CityAR: Wellington

Exploring Cities through Mixed Realities

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This paper aims to study the potential impact of Virtual, Augmented and Mixed Realities (VAM) technologies on the built environment and to understand how immersive environments can be used to enhance the human experience within the built environment. In order to investigate and test how these technologies may improve our experience of the city, an augmented reality app is being developed in partnership with Victoria University of Wellington, the Wellington City Council and NEC, New Zealand. The research aims to explore ways in which VAM helps users in exploring cities. The philosophical driver of this project aims to focus on supporting the experience of moving between two points on a map rather than achieving the shortest route to a destination. Once developed, the project proposes the CityAR app which is to be distributed to the general public in order for them to test its functionality and in return, provide user feedback.

Keywords: Mixed Environments, Augmented Reality, Smart Cities, Cybrids

INTRODUCTION

With the current advancements in Virtual, Augmented and Mixed Reality (VAM) technologies, the possibility of our built environment merging with the virtual environment is increasingly likely. Within most advanced faculties: technology, education, medicine etc. VAM environments are being developed, researched and implemented. VAM environments can be explained as, “The intersection of real and virtual environments, within which physical and digital elements co-exist, and interact and intermingle in a more expansive form (Schnabel, 2009).” Novel realities such as these enable a new construct for the way we perceive our world. Furthermore, consumers have gained access to such technologies with the help of smartphones and VAM headsets. As frequently publicized, many major companies from Facebook, Google, Magic Leap and HTC are pressing the applications of VAM ever forward. Facebook recently launched a version of Facebook Spaces, a platform in which users are able to interact simultaneously in both real and virtual environments. The platform begins to merge the real and unreal, creating a space in which users are able to experience a Mixed Reality environment. Such projects are extremely exciting as they continue to break barriers allowing the world of communication to be more connected than ever.

Conversely, Keiichi Matsuda, in his concept film, ‘Hyper-Reality’ (see Figure 1), presents to us a world embellished with layer upon layer of digital information, a world where the built, the virtual and social are
interwined. The depiction sheds negative light upon the potential impact of a VAM environment, presenting a disturbing scenario in which the digital world has enveloped every aspect of our lives. The readiness of immersive technologies is turning an age-old dream of many visionaries into actuality. As VAM becomes more integral to our daily lives, it is important to be mindful of the potential impact in order to use these technologies as a method to enhance and optimize our experience of the city rather than to dictate our every move.

Architecture has always been the foundation for social interactions but today, these interactions have moved beyond the built environment and onto digital platforms. In terms of design, the common feature between current implementation of VAM environments is the focus on graphics and game elements that simply relegates architecture and the built environment as a background to the digital. More research is required to understand the impact of the two environments on one another. It is important for architects to get involved in the design process, as they may be better suited to comprehend the phenomenological and functional attributes of a future where the digital and physical better interact.

**RESEARCH TOPIC**

Travel has become one of the simplest of tasks. No longer does one talk of travelling between cities or countries, but between or even across continents. Before, distances that took days if not weeks to complete can now be covered in a matter of hours. As a result, two things have occurred; initially, travel as a recreational activity has increased; secondly, due to the accessibility of transport, many people travel to more places for shorter periods. Now many travelers endure the pressure of racing against time; apps such as Google Maps enable users to navigate within unfamiliar places yet at the same time force us to rush from one point to another, hoping to catch a glimpse of everything a city has to offer.

Technology appears to liberate us more than ever, yet at the same time, it dictates our every move. This research proposes that Virtual, Augmented and Mixed Realities (VAM) environments can potentially enhance the experience of people within cities by immersing us into the rich history, phenomenology and culture of a place.

