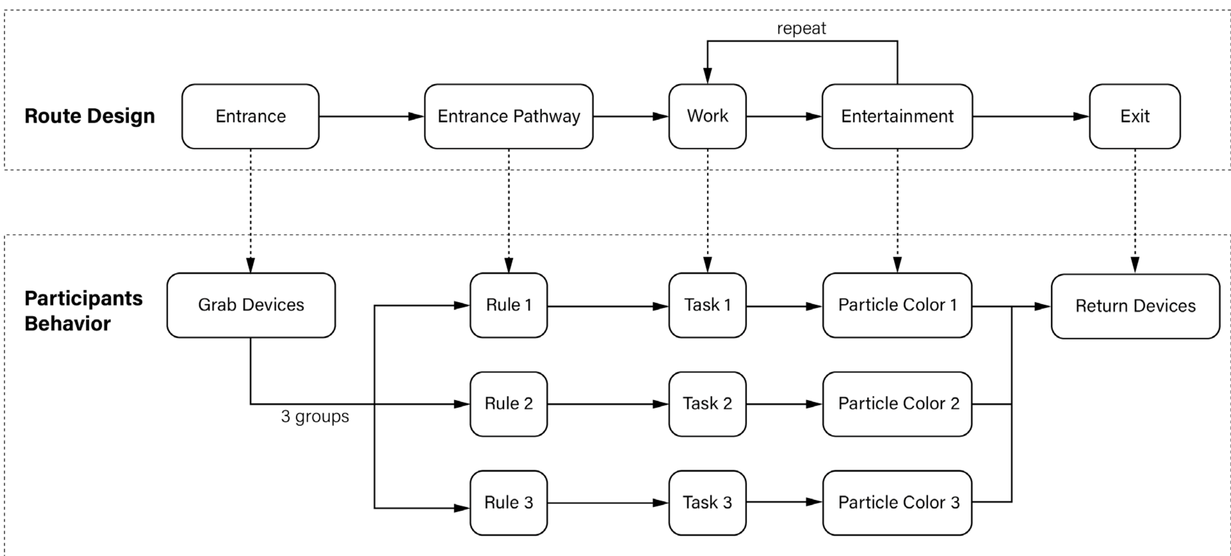


Figure 2: Route Design

Work

When working with glasses, participants perceive the information presented as an indication that they are engaged in the most important tasks and making significant contributions. .

When gaming, the same screen is utilized, but the glasses' filtering feature separates different games, allowing distinct groups of players to engage in different operations based on the information filtered for their respective roles.

Entertainment

After completing the initial interactive part, participants are granted access to the entertainment zone to enjoy their rewards. By pressing the button on the console, stunning particle effects appear on the screen. Participants have the option to take off their glasses and admire the visual spectacle.

Instruction

To make participants feel more comfortable in the environment and to ensure they remember the process, each individual will be provided with a brochure containing instructions and construction detail . These instructions are displayed on the next page.

