Using Virtual Reality to develop immersive audio experiences centered around homelessness

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Abstract
This project aims to showcase a collective of stories gathered by the Peoples Republic of Stokes Croft [1] (PRSC henceforth) that highlight the timelines, issues and concerns of those whom consider themselves to be or to have been rough sleepers. Audio interviews were recorded by the PRSC and provided to be used for this project. This project utilises Virtual Reality (VR), puzzle game design and user collaboration to create an experience in which users aim to uncover various audio segments in a navigable cityscape. The audio segments form a leading narrative that is unlocked as players progress to each new orb. The project was created using the Oculus Quest [2] and the Unity game engine [3]; utilising FMOD [4] as the audio middleware tool.

Author Keywords
Virtual Reality; Immersion; Audio Experience;

Introduction
Homelessness in Bristol, United Kingdom is a persistent issue in the city. In the last seven years, the total number of rough sleepers found on any given night in the city centre rose from 8 in November 2007, to 82 in November 2018 [5]. Furthermore, less explicit examples of homelessness, such as individuals who

'sofa-surf' or live in temporary accommodation has been shown to increase, with facts suggesting "as at 31st March 2019 there were 520 households living in temporary accommodation, compared to 160 at 31st March 2012, a 225% increase" [5]. Statistics concerning the members of the homeless spectrum is accessed easily via the internet and can provide a generalized overview of the situation as a whole. However, it is easy to forget that numbers represent individual people or families, each of whom have their own story to share. The PRSC provided a series of interviews conducted with members of Bristol's homeless population, offering insight into the experiences they had to share. The outcome of this project is to represent the stories of these people in an accessible interactive format. Proposed for this project is the use of VR to isolate individuals and place them into a landscape designed using information gauged from the series of interviews. The interviews are split up into short segments and will act as collectibles that can be found around the environment.

Research Journal

Primary research for this project surrounds the homeless spectrum within the United Kingdom, the application of VR for immersion and the use of collaboration in video games. Furthermore, this project exists personally as a vessel for learning better practice in VR development.

Interviews and raw data

The core idea of uncovering themes and piecing them together arose from the interviews. It is evident that the stories told by the interviewees share many common elements, suggesting an underlaying theme that interconnects each of the stories. Though many statistics are provided by the UK Government on homelessness [6], this has the downfall of reducing personal information to mere numbers. In focusing on the semantic detail within the interviews, core principles and opinions from individual people were extracted. This aided in the immersive nature planned for the project by manifesting a feel of relatability in the process, rather than acting solely as an educational tool through facts and figures. The prototype of this project focuses on the interview of 'Dave', a gentleman whom was on varying stages of the homelessness spectrum, however, now resides in a more secure housing situation.

Literature Review

IMMERSION

Browns and Cairn [7] identify three levels to immersion, *engagement*, *engrossment total immersion.* A statistical approach to this topic would allow for engagement to occur since engagement focuses on the accessibility to a of something, requiring the user to "invest time, effort, and attention" before any further immersion can occur [7]. Statistics alone would provide this, as they require little time and effort to read and understand, and are generally void of a game genre, meaning they can pique attention cross-genre. However, to further this engagement, engrossment needs to occur to affect the user emotionally. Browns and Cairn note that "some game features mentioned by participants that form this quality were visuals, interesting tasks, and

plot.” Plainly represented statistics do not fill the requirements for this. As such, a collection task was designed that allowed the user to navigate throughout an environment to collect information derived from the interviews.

Environment and Aesthetics

Visually, it was desired to create an overwhelming environment, that is similar to the locations described in the interviews, however with amplified features. In his interview, Dave mentions the gentrification of Bristol. Books such as *Voices of Bristol: Gentrification and Us* [8] comment these issues. On their Facebook page, regarding St Mark's Road, Easton winning an award for being best Road in UK, they mention “let's not forget that parts (especially to the west) of St Mark's Road remain in the top 10% of most deprived areas in the UK, although up from 659th to 2,334th out of 32,844 (between 2015-2019)” [9]. To design a resultant environment from this, references to Bristol’s own environments were used to isolate their key features, and to then use them to represent the statistical data. This way, both the engagement and engrossment levels of immersion are represented, and the reverse effect of gentrification is utilised by advertising statistics relating to homelessness in ways that you may find in wealthier areas, such as billboards and building texts.

