CHALLENGING SURVEILLANCE CAPITALISM IN URBAN PUBLIC SPACES THROUGH GAMIFIED SPATIAL PRACTICE SIMULATION WITH VIRTUAL REALITY

A Case Study of Piccadilly Circus Urban Screen Space

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Abstract. The proliferation of urban screens in public spaces has not only given rise to the phenomenon of digitally augmented architectural and city interfaces but has also enabled the quiet expansion of surveillance capitalism through some urban screens' exploitation of digital smart, where personal data becomes a commodity without the explicit consent of individuals. This paper examines the use of large digital advertising screens at Piccadilly Circus, London, which employ hidden camera sensors to monitor the area and collect passengers' data to generate automated reports on the audience, allowing for more targeted advertising. Since their implementation in 2017, these systems have operated without public awareness, creating significant power imbalances. This study proposes the use of Virtual Reality (VR) and gamification to educate and empower the public, mitigating the invasive aspects of urban screen surveillance. We discuss the development of a VR simulation that mimics real-life interactions within Piccadilly Circus, aiming to raise awareness and foster resistance against surveillance capitalism.

Keywords: *Urban screen, Virtual reality (VR), Immersive gamified spatial experience, Surveillance capitalism*

1. Introduction

The proliferation of digital screens in urban public spaces has fundamentally transformed city interfaces, creating digitally augmented environments that seamlessly blend physical and virtual realms. However, this visible technological integration represents only the tip of a more complex iceberg.

Beneath the surface lies a network of hidden sensors and devices embedded within the built environment (Streitz, N. A., 2021), which, in concert with visible screens, commodify personal data in urban public spaces. This technological advancement has facilitated the covert expansion of surveillance capitalism (Zuboff, 2019), extending from online platforms to offline urban spaces and raising significant concerns about privacy rights and citizens' autonomy in public areas. A prime example of this phenomenon is the iconic Piccadilly Circus in London, where hidden camera sensors monitor the area and gather data, generating automated reports for targeted advertising (Karolina M. and Ava, 2018) for commercial gain. This case exemplifies the quiet yet pervasive expansion of surveillance capitalism into urban landscapes, challenging fundamental principles related to the right to the city (Lefebvre, 1968) and the concept of publicness. While many internet users are aware of online surveillance capitalism through experiences with targeted advertising, the 'invisible' or 'disappearing' computers (Streitz and Nixon, 2005, cited in Streitz, N. A., 2021) in sensor-based urban environments often remain unknown to the citizens who navigate these spaces. This situation is exacerbated by a significant knowledge gap between those implementing these technologies and the general public. The presence of such a pervasive surveillance capitalism milieu raises concerns about the asymmetry of power in public urban spaces, diminishing citizens' ability to contest or even acknowledge the extent of their observation and data collection. This information disparity creates power asymmetries that leave individuals under surveillance with limited capacity for resistance (Lightfoot and Wisniewski, 2014).

Addressing these challenges necessitates innovative approaches that transcend traditional urban planning and design strategies. Recent advancements in virtual reality (VR) and gamification have shown promising potential in redefining architectural and urban education, enhancing spatial awareness, and fostering engagement through immersive learning environments (Antonieta Ângulo & G. Velasco, 2013; D. Fonseca et al., 2017). These technologies not only support collaborative design processes but also facilitate greater public participation in urban development (Mónica V. Sánchez-Sepúlveda et al., 2019). Moreover, the emerging concept of Virtual Place-making (Mohammad Qabshoqa, 2018) through urban gamification offers a novel approach for architects and designers to redefine and rediscover architectural spaces. Building on these advancements, this paper proposes to explore how VR technologies can be employed to challenge and mitigate the impacts of surveillance capitalism in urban public spaces. By combining immersive experiences and role-playing games in a simulated environment, using the urban screen space of

Piccadilly Circus as our case study, this research aims to provide a comprehensive understanding of the potential of digital technologies to transform public awareness and engagement in urban settings. Our investigation is guided by the following research question: How can virtual reality (VR) technologies be employed to challenge and mitigate the surveillance of urban screens in public spaces, thereby empowering individuals with the knowledge to assert their rights in the city? It enables the public to visualize and understand the mechanisms of data collection and surveillance, thereby demystifying the processes and potentially fostering resistance to invasive monitoring practices. This research contributes to the growing body of literature on the intersection of digital technologies, urban practice, and public space. By proposing innovative methods for public engagement with complex socio-technological issues, we seek to bridge the gap between academic discourse and practical applications in urban planning and design. Moreover, this study offers insights into the potential of VR as a tool for fostering digital literacy and civic engagement in increasingly technologized urban environments.