Instructions

i Claim your *Castes Bubble*®

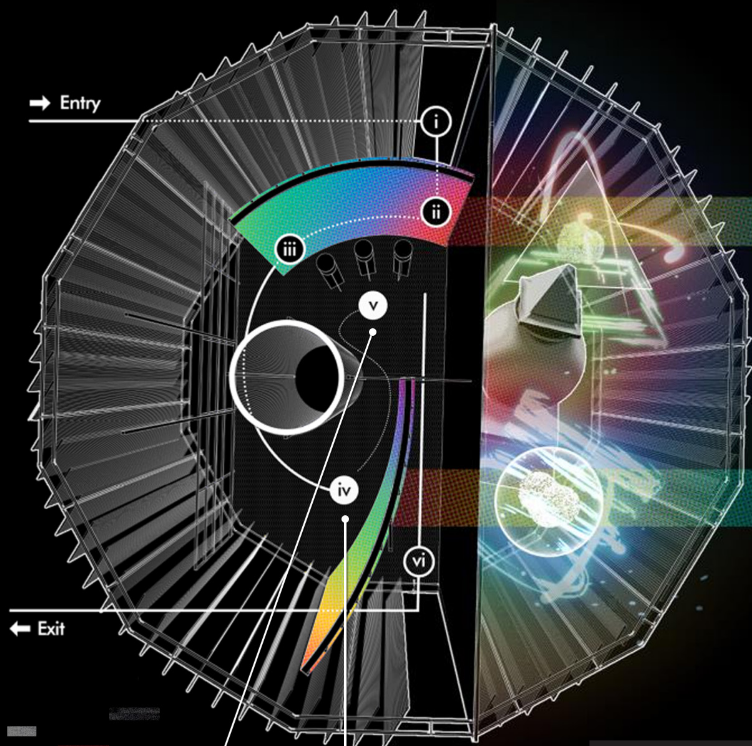
Castes Bubble® is a necessity for your life in the New World. It is a proof of your legal identity. Please keep your *Castes Bubble*® with you safely and present it to the terminal whenever you need to verify your identity.

ii Exchange Information Collection Equipment

Hold Castes Bubble® close to the terminal until the indicator lights up when the terminal completes identity registration. Please pick up and wear the glasses with the same color as the indicator light.Then you can enter the acclimatization area once the equipment is worn.

iii Finish Adaptive Training

Place your Castes Bubble® on next terminal and download the instructional file from Instructor. Adaptive training is an explanatory service set up for new citizens to adapt to life in the new world. In order to avoid losing your way in our perfectly functioning social system, please remember and trust only the advice that the instructor provides to you, so that you can fit into the new world and enjoy your beautiful new life as soon as possible!



v A SOMA cures all.

Place *Castes Bubble*® on the terminal to receive your SOMA allotment for the day's work. Every citizen who completes work has right to be happy. Occasionally life can give us little shocks and make our emotions fluctuate a little. The state has taken these into account and will offer a "little jelly bean" called SOMA. When feeling negative emotions, just take one!

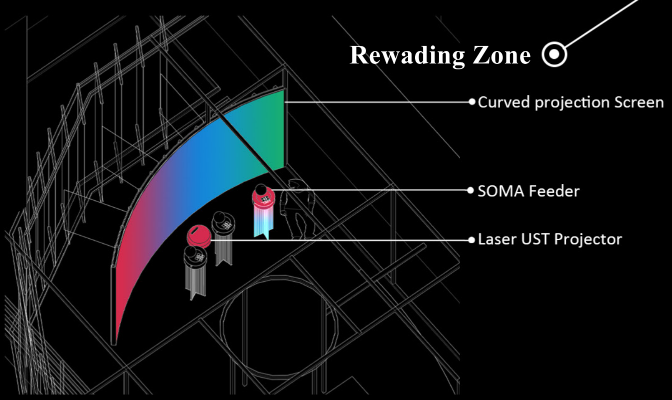
iv Fulfilling the obligations of a New citizen

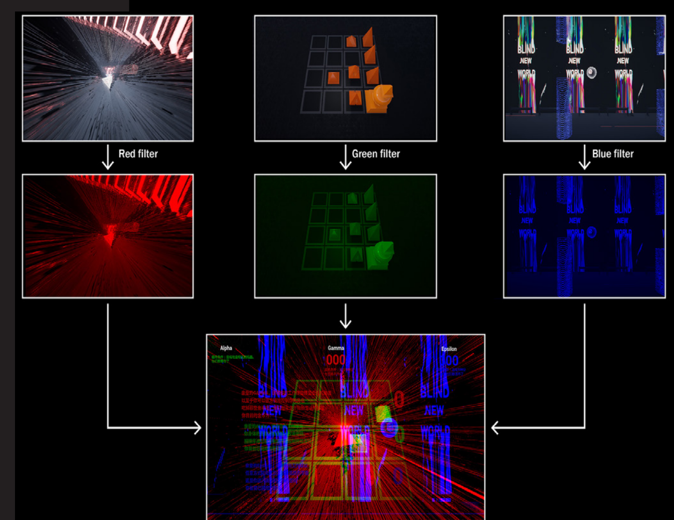
Do our bit to the New World is the way for every citizen to realize his personal value, and you will definitely feel great satisfaction and joy by working diligently in working zone! The manual has been projected on the work panel in front of you, and *Castes Bubble*® will assist and remember your work. Please have fun after finishing your work!