**LITERATURE**

Peter Anders is an architect, educator and theorist. He has published numerous papers discussing theories on the merging of real and virtual environments. He is currently a fellow of the University of Plymouth CAiiA-STAR Ph.D program and is the founder of MindSpace.net. In the paper, Cybrid Principles: Guidelines for Merging Physical and Cyber Spaces, he discusses the role of technology in the world today, bringing into context the interdependence of the real and virtual in contemporary society. By centering on human social interactions and drawing comparisons between the physical and virtual, Anders states, “Despite its past success architectures focus on materiality, both in theory and practice, has rendered it increasingly inadequate for the challenges presented by telematics and global culture” (Anders 2005). The statement addresses how contemporary society has transcended beyond the scope of architecture through the realm of virtuality (social media, e-mail etc.), as it is fast paced and all encompassing. He further goes to state, “Now reality is becoming only the social world, excluding nature and things, and experienced primarily through the reciprocal consciousness of others, a form of imagination to be realized as a social construction”(Anders 2005).
The virtual may have opened horizons for many people but simultaneously, many others have become detached; with the constant flow of tailored information, the virtual has enclosed people deeper within their own worlds. As a result, mixed environments opens up numerous possibilities to combine the benefits and address problems faced by social interactions in both the real and virtual; Anders calls this union a shared social reality.

VAM technologies enable designers to further their design potential. The overlay of digital medium allows designers to explore a new spectrum in designed environments, especially in the development of Cybrids, a term coined by Anders. They can be explained as, “Objects that incorporate the material presence of sensory objects with the capacities of virtual ones” (Anders 2007). Cybrids, as a result, are experienced as hybrids of the real and virtual environments essentially making the divide between the two environments indistinct.

In order for a successful integration, Anders has devised seven principles for designing mixed environment spaces (see Figure 2). His principles take into consideration both the tangible and intangible qualities of the built environment that help to fulfil human physiological and psychological needs; qualities such as, dimensions, arrangement, and location along with qualities relating to sensory stimuli such as light, void and perception.

The principles adhere to a range of design criteria considering both the real and virtual assets of a mixed environment. For instance, the importance of composition that highlights the importance of strategies used to compose the virtual and physical in a manner that is best suited for their integration and readability. Another core principle focuses on the idea of reciprocity between the real and virtual environments. Anders explains this as, “A coupling between the material and cyberspaces such that changes in one state affect the other” (Anders 2005). This notion of a direct relation between the two spaces highlights an integral insight into the functionality of cybrids.

AIMS AND OBJECTIVES

In order to investigate and test how immersive technologies may improve our experience of the city; a prototype for an augmented reality app was developed in partnership with the Wellington City Council and NEC, New Zealand. Wellington in its ambitions to becoming a ‘Smart City’ partnered with NEC, New Zealand, to digitize all existing and new data, including everything from the number and location of homeless people; to recording traffic and pedestrian flows; to even presenting scenarios of potential earthquake and tsunami disasters. NEC generated a highly detailed model of the city upon which all of the data can be layered. The model can be visualized within Virtual Reality, providing the users with an immersive experience of the city.

By incorporating this existing data, the research aims to propose a novel method by which users may
navigate and explore a city. The philosophical driver of this project aims to focus on supporting the experience of moving between two points on a map rather than achieving the shortest route to a destination. Once fully developed, the project proposes the ‘CityAR’ app that is to be distributed to the public in order for them to test its functionality and in return, provide user feedback. The feedback aims to gather information on the designed Human-Computer Interface, the overall AR experience and more importantly, how successful was the app in enriching the experience of navigating within a city.

Furthermore, the various routes taken by users’ is to be collated as data, this will help the council to recognize how people both familiar and unfamiliar to the city navigate within it. One may assume that users will make use of the main arteries within the city to begin their journey but as they move along the route it is natural for people to make use of secondary and tertiary routes depending on urban and natural settings.

