Virtual Reality and Cultural Heritage: A Prospect for Archiving in 2017

Using a postmodern perspective to contextualise the role of archivists and other cultural heritage specialists in the hyper-digital era.

Master of History in Archival Science

Thesis

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Appendix found at: https://miriammcbride93.wixsite.com/vrarchive

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Abstract

This thesis was designed to investigate the the uses of Virtual Reality technology within in cultural heritage. Using a postmodern analysis, this thesis is both a document study and case study that aims to inform, and help archivists and other cultural heritage specialists to contextualise themselves and their new digital environments. First, I establish why postmodernity is important to the archival profession by outlining its relevance to knowledge, technology, and the economy. I then describe Virtual Reality (VR) and the newly released and commercially available Head Mounted Display units (HMDs). This is followed by my case descriptions of Virtual Reality developers and developments, and a discussion of examples of VR's current use in cultural heritage sites. I then move on to a discussion of archiving Virtual Reality. My thesis shows that Virtual Reality is no longer a promise, or something to work towards, but that it is presently here. The audio/visual illusion created by the currently available Virtual Reality hardware and software, has serious potential in the realm of cultural heritage learning. And this thesis argues towards an interdisciplinary method of creating cultural heritage content, with archivists, librarians, and museum curators teaming up with information technology and VR specialists to create, and store, their work.

Appendix available at: https://miriammcbride93.wixsite.com/vrarchive

Introduction

The problem on which this thesis will focus is archives and other cultural heritage sites in the digital age. A postmodern perspective is used to try to understand how archivists and cultural heritage specialists remain relative in a digital world and how they can use new technology to further their collective and individual aims. This paper aims to investigate and describe and then categorize some of the cutting edge work being done with technology in digital heritage sites in the Netherlands and Germany. A plethora of technological innovations could have been chosen to review for potential use and impact in the profession of archiving, but the innovation I have found most intriguing from the past decade, is the invention of Virtual Reality programming and headsets as an electronic emulation experience. Despite their popularity, and since the release of consumer ready headsets, theoretical discussion on the professional use of Virtual Reality has been relatively dormant since the mid-2000s. This thesis will explore the creation, and application of Virtual Reality (VR) in and to archives and cultural heritage sites. The Appendix used for this thesis comes in the form of a website, created by me, with text, picture, and video content to help better understand the VR concepts and technology being discussed.

My research question is how is the archival profession adapting to postmodernity, and able to utilise the resources we are now presented with, particularly in relation to the advent of Virtual Reality? The methodology by which I have chosen to inquire into my research question is an exploratory case study after Yin 2014 including using a document study as means to contextualise enhance my research. An exploratory case study is described as a linear but iterative process, most suitable for investigating a complex, real life phenomenon where the boundaries between the phenomenon and context are not clearly evident, such as in

inquiring into technological innovation in a professional context.[1] The benefit of a case study research is that it draws on a range of available data sources. In this study, I have drawn on published documents (texts) and conducted on-site, field visits with three separate innovators and developers of Virtual Reality (two on-site developers and one online developer) in order to discover how Virtual Reality is developing in 2017. With hopes that outlining this technology and its potential use will inspire cultural heritage professionals to begin considering how such technology will enhance and affect their work. This thesis includes a discussion of the problem of archiving Virtual Reality and well a scholarly exploration of its uses. In order to utilise the plethora of technology available, we must first understand it. This thesis aims to help cultural heritage specialists understand Virtual Reality, and hopes to inspire further thought on the subject.

In 2001, Guthrie wrote, "archiving is not, and never has been, an issue fundamentally about technology; rather it is about organization and resources"[2]. When one is asked to conjure the mental image of an archivist, (assuming they have heard of the profession) unfortunately what appears is an aging, cardigan-wearing individual sitting in the basement, moving dusty files. Now, this may be an exaggeration for making a point, but the imagery works. I understand the relative nature of that image to an analogue time, but this thesis will be written under the assumption that that is not the image or reality for archivists as we approach the third decade of the 21st Century. Archiving is a profession that has always had to remake itself through time in relation to emerging modalities and technologies[3]. In the digital age,

[1] Yin, R. (2014). *Case study research*. London: Sage Publication.
[2] Guthrie, K. (2001). Archiving in the digital age:There's a will but is there a way?. [online] *Educause*. Available at: https://www.educause.edu/ir/library/pdf/erm0164.pdf
[3] Tibbo, H. (2003). On the Nature and Importance of Archiving in the Digital Age. *Advances in Computers*, pp.1-67.

archiving remains as the profession that is responsible for developing the theory and practice of appraising, acquiring, authenticating, preserving and providing access to recorded materials, no matter the media in which those materials were created.[4]

The underlying assumption of this thesis is that archives, and, especially cultural heritage sites, orient themselves to suit society's interests, and the overall mission in this context is public education and justice. As Dietrich and Adelstein write "providing access to users is a key function of archives".[5] I also assume that archives and cultural heritage sites wish to be both popular in their physical place as well as online. Before I discuss my original research into the specific technological innovation of Virtual Reality programming and headsets, I will first justify my attention to what is know as the postmodern condition, and explain why this way of thinking is vital for archivists to consider when thinking about the theory and practice of the profession in approaching the third decade of the twenty first century. I will then identify my terms of reference and describe what Virtual Reality is and the growing influence this technology is having on a range of professions. I will then explain my use of document study and case study methodology and how I gathered the data presented and analysed in this thesis. I then discuss these data drawing on postmodern understandings and conclude with a discussion on likely future directions and possibilities for the profession, including a discussion of the problematics of archiving Virtual Reality as well as on its applications.