Collaboration in video games

One prominent theme derived from the interviews was the lack of support, and the resultant isolation that comes of it. From personal observation in Bristol city centre, there exists a severe disconnect in the relations between the homeless and members of the public whom pass by.

Using this as a catalyst, it was decided that a collaborative process that emphasises the need for communal effort to tackle homelessness was a viable method forward. The prototype demonstrates the viewpoint of a singular player, however future iterations would develop a localised environment for multiple players to exist within; the core mechanics are demonstrated here.

Virtual reality and immersion

Though a collaborative effort will be required to participate in the final version of this project, there is also a heavy focus on removing the player from their immediate surroundings. As aforementioned, isolation and a lack of support is a prominent occurrence for those on the homeless spectrum. [10] As such, to help the player empathise with this, once the headset is on, it is down to them to figure out how to proceed. VR is an ideal platform to this due to its substitution of a player’s senses for digital counterparts.

Design Process

This project followed an iterative design process, aided by the use of GitHub for source control.

Conceptualising

The initial concepts for this project were created though source material analysis, field-testing, exploration of art and visual medias, and through small experimentations with Unity.

Source material analysis and collection

The first stage of design was to understand the interviews provided, and also the physical positions they were created in. Core themes were extracted from the interviews to act as design pillars. From Dave's interview came community and the lack thereof, a lack of help from the relevant powers, and the gentrification of Bristol. Endeavors into Bristol's city centre add depth to these topics. First-hand experience in travelling through the city centre shows that there is a large populous of homeless people on the streets of Bristol. Many are tucked into doorways and smaller spaces to be protected from the elements. Further observations showed that these people often clustered together and interacted socially, as members of the public would not provide interaction themselves. One spontaneous spoken encounter with an unnamed gentleman in Clifton, Bristol resulted in him saying "there needs to be more people who stops to talk, we're not always after money you know" (*this is a recollected quote and is a representation of the conversation's content*).

Photographs are not provided as to not disrespect the members of the homeless involved in this site visit.

Field-testing the experience medium

Since the Oculus Quest was the medium for this project, current experiences offered on it were played first to see how released products functioned on the device. This allowed for first-hand experience into the use of the core control systems and the immersive quality of the VR headset. One game in particular was Journey of the Gods [11], a first-person adventure game. This game is highlighted as it featured a two-handed control scheme to allow the player to freely traverse a map, using the left joystick for player movement, and the right joystick for camera movement. Other experiences, such as Space Pirate Trainer [12], offered a static experience, focusing more on mechanics than movement, offering a static experience in which the player shoots enemies but does not move. In testing both experiences, it became evident that to fully immerse a player, they should be given control over their movement, and as such dual-controller, joystick-based movement system was chosen. This also shows parallels to other controls for other games devices [13], and perhaps offers a more familiar system to use for the experiences.

Art and visual medias

It was paramount to have an expressive and emotive direction for the visual elements from the start of the project to fully maximise the empathic response from the player. Two references use for this were the 1988/2008 comic 'Batman: The Killing Joke' [14] and the 2010 video game 'Limbo' [15]. Reading through The Killing Joke, the use of extreme contrast and obtrusive imagery is immediately apparent, and it representative of the content within; the madness of the character, The Joker. This provided a good stimulus to start from in terms of emotive expression of an emotion, however the visuals felt too exciting for the purpose of this project. Thus, attention was turned to 'Limbo', a 2D puzzle platformer. Limbo utilises an aesthetic similar to that of the art technique 'chiaroscuro' [16], the harsh contrast of light against dark. This, combined with a greyscale colour palate and a strained offering of information, creates a melancholic and depressing video game experience. Together, these references offered insight into developing an overwhelming yet bleak experience for a visual purpose.