vi Escape□□□□6m □□□□□N□□□□World

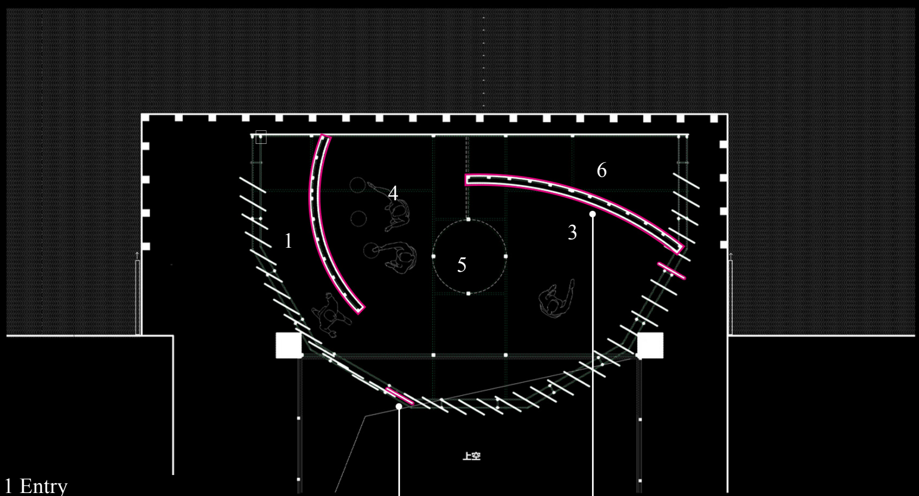
Please be sure□□□□□□□□□ drop off □□□□ deactivated *Castes Bubble*® □□□□□□ New World Waste Disposal□□□□