2. Piccadilly Circus: A Case Study in Urban Screen Surveillance

2.1. PICCADILLY CIRCUS – THE EVOLUTING MEDIA SPACE

Piccadilly Circus, established in 1819 as a roundabout connecting Regent Street and Piccadilly, has evolved into a significant urban screen space in the heart of London. The advertising screen was initially introduced to the site in 1908 and later replaced by digital projectors in 1998. The Piccadilly Lights have been one of London's icons for over a century, an unmissable sight for the hundred million people who pass through Piccadilly Circus annually. This iconic location, often compared to New York's Times Square, has become a focal point for commerce, entertainment, and tourism, attracting a diverse range of visitors from both local and international backgrounds.

The integration of urban media in Piccadilly Circus has been a process marked by complex interactions among various stakeholders, including real estate managers, developers, politicians, and civic groups. Concerns about screen content management, technological advancements, audience engagement, and the impact of signage on property values have played crucial roles in shaping the area's redevelopment discourse. These concerns have been legitimized through appeals to notions of taste, aesthetics, historical heritage, and architectural preservation (Melzer, 2019). The site's transformation into a prominent urban media space offers a compelling case

study for examining the complex interplay of technology, urban planning, and social dynamics in modern cities.

2.2. THE TECHNOLOGY BRINGS SURVEILLANCE CAPITALISM

In 2017, Piccadilly Circus underwent a significant technological upgrade with the installation of Europe's largest advertising display. Measuring 17.5 metres by 44.6 metres, with a total area of 783.5 m², the screen comprises 11 million pixels. This new digital screen, known as Piccadilly Lights and owned by Landsec, employs sophisticated technology that goes beyond mere media display. Its visual sensors can detect certain elements, such as weather conditions or the colour of cars in the surrounding area, with the potential to adapt displayed media content in response to these factors. For example, hidden cameras within the screen can track the make, model, and colour of passing vehicles, enabling targeted advertising. Brands can pre-program specific advertisements to play when particular types of vehicles pass by, demonstrating a high level of customization and responsiveness to the immediate environment. Furthermore, the system utilizes algorithms to analyse visual cues such as hair length and height to make demographic assumptions about the area's population. For instance, if the algorithm detects a higher proportion of women in the area, it might display promotions for women's clothing. This capability allows for dynamic content adjustment based on real-time crowd composition (Yalcinkaya, 2017). The Piccadilly Lights system extends its capabilities beyond visual recognition, responding to changes in weather, news, sports reports, and social media updates, allowing for highly contextual advertising. The integration of local Wi-Fi enables passersby to interact with the displayed brands through social media platforms, creating a two-way communication channel.

While these technological advancements offer new possibilities for engagement and advertising, they also raise significant privacy and ethical concerns. Of particular note is the "Look Out" facial recognition technology employed by the system. This advanced feature not only identifies the number of people in its vision but also categorizes them based on gender, estimates age within a five-year range, detects facial hair, tracks gaze direction, and even attempts to discern emotional states—whether people appear happy or sad (Garwood, 2017). While Landsec, the owner of the Piccadilly Lights, asserts that the technology does not identify individuals or display personally targeted content, the sophistication of the data collection system still raises debate and concern. The mechanism of tracking and identifying individuals raises profound questions about privacy, consent, and public rights in urban spaces. Furthermore, serving targeted advertisements based on these data provokes reflections on the use of public spaces for

commercial purposes, class stratification, potential social inequalities, social prejudices, and the ethics of labelling individuals.

The situation at Piccadilly Circus exemplifies the growing trend of surveillance capitalism in public spaces, where individuals unknowingly become sources of valuable data. This case highlights the conflict between technological innovation and privacy protection in urban environments. It underscores the need for transparent communication about data collection practices and the importance of public awareness regarding the capabilities of urban screen technologies. The ongoing evolution of Piccadilly Circus as an urban screen space demonstrates the critical need for a careful balance between technological innovation, commercial interests, and public welfare.