POSTMODERNITY

[4] Pearse-Moses, R. (2005). *A Glossary of Archival and Records Terminology*. [online] Society of American Archivists. Available at: http://files.archivists.org/pubs/free/SAA-Glossary-2005.pdf

[5] Dietrich, D. and Adelstein, F. (2015). Archival science, digital forensics, and new media art. *Digital Investigation*, 14, pp.S137-S145.

The Rationale for adopting a postmodern theoretical perspective

Very rapid societal shifts due to technological and social changes have been and are continuing to take place in the twenty-first century. The data boom is upon us. The profession and practice of archiving must learn to adapt to the new systems of information being constantly created[6]. The unimaginable speed in which society is changing and integrating electronically and geographically leaves many of the structuralist ideas of the past unable to account for the information explosion and consequent digital information overload in the 21st century. Postmodernity, with its flexibility and ability to encompass all forms of knowledge and information into its methodology, provides a convenient stand point for archivists looking to conceptualise, understand and possibly solve the challenges the digital age brings. On a personal level, a postmodern stance appeals to me; as I am product of the digital age, a person whose life has seen a new advancement in science and technology almost daily. I have witnessed the fragility of truth and the temporal nature of information and data. Although my youth (I am 23 years old) has limited me from living in both modern, and postmodern times; the inability to compare my life between ages can be seen as a limitation to the legitimacy of my work, but can also be seen as a useful theoretical perspective as a matter of dealing with the now.

My approach to postmodernity is heavily influenced by the ideas of Jean-François Lyotard who in his book, *The Postmodern Condition* (1984) self- simplified his definition of postmodernity to "an incredulity towards meta-narratives".[7] Meta-narratives - as large overarching historical and cultural structures of human condition and purpose- are contained

[6] Dietrich, D. and Adelstein, F. (2015). Archival science, digital forensics, and new media art. Digital Investigation, 14, pp.S137-S145.
[7] Lyotard, J. and Bennington, G. (2010). *The Postmodern Condition*. Minneapolis, Minn: Univ. of Minnesota Press.

in or implied within all major philosophies, such as Kantianism, Hegelianism, and Marxism; all which argue that history is progressive and linear, that knowledge can liberate us, and, importantly that all knowledge has a secret unity, continuity and integrity. The two large narratives Lyotard critiques are those of the progressive emancipation of humanity – from Christian Redemption to Marxist Utopia – and that of the triumph of science.[8] Lyotard was very careful not to describe himself as a theorist, nor the condition of postmodernity as postmodernism. He disliked 'isms' and his work is an exploration and interrogation of our 'condition', and not an ideology according to Olsen in his 1995 conversation with Lyotard. [9]

Meta-narratives exist, or are put into play to legitimise or authorize dominant, existing cultural practices and social arrangements, which, commonly, privilege the few over the many. In the book, *From Modernism to Postmodernism: An Anthology* (2003) Lawrence Cahoone explains that postmodernist thinking requires a response to normative claims of 'truth', by "displaying the processes of thought, writing, negotiation and power which produced these very normative claims". It is usually conceived that the "decline in the inclination towards meta-narratives" [10] can be seen as the outcome of the fast evolving technologies since after the Second World War commensurate a worldwide retreat from Keynesian economics and communism, the redeployment of advanced liberal capitalism and the valorization the individuals and their enjoyment of goods and services.[11] This shifted the emphasis to technology itself as the means of action.

[8] Ibid
[9] Olsen, G. (1995). Resisting a Discourse of Mastery: A Conversation with Jean-François Lyotard. [online] Www2.idehist.uu.se. Available at: http://www2.idehist.uu.se/distans/ilmh/pm/lyotard-interview01.htm
[10] Cahoone, L. (2003). *From Modernism to Postmodernism*. Malden, MA: Blackwell Pub.
[11] Ibid

In his book *Homo Deus, a Brief History of Tomorrow,* Yuval Noah Harari discusses this change in the postmodern economic climate. Power is no longer derived solely from physical resources, such as arable land, mines and oil wells. Now, knowledge, information and skills are of most value.[12] Technology is no longer the outcome of multiple resources, but now a means in itself, in the quest to produce the ends of knowledge. This does not mean there is now a clear path to an enlightened and educated society, rather, all our complex technology leads to a whole new set of theological and humanist issues. The world had changed in such a distinctive way over the past half century. These times we live in, if I may call them 'postmodern times' are characterized by speed. We live in perpetual acceleration, and yet, over the past two decades society has stalled. Post-war prosperity has slowed substantially in the developed world even though international financial market are deregulated. There are international/transnational companies with more buying power than a number of countries. Harari states that the current economy needs constant and indefinite growth to survive, yet in a time of realisation that physical resources are limited, this perpetual growth no longer seems feasible.