SOMA□□





GAME VIEW



1 Entry

2 Adaptive Training

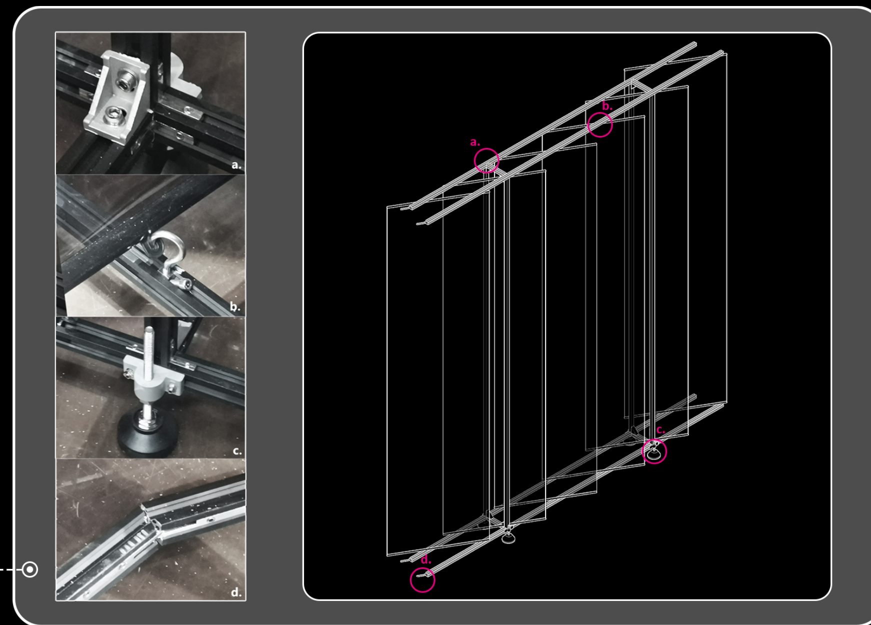
3 Working Zone

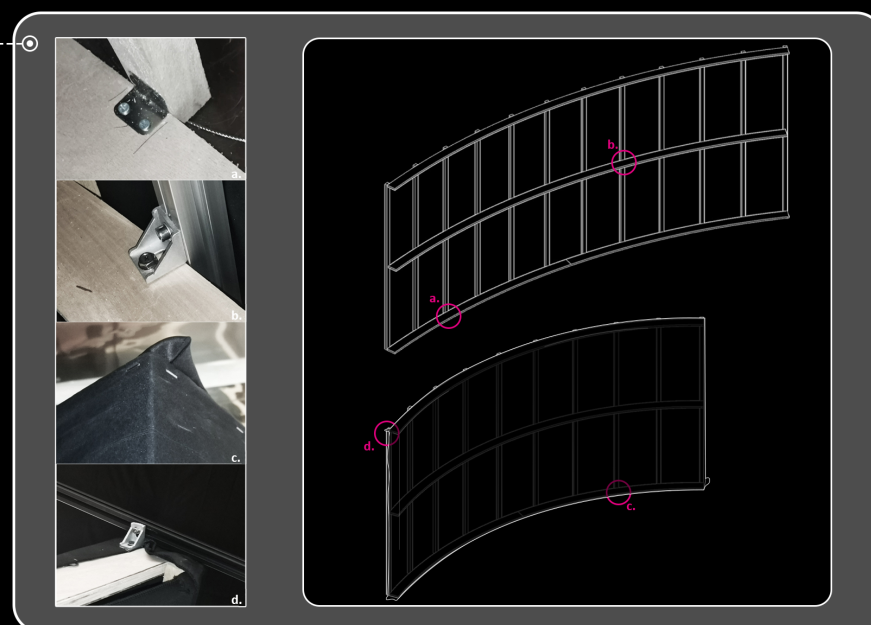
4 Entertainment Zone

5 The Core

6 Exit

Scheme Plan





Peripheral Structure Unit Details

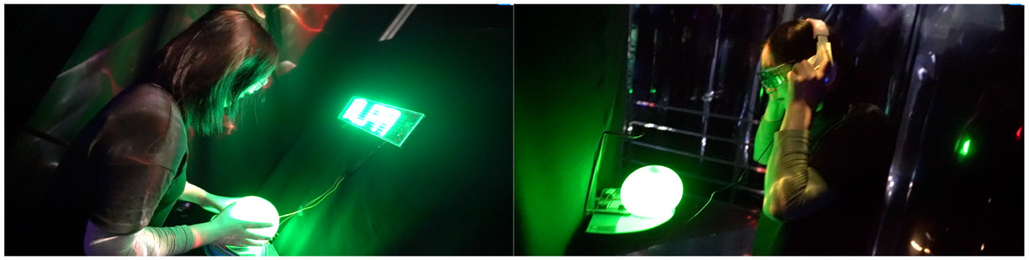
The planks are cut by CNC machine and are orthogonal to the pine wood square. The joints are reinforced with metal angle yards and self-tapping screws.

Curved Screen Structure Details

The frame is built with profiles and fixed with angle yards and socket screws. Finally, mark and hang the unidirectional fluoroscopy film at the mark according to the parameters.

The building process continued for two weeks to achieve the jettied construction. We experimented with various solutions to ensure its stability and practicality. The entire process has been recorded and is displayed on the next page.