2.3. AN IDEAL CASE STUDY

As smart cities continue to develop, the case of Piccadilly Circus serves as a crucial reference point in the ongoing dialogue about the role of technology in shaping our urban futures. It raises critical questions about who has the right to decide how people are classified and categorized in public spaces, and how these classifications might reinforce or exacerbate existing social inequalities. This makes Piccadilly Circus an ideal case study for exploring the implications of surveillance capitalism on urban rights and the potential biases in systemic classification of individuals based on gender, class, and other characteristics.

To address these complex issues, we propose using this location as a basis for a VR simulation of urban public spaces. This approach can create an engaging, gamified method for information dissemination, allowing for a more immersive and interactive exploration of the issues surrounding privacy, surveillance, and individual rights in smart cities. Through this VR simulation, users could experience firsthand the feeling of being tracked, categorized, and targeted by advertising based on their perceived characteristics, fostering a deeper understanding of the ethical implications of such technologies. Moreover, this case study could inform policy recommendations for the responsible implementation of smart city technologies. These might include mandating transparency in data collection practices, establishing clear guidelines for the use of facial recognition technology in public spaces, and creating mechanisms for public oversight and consent in the deployment of urban screen technologies.

In conclusion, the Piccadilly Circus case study offers a unique opportunity to examine the intersection of technology, privacy, and urban rights in the context of smart city development. By leveraging VR technology to educate the public about these critical urban issues, we can

foster informed discussions and shape more equitable and privacy-conscious urban futures.

3. Method and Developing a Gamified VR Prototype

3.1 METHOD FRAMEWORK

This study adopts a comprehensive approach to explore the challenges of surveillance capitalism as manifested in urban screen spaces, specifically at Piccadilly Circus. By integrating Virtual Reality (VR) technology, gamification principles, and spatial practice simulations, the methodology is designed to provide an immersive and informative experience that highlights critical issues associated with surveillance capitalism. The method's framework is structured around three main components: the simulation of Piccadilly Circus, the game design, and the content displayed on the urban screens. These elements are meticulously developed to ensure clarity in how hardware, software, game design, screen media content, and user interactions interrelate and contribute to the overall educational objectives of the project.

The simulation of Piccadilly Circus is crafted to mirror the actual environment as closely as possible, providing a realistic backdrop that enhances the realism aspects of the game. This setting is not only a reproduction of physical space but also incorporates dynamic elements that react to user movements and choices, simulating real-world interactions with urban screens. The game design is tailored to encourage exploration and interaction, utilizing mobility as a key component to trigger various scenarios within the game that reveal the workings of surveillance capitalism. Meanwhile, the screen media content is carefully curated to respond to user interactions, offering artistic content to against targeted advertisements and educational content that elucidate the phenomenon and implications of surveillance capitalism and data collection

By clearly defining and integrating these elements—hardware, software, virtual built environment, game design, and media content—the methodology provides a clear roadmap for users to understand the complex relationships and consequences of surveillance capitalism. This structured approach not only enhances user engagement but also fosters a deeper understanding of privacy issues in public spaces, making it an effective tool for educating the public about contemporary challenges in urban environments.

3.2 TOOLS

The primary hardware and software components identified for this project include the Unity 3D for the game environment and VR headsets (Oculus 2) for the immersive experience.

3.3 SIMULATION OF PICCADILLY CIRCUS (DIGITAL TWIN)

The initial phase of our methodology involved collecting data on Piccadilly Circus. This included accessing open-source resources from Sketchfab, capturing high-resolution imagery, and conducting 3D modelling of the area. We gathered detailed information on the placement and specifications of urban screens to develop a realistic simulation. Building on this foundation, we created a digital twin of Piccadilly Circus using advanced 3D modelling and virtual reality technologies. This virtual representation replicates the physical layout, architectural features, and ambient conditions of Piccadilly Circus, offering an immersive experience. Participants can interact with this environment as though physically present, enhancing the authenticity of the simulation.