Postmodernity can be constructed as what occurred to the world when we stopped trusting in modernity, when order and reason, moral progress and enlightenment, ceased to be high values we held in common. Humanistic values were left behind in favour of capitalist values, growth being the only concern. The postmodern age can give us everything modernity offered " without its abstractions, it's unreachable social ideals and its moralising". [13] Postmodernity for many of the world's 1.7 billion people between the ages of 15 and 24 years of age gives us the freedom to pick and choose from a plethora of structured thinking to suit

[12] Harari, Y. (2016). Homo Deus. Harvill Secker.
[13] Hart, K. (2004). *Postmodernism*. Oxford: Oneworld.

any given situation, to ‘play’ with the ideas of modernity and reshape them into something that works for us as individuals and as groups.

When Implying that we are living in postmodern times, one must assume that there are distinct differences in experience between someone born today, and someone born during modernity one hundred years ago. Of course today we live with the internet, and forms of ‘hyper reality’, digital media and many and proliferating forms of electronic and material technology; but two people 100 years apart still share commonalities in experiences such as democracy, capitalism, industrialism, and urban living. The distinguishing difference is how each person experiences the world. Postmodern experience is experimental . Classical philosophers follow the idea that experience is what happens when ‘subject’ and ‘object’ interact, I am the subject and I engage with the object, whether it be an external, physical object, or an internal one such as a memory. Postmodernists reject the notion of the fixed and stable subject, and wish to rework the entire notion of subject, by concentrating much more on subjectivity (the multiple and contingent experience(s) of the world). The subject has become “decentered”. In the words of Hart, the subject “ is merely the place from which a voice speaks; or it is constituted by the play of desires or by being brought before the laws of various institutions”. [14] Therefore, if the idea of the subject is no longer fixed, then our understandings of experience has to be rethought. “If experience itself has changed, then presumably knowledge has also been refigured: in its contents, in what we take it to be, or in how we organise the items we counts as knowledge”.[15]

[14] Ibid. p.63
[15] Ibid. p 62

Willingness to experiment with different 'truths' can be seen as a defining feature of postmodern knowledge and learning. A person in possession of postmodern mind is less likely to take information at face value, more likely to be critically literate and to be cognisant that most texts are subjective and meaning is slippery. The technology at our disposal (including the accessibility of the internet and high use of social media) enables people in open, and usually democratic nation states to see the world from multiple perspectives. We are notified in real time to international happenings, the news rarely breaking from our conscious lives. People alive today are able to learn the intimate details of lives lived by those across the globe. Postmodern people are less likely to equate themselves with a geographical location, or an arbitrary physical feature, and more likely to equate themselves with those who think similarly to them, or those who consume the same kinds of media.

Fixed sources of information is a thing of the past, with countless media outlets to listen to, read, and watch. But with an excess of rich knowledge comes its counterweight, a plethora of shallow content. Articles written solely as 'click-bait"(dramatically worded headlines used to make people go to a site), to some people, is seen as the same worth as a peer reviewed journal article. This is why, in postmodernity, cultural heritages sites and archives are particularly important to the memory of society. When archivists select and appraise for the benefit of society, they are helping people them see through the barrage of data, to contextualise themselves in a globalised world. Our aim should be to guide the postmodern consumer, and suggest ways in which they can enjoy the pursuit of truth and knowledge. Museums, libraries, and archives are still trusted places of justice and learning, but are in fear of potential abandonment by the digital natives, who enjoy disneyfied versions of culture.

The Status of Knowledge in Postmodernity

The way in which knowledge and information are perceived and understood is changing. According to Lyotard in postmodernity, knowledge can only claim itself to be so, if it is able to undergo a "universal process of engendering"[16]. This engendering can be seen as the set of rules one must accept in order to participate in the pursuit of knowledge. This means we are able to accept that the sciences represent the general mode of knowledge, but these sciences rely on certain formal and axiomatic presuppositions, which are always to be made clear and justifiable. Every discipline has its own specific axioms on which they work, and their own languages in which to communicate truth. Every discipline has its own set of academic processes in which information must be filtered in order to be accepted. Separated disciplines have begun to overlap and recombine, and new territories of knowledge and (therefore) language are opening up. The axiomatic presuppositions of the new terrain means, as Lyotard states, "there has to be a metalanguage to determine whether a given language satisfies the formal conditions of an axiomatic; that metalanguage is logic". [17]

These postmodern conditions, including those of rapid technological change are felt to the extreme by the archival profession. While the core archival principles and functions of memory keeping remain, practices are changing rapidly. As Pearce-Moses and Davis (2008) remarked: " Librarians, archivists and records managers must be able to work with technology and digital media as easily as they have worked with paper. They must be able to