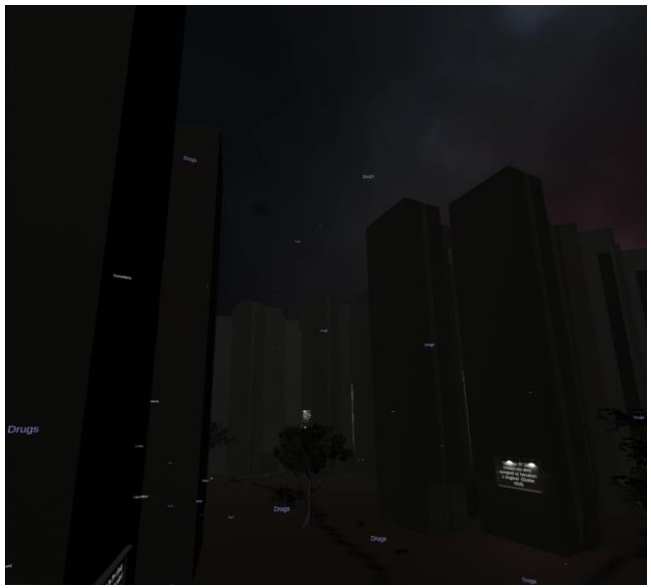

Figure 1 - Tall Buildings and greyscale colour palates were used to capture a dark and overbearing cityscape

Unity Experiments

Small projects were developed in Unity to demo ideas for use in the final iteration. These are outlined below.

Boids and Flocking

The use of a flocking algorithm was implemented to mimic the swathes of members of the public whom pass by members of the homeless on a daily basis. From visual field research, it was noted that most people ignored or briefly reacted to those on the street, even though there were often hundreds of opportunities for interaction. Flocking affords this, as each member of a flock interacts with each other whilst avoiding anything outside of its flock. Inspired by the original theory of flocking [17] a small demo was created. In adjusting the base code, a method was designed to allow for boids to cluster with each other, but rather than avoiding the environment, instead they were asked to home in on the players location. Various iterations of this were created, in incessantly following the player, avoiding the player and homing in on the player. Homing in on the player provided a good method of bombarding them with something, however the placeholder of using spheres felt unusual, as they served no purpose other than as a physical representation of the algorithm.

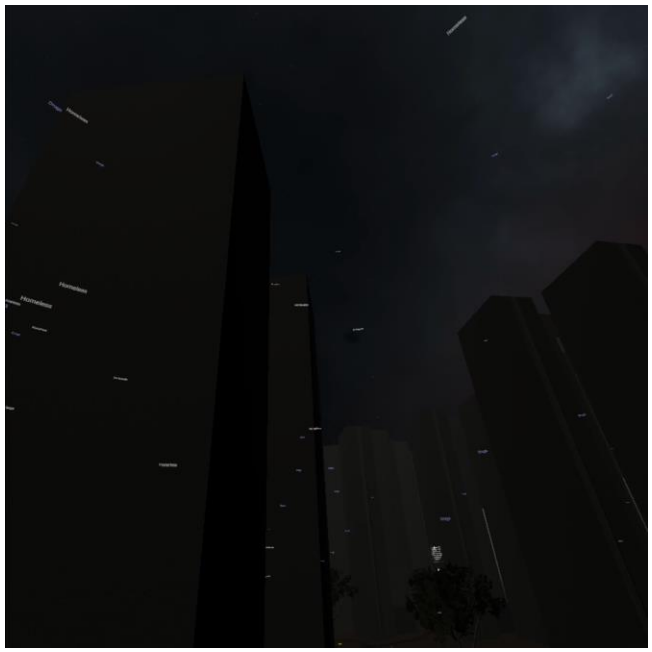

Figure 2 - Text Boids flock around the map and track the player's location

Using the Unity package 'TextMeshPro' [18], text objects were created that could be used in place of the spheres. One idea was to have the text choose a word from a document at random, however in testing, it felt as if the words needed to be pieced together, and more time was spent doing this than exploring the map. Instead, key words were chosen to represent various flocks, meaning that the same singular word flocked with itself, however not with other key terms. This created separation between key topics, but whilst keeping the obtrusive flocking mechanism. In the prototype, it was also decided that the text should always face the player. This made it feel as if the player was always being watched or stared at, again reversing the role of an ignorant, swarming public, instead creating an attentive, swarming information source.