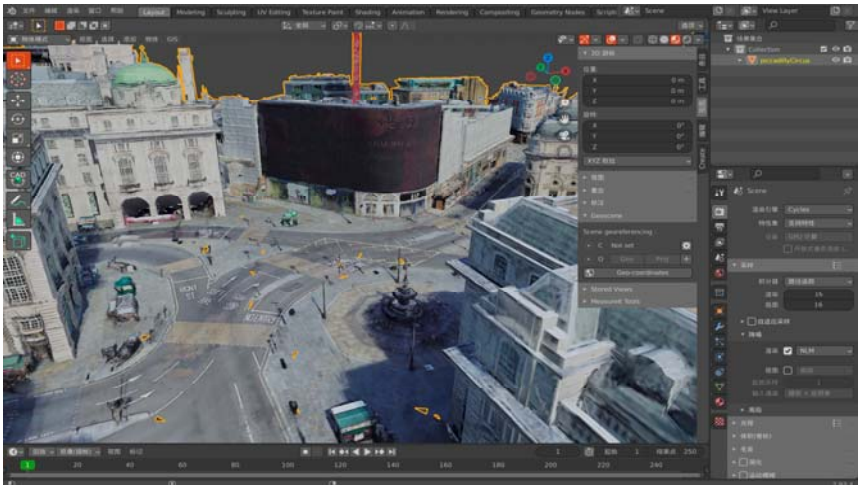

Figure 1. The Piccadilly Circus built environment model.

3.4 URBAN GAMIFICATION AND USER INTERACTION STEPS

The game design is centred around mobility and user interaction within the virtual space. Participants can navigate the simulated environment using

personal avatars, which they customize to reflect varied demographic profiles. This includes gender, age, and mood options, emphasizing the role of personal identity in surveillance dynamics. Mobility options within the game include walking, bicycles, and cars, each affecting urban screen media content display relate to the avatar.

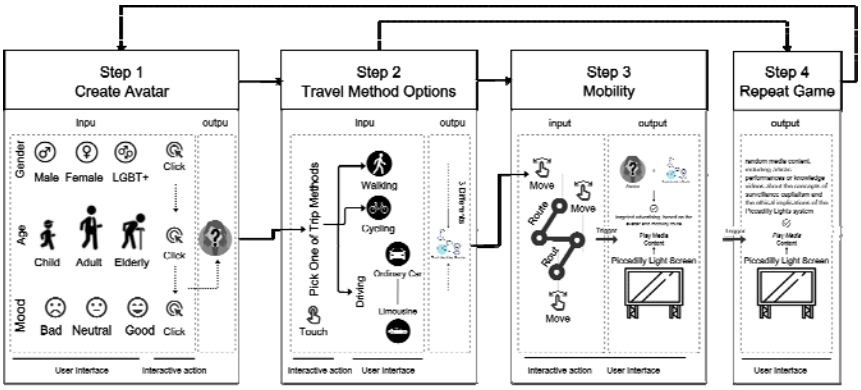

Figure2. The 4-Step Flow to Play Piccadilly Circus Game

3.4.1. Step 1: Personal Avatar Creation (Personal Representation)

In the urban immersive game, participants create customizable personal avatars to navigate the virtual environment. The avatar creation tool offers options to select attributes such as gender, age, and mood. This flexibility empowers users to explore how demographic profiles might influence targeted advertising in digital environments like Piccadilly Circus, providing insights into how individuals are categorized and targeted based on their characteristics.

During the avatar creation process, the user interface encourages participants to construct avatars that do not match their actual identities. This deliberate disconnection between the player's real identity and the avatar's appearance is a key design feature. It enables users to subvert and resist the societal biases often reinforced by capitalist values and commercial assessments. This aspect of the design is crucial for understanding and challenging the underlying assumptions of surveillance capitalism and its impact on personal privacy and the right of individuals to define themselves.

3.4.2. Step 2: Travel Method Options

After creating their avatar, players are presented with various transportation options to navigate the virtual Piccadilly Circus. These options include walking, cycling, or driving a car. If a player selects a car as their mode of

transport, they are further prompted to choose between a standard or luxury vehicle.

Each transportation method corresponds to a distinct route through the virtual urban screen space. The variety of transportation options and routes allows users to explore the virtual environment from different perspectives, enhancing their understanding of how surveillance capitalism operates in public spaces.