[16] Lyotard, J. and Bennington, G. (2010). *The Postmodern Condition*. Minneapolis, Minn: Univ. of Minnesota Press.
[17] Ibid

manage electronic collections, including the ability to select, acquire, describe, organize, reference, and preserve these digital works".[18]

The challenges lie not just in the types of works to be preserved, but also the increasing quantity of those records, the speed at which information can be transferred, and the types of technology that are rapidly emerging, which were all foreseeable challenges. Richard Pearce-Moses gave a talk to the Society of American Archivists in 2006, when he said that archivists "need to become comfortable in the digital world". To quote him further, he said the archiving profession needs "trend spotters, who watch the horizon for any changes in the environment … embracers, who find creative, practical uses for new technologies … [and] planners and evaluators to ensure that technology meets … needs and is used appropriately".[19] Archivists are now challenged to be informational logicians, as well as having to find their most effective place in the system they preserve.

The Status of Technology in Postmodernity

Lyotard wrote, that " both capitalist renewal and prosperity and the disorientating upsurge of technology" will "have an impact on the status of knowledge."[20] Before technology creeped its way into every aspect of our social and economic lives, an equation between wealth, efficiency and truth was established in the analogue world. As the pragmatics of science and scientific knowledge came to replace traditional or revelation based knowledge, it also became understood within postmodern analysis that the production of truth required

[18] Pearse-Moses, R. and Davis, S. (2006). New Skills for a Digital Era. [online] Archivists.org. Available at: http://files.archivists.org/pubs/proceedings/NewSkillsForADigitalEra.pdf
[19] Pearce-Moses, R (2006). Janus in cyberspace: Archives on the threshold of a digital era. Presidential address to the Society of American Archivists, August 26, 2006
[20] Cahoone, L. (2003). *From Modernism to Postmodernism*. Malden, MA: Blackwell Pub.

expenditure. As Lyotard states "No money, no proof - which means no verification of statement and no truth". [21] Whomever was wealthiest, had the best chance of holding truth. What happened at the end of the eighteenth century, with the advents of the first industrial revolution, is that the reciprocal of this equation was also discovered:that there is "no technology without wealth, no wealth without technology. A technical apparatus requires investment; but since it optimizes the efficiency of the task to which it is applied, it also optimises the surplus value derived from this improved performance" [22].

In Lyotardian analysis, the "organic" connection between technology and profit preceded its union with science. But since knowledge and power are connected in our society, technology becomes an extension of that knowledge and "important in contemporary knowledge only through the mediation of a generalised spirit of performativity". Increasing our performativity, increases our ability to produce proof, which, according to Cahoone (1996), increases an ability to be 'right' and to establish and hold on to 'truth'. Technology, as a tool of performativity increases our ability to be right, and with its introduction on a massive scale over a short period of time, cannot fail to influence "the criteria of truth". [23]

When Lyotard discusses the problematics of the electronification and computerisation of society, he says the computer is a "dream" instrument, or mechanism, for controlling and regulating the market system, which is now governed exclusively by the performativity principle. He predicted computerisation of reality would "aid groups discussing metaperscriptives by supplying them with the information the usually lack for making

[21] Ibid Pg. 496
[22] ibid
[23] Cahoone, L. (2003). *From Modernism to Postmodernism*. Malden, MA: Blackwell Pub.

knowledgeable decisions" on the proviso that people ("the public") were given "free access to the memory and data banks".

Another famous thinker who has guided my thinking on technology in postmodernity is Jacques Derrida. Derrida has shown that philosophical concepts are not restricted only to philosophical texts: they can be found operating in economics and literature, art criticism and politics, psychoanalysis and theology, pedagogy and architecture. He writes that Western thought has always sought firm grounds - those being, god, the subject, truth, the will, even speech - but that the quest for these grounds can never "arrest the play of contextual meaning".[24] In his essay, *Archive Fever (1996),* Derrida discusses the invention of email, and how it was/is "on its way to transforming the entire private and public space of humanity" as well as the immediacy ability of email to blur the lines between these public and private spheres. This accurate prediction is also followed by another: "This instrumental possibility of production, of printing, of conversation, and of destruction of the archive must inevitably be accompanied by judicial and thus political transformations". [25] Technology may allow us to reaffirm and strengthen our notions of truth and reality, it also forces us to reevaluate some of the systematic traditions we participate in, because they no longer can account for the new type of information being created by all this advancing technology. What is no longer written in the same way, cannot be read, or even archived in the same way.

[24] Hart, K. (2004). *Postmodernism*. Oxford: Oneworld. P4
[25] Derrida, J. (1996). *Archive Fever*. University of Chicago Press.