On-Site Records



Step 1: Entrance Pathway

Step 2: Work Zone

Step 3: Entertainment Zone

Figure 3: Experience Scene

Interaction Design

Within this context, our research focuses on prioritizing an accessible and cost-effective solution: the utilization of filtering glasses to enhance and filter personalized visual information for users, coupled with a tangible Arduino-based controller to facilitate personalized information feedback. We aim to leverage this technique to segment data between users sharing a single screen, tailor experiences for individual users, examine multiplayer mechanisms within tangible installations, and develop a natural, accessible interaction protocol.

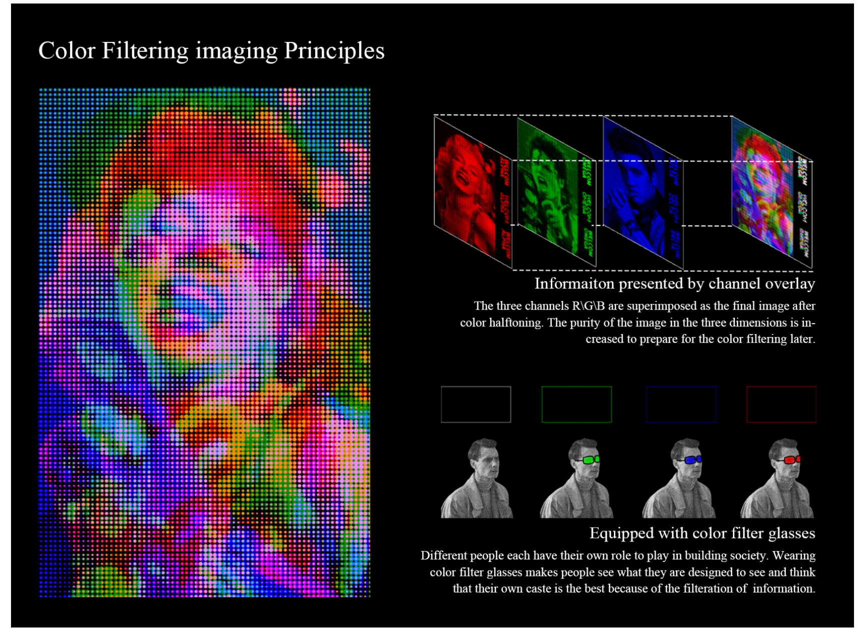


Figure 4: Color Halftoning

Techniques of Color Filtering in visual content

Color filtering, an established technique within optics and image processing, is frequently employed within these interfaces. Some researchers have harnessed color filters for 3D displays[7], a technique that involves data division between the viewer's eyes to generate vivid view. Nevertheless, the potential of color filtering in sculpting personalized experiences within shared immersive environments remains limited explored.

We implement this cost-effective method in the installation design to enhance the information experience. People can choose whether they wear filter glasses to realize the transition from personal information to mixed information.

Each player is provided with glasses featuring a specific primary color filter—red, green, or blue—that allows only light of the corresponding color to pass through. In the Work Zone, laser projections undergo a color filtering process that involves superimposing the original visual content after applying red, green, and blue (R/G/B) color halftoning (Figure 4). This process is accomplished through the superimposition of three distinct visual information targets onto a unified screen, thereby ensuring optimal visibility of the images subsequent to color filtering.