3.4.3. Step 3: Mobility: Traversing the Urban Screen Space to Trigger Media Content

As the player's avatar traverses the Piccadilly Circus area using their chosen mode of transport, they encounter the urban screen. This triggers the screen to display specific media content, including targeted advertisements based on the avatar's tracked characteristics (gender, age, and mood) and travel methods. Initial movements result in advertising targeted based on the avatar's attributes and mobility patterns, simulating how the real-world Piccadilly Lights screen system uses hidden sensors and data analysis techniques to categorize individuals and serve them customized content. This mobility-centred approach places the user at the heart of the scenario, providing a direct and immersive spatial experience of urban screen surveillance.

3.4.4. Step 4: Repeated Gameplay and Knowledge Content

After the initial encounter with the targeted advertising, users will have the opportunity to repeat the simulation traversing. During subsequent playthroughs, the urban screens will display a mix of random media content, including artistic performances or knowledge videos about the concepts of surveillance capitalism and the ethical implications of the Piccadilly Lights system. This repetition and the introduction of informative content are designed to deepen the user's understanding and foster critical reflection on the issues at hand.

3.5 MEDIA CONTENT

The preparation of media content is a crucial aspect of this study. In urban screen spaces, media content is a key factor in determining the quality and impact of the space (Tomitsch et al., 2015). To reflect the principles of targeted advertising, we have developed a comprehensive set of media content based on the avatar's characteristics.

The media content is designed to correspond with three main factors of the avatar: gender, age, and mood. Each of these factors has three variables,

resulting in 27 distinct combinations. An additional variable for luxury car selection brings the total to 28 unique advertising content pieces. This variety ensures that the targeted advertising experience is nuanced and responsive to the avatar's characteristics.

In addition to the targeted advertisements, we have prepared three random video contents to be displayed during subsequent playthroughs. These include two short art films and one informative video explaining the Piccadilly Lights surveillance capitalism system. This diverse range of content aims to provide both an authentic simulation of targeted advertising and educational material about the broader implications of urban screen surveillance.

At the end of the game, players are informed that their participation in the seemingly simple interactive game has facilitated a shift in urban rights within the virtual space. This message serves to contextualize their experience within the broader framework of urban rights and surveillance capitalism. Players are encouraged to engage repeatedly and to spread their newfound knowledge. This approach not only enhances the immersive experience but also serves as an educational tool, reinforcing the understanding of surveillance capitalism and its implications on public spaces and personal privacy.

4. Conclusion

This study details the development process of a Virtual Reality (VR) simulation game designed to replicate the experience of urban screen spaces, with a specific focus on London's Piccadilly Circus. By transferring the physical environment of Piccadilly Circus into an immersive VR setting, we have created a unique platform that allows users to interact with and understand the implications of urban screen technology and its associated surveillance capitalism.

The core of our methodology integrates VR technology, gamification principles, and spatial practice simulation. This approach creates an engaging and educational experience that illuminates the complex challenges posed by urban screen surveillance. Users can customize their avatars and choose their mode of transportation, giving them agency within the simulation that is often lacking in real urban environments. This empowerment is a distinctive feature of our simulation, contrasting with the typically passive role individuals play in urban spaces.

Our simulation is centred around a targeted advertising system that responds to the user's avatar characteristics and choices. This dynamic content delivery mirrors the real-world application of surveillance technologies in urban screen spaces, providing users with a tangible

understanding of how these systems operate. By experiencing this firsthand, users gain insights into the ethical implications and potential privacy concerns associated with such technologies.

The gamified nature of our simulation offers a conducive environment for interdisciplinary exchange, open-ended exploration, and knowledge dissemination. It employs validated participatory methods to engage stakeholders in discussions about urban spatial practices and surveillance capitalism. This approach fosters open dialogue and constructive deliberation in an informal setting, stimulating creativity and inspiring innovative solutions.

Ultimately, this research contributes to the development of novel tools for addressing urban rights issues in the context of smart city technologies. By raising awareness and facilitating informed discussions, our VR simulation aims to empower citizens and inform policy debates surrounding the responsible implementation of urban screen technologies. As cities continue to evolve and incorporate more digital elements, such educational and experiential tools will become increasingly valuable in shaping equitable and privacy-conscious urban futures.

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