Virtual Reality Mechanics

A key mechanic in VR games is being able to grab and manipulate physical objects within the digital realm. Small tests were made to determine the best method for the project. With the concept being a collection-based game, it felt natural to include a physical collection method. However, this lead to many issues, including objects clipping with the player body, unsuccessful grabbing and holding, and utilising the grabbed object for a further purpose. The result was to have the player grab and interact with the object as a form of success and involvement, however with no use for the object after to avoid the aforementioned issues. Instead, a counter is provided to the player that updates when a collectible is collected, offering them feedback without requiring further work.

Design Proposal

This project is a Virtual Reality experience that challenges the user to collect audio segment orbs while navigating a gentrified environment. The general theme of the piece is to induce a feeling of isolation and melancholy that is combated through collaborative engagement and intrigue. These concepts are represented through the game's medium, environment and the core collective mechanic. This project was designed to use VR as its medium. Typically, VR is a solo experience; one user with one headset navigating one experience. Though this could be seen as a personalised experience, this project treated it as an

isolating device, emphasising the sense of solitude, but as a part of a collective whole. This means that though one user may experience the project at a time, their efforts in navigating it form a part of the larger picture, setting the way for those who experience it afterwards.

The environment is inspired from personal experiences of the Bristol cityscape, as well as collected themes and excepts from the provided interviews. Using extreme size and aesthetic manipulation, the environment is designed to feel cumbersome and consuming, whilst inducing intrigue and familiarity. Block-like, tall and repetitive buildings with a grey palate offer the urban gentrification of Bristol, whilst the use of lighting and audio; sensory information, and design choices such as selective colours should govern the sense of curiosity in the user due to their stark difference to the greyscale environment. This overall helps the exploratory theme manifest itself as a root of the experience's design.

A secondary theme that arose from the interview was the feeling of isolation, furthermore the importance of community amongst those in similar situations. The concept of 'flocking' acts as the driving force for this idea. Using extracted topics from the audio segments, a flocking system was created to visually engulf the user with text objects that represent the topics.

The purpose of the boids is to act as members of an all-seeing public. The words in the flock always face the user, so that their content is always readable. They are also designed to flock to a user's last location every 10 seconds, following them but less intently. However, the members of the flock are void of any interaction other than sensory; they possess no interactive features for the user other than to provide textual information consistently. There is a parallel to be drawn here between the members of Bristol's gentrified society and environment; ever-engulfing however ignorant to that which it engulfs. This subconsciously places the player in the position of the *watched*; everything is alluding to them, but without ever fully acknowledging them.

The project is designed to be solely experienced in the virtual environment. As such, there is a lesser need for a physical environment. Future iterations of the project may involve a multiplayer element however, and the use of multiple headsets would need to safely make use of physical space to avoid injury.

To summarise, the project exists to isolate the user through VR and place them into an amplified digital realm. By fostering curiosity they will be guided to uncover an audio journey that elaborates on the stories of those whom have experienced the project in a realistic fashion. Through collaboration, users will build a bank of story segments to unlock a unified narrative that informs and educates through personal recollection.

Prototype Report

Current iteration summary

The current prototype serves to showcase the key concepts that the final iteration of the project would contain. Featured is a microcosmic representation of the final map style, representing the singular topic of 'physical homelessness'; locations of residence, the surrounding environment, and the choice of terminology to describe such spaces. Inhabiting the map are various grabbable orbs. When interacted with by the player, they play out a sampled section of an interview with Dave, the interviews subject. To

reinforce the semantics of the interviews, the environment is populated with varying physical manifestations of key ideas from the interviews. Currently, there are text-shaped 'boids' that swarm the player. The word 'homeless' takes the place of birds in a flock, engulfing the player by following their position. Furthermore, the landscape is designed to feel hostile and bleak, reinforcing the gentrification of the Bristol landscape; the location of the interviewee. A nullified black and white colour palate coating hostile and amplified structures bring a melancholic and overwhelming feel to the aesthetic of the environment.