Postmodern Economy

Whether or not you choose to adopt the ideological processes of postmodern*ism* as a way of seeing the world, you cannot deny the conditions of postmodernity. Still living in the remnants of the capitalist boom, we still employ many features of the modern economy whilst simultaneously integrating ideas and products from outside this norm. The term 'sharing economy' has been introduced into economic language, and this term is fitting for the types of businesses which are emerging and often succeeding today. An individual can now outsource their knowledge and labour to a multitude of different companies, if they have the skills. The sharing economy encompasses online peer-to-peer economic activities as diverse as rental, for-profit service provision, and gifting. [26] The global economic success of by user-based, sharing businesses such as Uber and Airbnb have catalysed a vibrant discourse framed in contradictory ways; ranging from potential pathways to sustainability, to nightmarish forms of neoliberalism or worse, libertarianism. However, these framings share a common vision of the sharing economy and that is as decentralising and disrupting established socio-technical and economic structures .[27]

Hyper-developments in technology have reduced transaction costs, making the sharing of individual assets cheaper and easier and possible at very large scale. The big change is the availability of more data about people and objects and this allows physical assets to be disaggregated and then consumed as services.[28] Social media allows for a certain level of trust to be built before transacting, and payment can be handled by one of the many online

[26] Martin, C. (2016). The sharing economy: A pathway to sustainability or a nightmarish form of neoliberal capitalism?. *Ecological Economic*s, 121, pp.149-159.
[27] ibid
[28] *Economist.com*. (2013). The Rise of The Sharing Economy. [online] Available at: http://www.economist.com/news/leaders/21573104-internet-everything-hire-rise-sharing-economy

payment services such as PayPal. The sharing model works for objects and spaces that are expensive to buy and are widely owned by people who then do not make full use of them on a temporal basis. Bedrooms and cars are the most obvious examples, but you can also rent camping spaces in Sweden, fields in Australia and washing machines in France. As proponents of the sharing economy like to put it, access trumps ownership.[29]

Technology appears to be the main driving force behind this large, economic shift as sharing information and resources is easier, and specialist skills can now be readily accessed. A multidisciplinary approach to large projects appears to be the way to economise skills and knowledge. We are in an age of small-scale, specialised new companies, known as 'start-ups', whose specialist skills and products can be utilised by larger companies and businesses. Ideas for products and projects can also be 'crowdfunded', which means that anyone may become an investor, or pre-purchase a new product by pledging a certain amount of money towards the project. It is important for archivists to understand that specialised skills and knowledge are now more readily available than ever, with knowledge as a major resource in postmodernity. Cultural heritage specialists must be aware of the changes happening in the world, for cultural heritage sites are the mirrors that reflect society.

Why Postmodernity for Archivists?

Up until recently, and especially during Analogue Modernity (post industrialisation but pre-computerisation, archiving was a structured and monitored process, developed by societal mores, and governmental law and policy. When public archival institutions were first established, they were defined and defended as bastions of citizen and state rights and

[29] ibid

laboratories of history. [30] Archivists could be perceived as disinterested caretakers of received documents and artefacts , and their work was to ensure the proper order and use of these. Now consider the chaos of information being created in today's technology dense, computerised, connected society where the number of Facebook users exceeds two billion people. The structures on which archivists relied are now being used for processing information previously not accounted for when the original, professional systems were created. With adjustments to these systems being made, archivists could survive through the beginning of the technological revolution. But in the last decade, with a large portion of the world having access to internet, and their own personal data creating devices, the amount of information, (especially digital information) being created, shared, and stored is unprecedented in human history. Even with modification, the systems of the past are becoming unable to account for these disruptive changes, and, according to Lyotardian analysis, when a system becomes unable to justify its own efficiency, the system becomes obsolete.

Fiona Cameron and Helena Robinson have discussed the adoption of technology into the cultural heritage in their chapter *Digital Knowledgescapes: Cultural, Theoretical, Practical and Usage Issues Facing Museum Collection Databases in a Digital Epoch*, and have pointed out that technology does not only affect how we store and present information, but it is also affecting the algorithms of the practices and methodologies used to document and classify artifacts. They state that the "postmodern and poststructuralist paradigms in knowledge creation fundamentally challenge and undermine traditional concepts about the truth-value of

[30] MacNeil. H. (2010). 'Introduction' in *Currents of Archival Thinking.* Libraries United. California. p.i-xiii.

empirically based forms of museum documentation".[31] Item level description practices, such as those used by museums, has been taken as an unchanging practice within the cultural heritage sector. Basic descriptive criteria such as 'model' , ' make', and 'date of manufacture' as well as its physical measurements have remained largely unaltered. These sedimented record-keeping methods are a result of modern academic practices, entrenched with classical notions of value and significance. Archives use such practices developed during modernity, to classify, describe, collect, and appraise documents, prescribing predetermined notions of value without contextualising the contents.