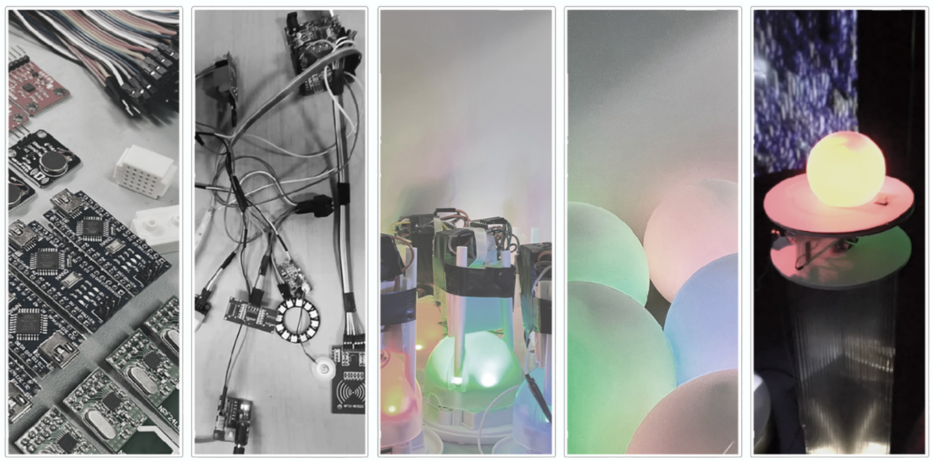


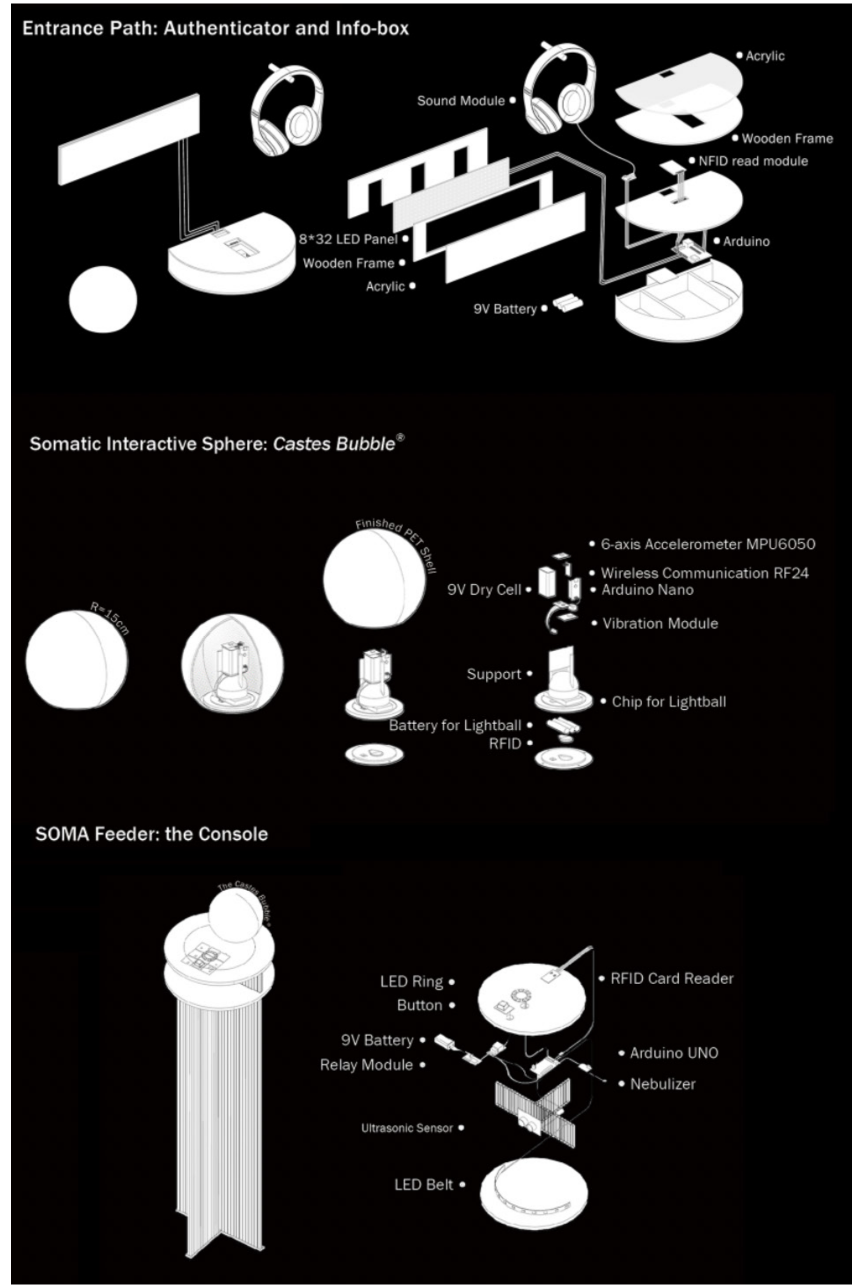
Figure 6: Installation Process

Techniques of Tangible Interactive Device

To realize the embodiment interaction in the installation, we design a bubble-like controller, 'Caste Bubble', that can detect the user's behavior and present personalized visual and haptic feedback (Figure 5). The device is composed of an Arduino NANO, an RFID card, a 6-axis accelerometer MPU 6050, and a wireless communication component RF24. Each caste of users interacts with the device through different movements, which elicit unique reactions based on the data division method employed.

The initial installation, located at the entrance pathway, incorporates a Castes Bubble dispenser, a Castes Bubble recognizer, and a set of headphones. These elements serve as authenticators, aiding in the identification of visitors' Castes. Moreover, they play associated background stories, fostering visitor immersion into the narrative world from the very beginning.

The act of ingesting SOMA is symbolized through user interaction with a dynamic screen via a console, which reflects the emotional and sensory experiences within the human mind. To facilitate interaction with the reward system, we've incorporated a console into the process, which registers user input and provides sensory feedback. This system is anchored by a frame constructed from polycarbonate hollow sheets and two panels made from PVC expansion sheets. The operations are managed by an Arduino UNO, with supplementary components including an RFID reader, a relay module, an atomizer module, an ultrasonic sensor module HC-SR04, and LED rings and rope light.