**METHODOLOGY**

The methodology for this research begins by designing the augmented reality app in accordance to the design principles set by Peter Anders in his paper. The development process for the app makes use of a combination of digital tools both software and hardware. These include, Unity3D for cross platform collaboration, real-time rendering and overall development. Rhinoceros and Grasshopper for designing various components for use within the app. Vuforia for enabling augmented reality functions. Monodevelop for coding complex commands. Mobile phone and/or HoloLens for testing and visualizing augmented environments.

**DEVELOPMENT OF APP**

The CityAR app is the key to distributing the model to the public in order to make them more aware of the forms that shape the urban fabric. It further helps to promote the idea of moving beyond maps to a form based navigation tool. The Wellington City Council is in the process of redesigning numerous signboards...
across the city. With the help of the CityAR app, these inanimate signboards are transformed into smart objects (see Figure 3).

One of the key ideas highlighted by Anders was the coherence of systemic static and dynamic behaviors. He explains, there are certain expectations of observers within the built environment that are quite different from those in the virtual. By and large, architecture is systematically static in terms of proportion, scale and compositional relationships. On the other hand, a person entering a VAM environment expects a sensory stimulus.

As soon as the user orients their phone towards the signboard, the map of the city begins to glow, immediately responding to the users’ expectations. As a result, it is only natural for the user to want to touch the map. Here, the app implements the idea of a transparent interface; Anders explains this as an, ‘interface that so anticipates users’ expectations that it quickly recedes from the users’ attention (Anders, 2005).’ Once touched, that map glides out and repositions itself. Here the buildings upon the map extrude and transform into a 3-Dimensional model of the city. Through touch, the user is able to explore the model.

According to Anders, cybrids act as an extension of the built environment generating a dimensionally rich mediated space. In the CityAR app, a spherical pod encompasses the users; enabling them to explore places of interests, events and heritage sites. The pods act as an extension of the signboard communicating information through a plethora of designed media: graphics, video, models, animations and even abstractions. With the use of cameras positioned at the signboard, people across the globe and the users physically present are able to interact and intermingle. As a result, the pod becomes an extended social space unifying the virtual, the augmented and the real. Once the user has selected a desired destination, an augmented landmark appears at the destination. The augmented landmark i.e. cybrid can be considered as a live object that feeds of data and retains the ability to transform itself.

Unlike other navigation tools, the CityAR app aims to be more of an exploration tool. The user must find their own way to the desired destination, only to use their phone in order to find the augmented landmark if lost. The app helps the user to be an active participant within the city as they take the time to explore and navigate. While gradually moving towards their destination, users’ are alerted of heritage sites or places of interests.

LIMITATIONS
The app is currently in the developmental stage and certain limitations regarding the positioning of the digital landmarks need consideration. GPS technology is not reliable as in many situations signals from satellites can be blocked or reflected by built infrastructure. Therefore, the position of the digital landmarks is likely to be affected.

Wellington has a wide network of free Wi-Fi stations available throughout the Central Business District (CBD). With Wi-Fi connectivity, we can assume an improvement in the apps ability to capture the position of the user and the digital landmarks. In order to validate this as a possible solution there needs to be further testing.

CONCLUSION
At the current stage of the project, the digital landmark exists only as an abstraction entailing a conceptualized interpretation of cybrids. While designing the CityAR app, apprehensions of disengagement occurred between the implementation of Anders’ principles and the designing of the digital landmark.

Firstly, in order to realize the landmark as a cybrid, there needs to be context in which to design it. In order to do so, the design should be inspired simultaneously by both the virtual and real environments. Considering the architectural qualities of cybrids, the design will change depending on the site of its origin, i.e. a digital landmark indicating one site cannot essentially be the same as another because the context of the physical environment has changed. Another factor that need to be considered are architec-
tural typologies, as they impact the virtual aspects of the landmark, i.e. a landmark that is an extension of a museum will reveal information and data completely different from one that indicates a restaurant or a government building for instance.

After having considered a certain context it will be possible to develop the design for a digital landmark that responds to an architectural typology, the built environment and the visualization of the data that feeds it.

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