Cameron and Robinson state that: "From the mid nineteenth century, it was practice of cultural heritage sites to impose a universal ordering structure based on empirical reasoning, to objects in their collection, and these tendencies, evidenced in complex taxonomies and the emphasis on the so called objective analysis of objects, still persist in a variety of forms in many organisations."[32] There is an assumption in this system that by fitting into a predetermined category of object and meaning, a singular historical truth will be revealed. This reasoning no longer appears to fit or even make 'sense' in the context of postmodernity, which is characterised by millions of electronic artifacts (such as memes and images and commentary) being created every hour. The significance of any object, to the past, to social change, and to expressions of cultural identity, can only be actualised in the present, and "only valid when understood as belonging to the present". [33]

[31] Cameron, F. and Robinson, H. (2010). Digital Knowledgescapes: Cultural, Theoretical, Practical and Usage Issues Facing Museum Collection Databases in a Digital Epoch. In: F. Cameron and S. Kenderline, ed., *Theorising Digital Culture Heritage*, 1st ed. Cambridge: The MIT Press, pp.169

[32] Ibid p.70

[33] ibid

In considering digital access to already existing heritage collections, how do these classic, seemingly 'subjective' documentation models fare in the context of a web-based environment? Most of the academic work done with history adopts a "reconstructuralist" approach, whereby artifacts are empirically studied, and assembled to produce an understanding of what 'actually' happened. Arthur Marwick in his book *The New Nature of History, Knowledge, Evidence and Language (2005)* rejects this reconstructuralist approach and suggests the acceptance of an "epistemic relativist" understanding to historical sources. This epistemic relativists understands our production of knowledge, and the real, as something which is derived from preexisting social concepts, including "linguistic, spatial, cultural and ideological compulsions". [34] The empirical relativist recognises the validity of the modern empirical records, but moderates their authority by permitting the inclusion of alternate forms of analysis, documentation, and a variety of specialist/non specialist/cultural interpretations. When designing a site of digital cultural heritage, you cannot always apply the same processed used to display information and objects in physical exhibits, information being presented in a linear form with hierarchical narrative may not translate to search engine based retrieval of knowledge.

Postmodernity is an excellent lens and theoretical tool for archivists to use when determining new structures to apply to their archival process. With truth being relative to its context, and metanarratives being avoided, archivists can now be free to use their own logic, as long as their bias is stated, to specifically tailor solutions for some of the problems facing the archival community. I am willing to say, that most of the logistical issues arising in contemporary archiving are concerned with technology, whether it be out of date hardware, old file formats,

[34] Marwick, A. (2001). *The new nature of history.* London: Palgrave.

continual need for updating, or how to utilise existing and emerging technologies to their fullest extents. All these problems are relatively new to the profession, whose problems up until recently mostly revolved around paper and other material (not electronic) artefacts. Therefore, we have a collection of professionals trained in methods that are becoming unsuitable to be adapted to newly emerging, electronic and diverse systems trying to solve issues they may not necessarily have the knowledge and skills to fully comprehend. This is where a need for multidisciplinary work and perspectives comes in, for when archivists learn to integrate the knowledge of others, particularly information technology specialists, will they be able to more fully understand the problems at hand, and realise logical solutions.

Postmodernity pushes strongly towards multi-disciplinary perspective, for a more solid and arguable truth can come about when all bases are accounted for. Archivists don't want to risk becoming obsolete in this digital world, for we are not always formally trained in information technology. The archivists of the future may very well need to be IT graduates as well as historians. In the meantime, when attempting to tackle the digital issues arising, it is vital that we employ the knowledge and specialisations of others in our work, so that it may enhance our own specialised knowledge. Our specialised knowledge, and way of thinking in terms of posterity is a great asset to all other realms of knowledge production. Those concerned with the advancement of technology, of society, are not yet or rarely concerning themselves with the past, or thinking in terms of historical significance or accountability, unless required by public interest legislation (and these legislative settings vary greatly between nations).

The symbiotic exchange of skills and knowledge is an emerging actor in staying relative and ensuring job security and this means lifting the barriers between disciplines and faculties, so

that specialist knowledge can be utilised by all. Our professional utility comes from our understanding of information and the ways it can be stored, arranged, and used. Appraisal and selection are more important than ever due to the amount of data being created. Since our discipline has not been as fixed in tradition as others, we are also more free to adopt a postmodernist perspective. We are now in a period of redefining the axiomatic presuppositions of the profession, and mastering the use of technology, or, at least, mastering the use of others' knowledge about technology - this should be a collective goal of archivists.

The evolution of archival thinking over the past 20 years has resulted in redefining of the traditional characterization of the archivist. Abandoning the image of a passive and neutral keeper of records, it is now accepted that archivists play a substantial role in shaping societal memory through the process of selection and appraisal, and descriptive practices. [35]

In the introduction to the book *The Future of Archives and Record Keeping: A Reader (2011)* [36] Jennie Hill and Victoria Lane state that the chapters (all written by separate, prominent archivists) were pervaded by "the growing influence of postmodernism". They argue there is a growing need to understand the "interconnectedness of creator and user as well as the need to balance the 'traditional' skills with recent developments in digital technology, and the place of the archivist within these changes". This thinking can amount to the archivist being able to identify themselves in their environmental and cultural *contexts* bringing an understanding that these contexts define the possibilities and impose criteria and limitations to their actions. Archists are very well ready and able to start utilising postmodern principles in their work, but how is this to be done?

[35] MacNeil, H. (2010). 'Introduction' in Currents of Archival Thinking. Oxford: ABC-CLIO, LLC. Pp.i-xiii.
[36] Hill. J, Lane, V. (2011). "Where do we come from? What are we? Where are we going? Situating the archive and archivists." In *The Future of Archives and Record Keeping: A Reader*, by Jennie Hill, London: Facet Publishing.3-22.