Questionnaire1: Content Recognition

Content Acceptance

Q1-1. Rate the difficulty you feel in accepting the contents and the settings. (Difficult 1-7 easy)
Q1-2. Rate the extent to which you feel you are immersive in the environment. (Difficult 1-7 easy)

Content Detail (Retrospective)

Q1-3. Rate the efficiency you feel that the concept of the Work Zone and Entertainment Zone is clearly conveyed. (Difficult 1-7 easy)
Q1-4. Did you feel the desire to do tasks repetitively to play in the Entertainment Zone? (Y/N)

Questionnaire2: Physical Experience

Physical

Q2-1. Rate the easiness you feel in discerning different visual contents through the filters during the experimental environment. (Difficult 1-7 easy)
Q2-2. Rate the extent to which the caste bubble make you feel immersive. (Difficult 1-7 easy)
Q2-3. Rate the extent to which the filter glasses make you feel immersive. (Difficult 1-7 easy)

Questionnaire3: Mental Comfort

Interactive Method’s Learning Efficiency

Q3-1. Rate the easiness you feel of learning and mastering this interactive method. (Difficult 1-7 easy)

Pleasure (Mental)

Q3-2. Rate the pleasure you feel with the filter glasses on during the environment. (Negative 1-7 positive)
Q3-3. Rate your willingness to come back to experience interaction installation again. (Negative 1-7 positive)