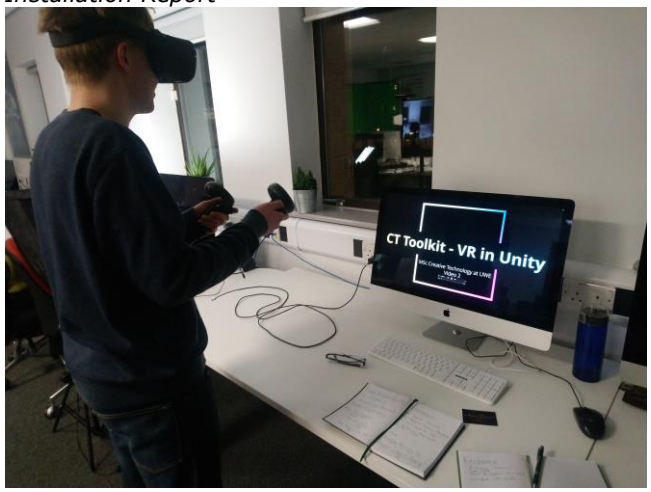

Figure 3 - The VR prototype in use

The prototype was demonstrated at a small university function to various colleagues and visitors. Key comments that arose from the presentation were regarding the inclusivity of the project, the lack of intuition for the control scheme, and adjustments to audio. Users deemed the scope of the project to be ambitious and thoughtful, showing praise to the use of mixed personal information and statistical information. Using the prototype was difficult for non-users of VR, and control methods had to be explained. This will be remedied through a redesign of the grabbing mechanic, and also an in-headset tutorial on how to fully utilise the experience. Finally, minor comments regarding a low audio level were mentioned. The prototype was not tested in the context of a busy exhibition, only a quiet space. This oversight will be met with adjustments to the audio volume in future versions, with varying-location testing to be performed, also.

Conclusion

The created project is working towards the need of the design brief by showcasing an immersive experience that utilises stories collected by the PRSC and presents them in an engaging and informative manner. Though only one story is recognised in the current version, future iterations will involve personalised sections that are developed with the key themes from other interview stories. This will successfully allow for the stories extracted from the provided interviews to be showcased via an interactive medium for public members to learn from and experience.

References

1. The People's Republic of Stokes Croft. 2019. https://prsc.org.uk/
2. Facebook Technologies, LLC. Oculus Quest. 2019. https://www.oculus.com/
3. Unity Technologies. Unity. 2019.
4. Firelight Technologies Pty Ltd. FMOD. 2019. https://www.fmod.com/
5. Insight, Performance and Intelligence Service. State of Bristol: Key Facts 2019. Retrieved December 4 from https://www.bristol.gov.uk/documents/20182/32947/State+of+Bristol+-+Key+Facts+2018-19.PDF
6. Ministry of Housing, Communities & Local Government. Homelessness Statistics. 2019. Retrieved December 4 from https://www.gov.uk/government/collections/homelessness-statistics.
7. Emily Browns and Paul Cairns. A Grounded Investigation of Game Immersion. University College London Interaction Centre. 2004.
8. Henry Palmer. 2019 Voices of Bristol: Gentrification and Us. Arkbound Publishers. Bristol, United Kingdom.
9. Bristol Gentrification. Facebook Post. 2019. Retrieved December 4 from https://www.facebook.com/BristolGentrification/photos/a.310240712840639/655654761632564/?type=3&theater
10. Ben Sanders and Brianna Brown. 'I was all on my own': experiences of loneliness and isolation amongst homeless people. Crisis. 2015. Retrieved December 4 from https://www.crisis.org.uk/media/20504/crisis_i_was_all_on_my_own_2016.pdf
11. Turtle Rock Studios. 2019. Journey of the Gods. Game [Oculus Quest]. California, USA. Played November 2019.
12. I-Illusions. 2019. Space Pirate Trainer. Game [Oculus Quest]. Galmaarden, Belgium.
13. Ryuji Nakayama and Ennin Huang. 2012. Gaming Controller, U.S. Patent US 2013/0178293 A1, Filed June 30, 2012, issued June 11, 2013.
14. Brian Bolland and Alan Moore. 2008. Batman: The Killing Joke, Deluxe Edition. DC Comics. California, USA.
15. Playdead. 2010. Limbo. Game [PC]. Copenhagen, Denmark.
16. The Editors of Britannica. Encyclopedia Britannica. Chiaroscuro. 2017.
17. Craig Reynolds. Boids: Background and Update. 1986 and 2001 Retrieved December 4 from https://www.red3d.com/cwr/boids/
18. Unity Technologies. TextMeshPro Package. 2019. Retrieved December 4 from https://docs.unity3d.com/Packages/com.unity.textmeshpro@1.3/manual/index.html