Research Context

In this thesis, I discuss archives under the umbrella term of 'cultural heritage sites', because many of the ideas and practices I am discussing can be applied to museums and libraries, as well as specialist cultural and learning centres. My use of the term consumer (as users) includes all people who use archives, from private citizens, members of social and cultural groups, staff of educational institutions and employees of state and non-state organizations, statutory authorities and other bodies with responsibilities for social and environmental governance. All cultural heritage sites are facing the same issues, of tailoring their content to suit the needs of the postmodern consumer, and utilising the technology the consumer(user of archives) requires to be stimulated and engaged. With exponentially increasing digitalisation of culture, how are cultural heritage sites going to tailor themselves for the new generation of digital natives? In his chapter 'Waiting for the barbarians: seeking solutions or awaiting answers?' featured in *Envisioning Future Academic Library Services,* Derek law states that "we are on the cusp of an era, where all certainties of literacy may disappear" [37]

The new generation of information consumers see the classical notions of literacy as optional, rather than fundamental attributes. The English language is being manipulated by digital culture and there is increasing reliance on images over written text. No longer are cultural reference points derived from literature, speeches and poems; images, gifs and video now take prevalence. People communicate with each other using instantaneous picture and video messaging, with symbols (such as emojis) becoming more and more of a substitute for written text. Raising the question: How are archives that are so heavily reliant on information

[37] Law, D., Carnaby, P., McDonald, A., Neal, J. and McKnight, S. (2010). Envisioning future academic library services. Londres (Inglaterra): Facet Publishing.

derived from text, going to be able to adjust and appeal to this new wave of information and knowledge production and consumption?

When images more than words define information practices in the new millennium virtual reality and its potential and present applications can be a useful technology which will help bridge the gap between the textual information of the archive, and the digital native's need for immersive non-text based content. Especially since the release of new hardware, which entails virtual reality headsets with audio/visual and real-time tracking capabilities, the potential for immersive learning experiences is larger than ever, and can only be held back by budget and imagination.

According to Lyotard, postmodern society operates within the following framework: since "reality" is what provides the evidence used as proof in scientific argumentation, and also provides prescriptions and promises of a judicial, ethical, and political nature with results, one can master all of these games by mastering "reality". Lyotard believes that this is exactly what technology can help us do. This may be one reason why the invention of Virtual Reality (VR) headsets, which are newly available to the public, has sparked such interest. Using this technology, programmers and designers are able to recreate reality, to a highly effective, and in some cases, almost indistinguishable degree. Users of VR headsets are able to see events in real time, with no fixed viewpoint. We have already legitimised the information retrieved through a computer screen, so it is not long until the spaces available in Virtual Reality become legitimate learning places.

In seeking to understand what Virtual Reality is, and what it is currently being used to achieve, I draw evidence from document study and from my specific case study. My aim is to understand Virtual Reality and the development of the portable headsets and how VR is being used by cultural heritage sites, in conjunction with technology specialists. l describe the potential methods of archiving Virtual Reality in this thesis, followed by a discussion of the epistemological issues faced by the incorporation of virtual reality into the academic substrate of cultural heritage preservation and learning.

Research Problem and Methodology

Archiving must respond to to and be made for consumers (users) because without the consumer what is the point of the archive? To quote from Torkington (2011), "If nobody uses your digital collections, what's the point? If nobody can find the digital objects, what's the point? If you recreate medieval standards of access in the digital age, what's the point? You won't get to the 21st century by doubling down on the 11th century". [38]

There are new technologies being developed that have the potential to change professional archiving practice. Archiving, as must all professions, has to remain vigilant to new technologies, especially those that have huge communication potential. Archiving is an intentional profession whose function is to support our understanding of social and cultural life through the management and retention of personal, corporate and social memory. [39]

This thesis considers the matter of the recent development of Virtual Reality (VR) and the recent commercialization of Head Mounted Displays (HDMs), also known as VR headsets,

[38] Torkington, N. (2011) Libraries, where it all went wrong. Address to the national and state librarians of Australia, November 23 2011

[39] Archivists.org.au. (2016). Connect - Australian Society of Archivists. [online] Available at: http://www.archivists.org.au

which have the potential to bring different and enhanced user experiences of cultural preservation practice to different archiving sites across Europe . Virtual Reality is defined at length in the next section of this thesis. In this section I will discuss the methodology I used to inquire into this research problem, that is, of inquiring into the problem of what Virtual Reality might mean for the archiving profession.

I use two qualitative research methodologies. The first is a document study, the second is a limited case study where I visited two sites where Virtual Reality applications are being developed in order to understand the nature of the rapid explosion of VR technology. These are Realities I.O in Berlin, Germany and The Virtual Dutchman located in Wierden, The Netherlands. Firstly I will discuss document study and then I will discuss case study. I combined both postmodern theoretical lens to collect data and make the argument in this thesis.