Table1

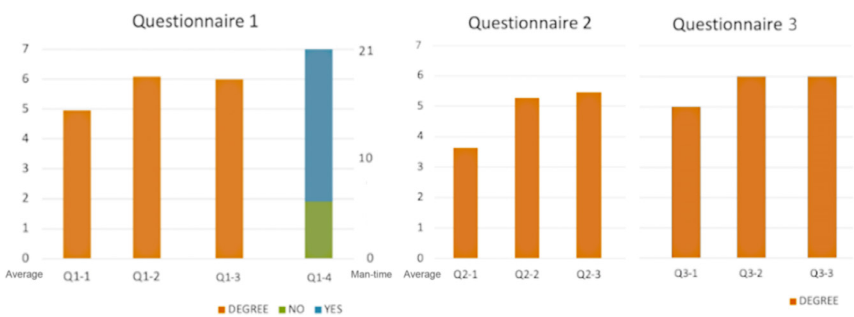


Figure 7: Questionnaire Result

RESULT AND DISCUSSION

Questionnaire Design

To garner authentic feedback, we opted for a qualitative research method grounded in a questionnaire to evaluate the user experience. Post-experience, we surveyed 21 participants aged between 20 and 50 years old. Inspired by existing research on virtual reality space presence evaluations[8-10] our questionnaire assessed three aspects: content recognition, physical experience, and mental comfort. Consequently, our survey comprised three sections with a total of ten questions, as shown in Table 1.

Questionnaire Result

After analyzing the average scores extracted from the questionnaires, we arrived at the following conclusions (Figure 7).
Our feedback questionnaire findings can be categorized into three aspects: content recognition and engagement, and physical and mental experiences. We provide insights for each of these aspects:

- Content Recognition and Engagement:

Participants demonstrated a substantial understanding and acceptance of the core principles and rules, despite the inherent complexity of the content. This success signifies that our system effectively engaged users' attention and functioned as a stronger motivator compared to conventional interactive games. Additionally, this method contributed to information filtering, enabling players to quickly grasp the content. In a broader societal context, more precise information can streamline goals and communication, ultimately leading to increased efficiency.

- Physical Experience:

Our novel method of enhancing the multiplayer experience through data segmentation and an embodied feedback controller proved effective. However, some participants reported a diminished visual effect when using green color filtering compared to those wearing red glasses, likely attributable to varying human sensitivity to green light. To address this, we suggest further exploration into alternate color filters or lighting configurations to universally enhance the visual experience.

- Mental Comfort:

While participants widely praised the overall experience, some found the process of adapting to the devices and tools less satisfying. This feedback might stem from the limited duration of the experience or the complexities associated with our novel controller, Caste Bubble. Future improvements will focus on fine-tuning content and procedures and boosting the interactive experience through more direct feedback on the Caste Bubble. Interestingly, despite assurances that "your character is the best," many players expressed a desire to experience other roles. This behavior likely reflects human curiosity and an inclination for personal discovery rather than mere acceptance of provided information – a testament to the human need for exploration rather than mechanistic compliance.

In sum, the immersive environment we created was generally well-received, with most participants awarding high scores for interaction.

The results indicate a promising foundation, with opportunities for refinement and enhancement, ensuring that the desire to explore, understand, and engage remains a central aspect of human interaction with our increasingly technologically driven world.

CONCLUSION

Within the philosophical scope of our discussion, we underscore the significance of information filtering as a catalyst to enhance societal efficiency. However, it is crucial to retain a human-centric approach, which safeguards the individual's right to remove their filter glasses. While there is a certain satisfaction in conforming to a single role, the different aspects of life. This yearning for exploration and varied experiences is a testament to our human nature.

As for the methodological aspect, our study introduces a novel approach to data segregation during immersive experiences. By harnessing emerging technologies, users can engage with digitally personalized, tailor-made interactions, leading to heightened user engagement and immersive experiences. This method has potential applications in immersive theatre and other tangible installation systems, thereby offering audiences a personalized experience. Importantly, the scope of this approach is not confined to virtual environments but extends to everyday life scenarios, such as advertising billboards or road navigation signs.

Furthermore, in our design we acknowledge the limitations of single-color vision effects and their inability to wholly replicate the original viewing experience. There is room for improvement in the recolorization of filtered data through the use of neural networks. This advancement could further enhance the immersive experience by restoring more accurate and vivid colors. Additionally, the incorporation of haptic feedback into the experience could contribute to the development of lightweight, affordable augmented reality systems, thereby improving user comfort and accessibility in immersive environment experiences.

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