1. Document Study

Document study is defined as the qualitative study of published works (documents) to make and substantiate an academic argument. Document study can support and strengthen a research analysis as well as be used as a methodology in its own right. I have used document study to inquire into the development of Virtual Reality at global and general scale and have used case study to investigate Virtual Reality at a local scale. According to Bowen 2009, documents provide useful background data and are helpful in conceptualizing the research context and problem. Documents can be used to track and report on changes in a social phenomenon. Document study can point to questions that need to be asked and to situations

that need to be observed and making use of a document study enhances critical and comprehensive research.

There is no limit to the types of documents that a researcher can draw upon. I used many sources including recent academic articles (including book chapters) and popular press articles and industry blogs to find the data from which sought to inquire into and understand the nature of the very rapidly developing Virtual Reality field. One of the key concerns of document study is that the documents drawn upon are reliable sources of information. Peer reviewed academic work is considered trustworthy for the purposes of data collection.[40] I was very careful to use reliable industry sources such as known authors with a long track record and established publishers (such as *Forbes* magazine) and established industry blogs to gather data reported in this thesis. As there is a proliferation of information about Virtual Reality, I started with organisations such as the Virtual Reality Society who present a trustworthy face to the world. When considering which information to use, I considered everything from an archiving professional perspective. My aim was to uncover information about recent developments and apply selected data to a consideration of the research problem in order to tell a research story exploring the likely and possible impacts of Virtual Reality on the profession of archiving, given the limitations imposed by a masters research thesis.
The importance of undertaking a document study is that is serves as a reliable method of confirming data about a social phenomenon, in this case, a technology trend. It is important in a document study to be aware of bias, both from the researcher's perspective and the writer of the document's perspective. In the case of any emerging technology there is a lot of hype (I discuss this in the next section), so it was important to triangulate and corroborate

[40] Bowen, G. (2009). Document Analysis as a Qualitative Research Method. Qualitative Research Journal, 9(2), pp.27-40.

information by using a number of sources where the information was settled and discussed as fact rather than promise.

I read a lot of materials but only selected data to report on where I was able to determine the information as being accurate and about which there was a consensus. As Bowen (2009) points out, generally documents are not written with a research purpose in mind, therefore many documents will be incomplete or not contain all the information needed or information may be inaccurate or inconsistent. This is why the researcher herself has to be systematic in appraising the value of information and double-checking the accuracy of presented facts. Document study relies on the researcher to both thoroughly investigate and evaluate the subjectivity of the document writer and her own subjectivity in seeking to uncover reliable data. Billions of dollars are currently being invested into Virtual Reality technology (see the next section) so while I read a lot of blogs and articles about this investment, I did not include a lot of this material in this thesis as I sincerely tried to avoid the hype and focus only on what is available now in 2017.

2. Case Study

Case study is used across the social and health sciences and takes many different forms usually in accordance with discipline norms. Case study enables a researcher to examine a situation in depth within a defined set of conditions, whether these be spatial, physical, temporal, geographical, organisational, or actional (such as an event). In 1984, Yin (who was a post-positivist) described case study as a method of "empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between

phenomenon and context are not clearly evident; and in which multiple sources of evidence are used". [41]

Case study can be used to answer all kinds of questions, and be used to understand social matters as they occur. In their historical summary of the forty year development of case study, Harrison, Birks, Franklin and Mills (2017) point out that case study has evolved to be a pragmatic and flexible approach to researching changing social phenomenon.[42]

Case study does not have a prescribed theoretical or philosophical underpinning. Harrison et al. (2017) describe it as "agnostic" and therefore it can be relativistic and interpretivist and "accepting of postmodern sensibilities". Interpretivism can "permeate" the research design and the researcher can co-construct data with people in the sites she investigates. There are different types of case studies and I have chosen to do a small, descriptive case study in two different sites, one site is in The Netherlands and the other site is in Germany. The purpose is to describe two start-ups developing Virtual Reality and identify some applications of VR in real time in the first half of 2017.

The challenge for the researcher doing a descriptive (and qualitative) case study is that she must produce a narrative that is coherent and well-informed, drawing on a range of data appropriate sources (Yin says multiple sources for data are one of the strengths of case study and these sources can include numerical data). To enhance reliability and validity, it is very important for the researcher not to be "sloppy" (Yin's 1984 term) and not to generalize a

[41] Yin, R. (n.d.). Case study research. Thousand Oaks, Calif. [u.a.]: Sage. P.23
[42] Harrison, H., Birks, M., Franklin, R. and Mills, J. (2017). Case Study Research: Foundations and Methodological Orientations. [online] Qualitative-research.net. Available at: http://www.qualitative-research.net/index.php/fqs/article/view/2655/4080

universal condition from a single case. As this is not my intention, this is not a weakness in my study. My intention is only to describe two cases as 'points in time' practice. I made these journeys to these VR development sites as I wanted to learn and inquire into what was happening 'on the ground' and in real time. I used my social network (Facebook) to find these two locations and then requested permission to visit the site in The Netherlands and the site in Berlin, Germany. I gathered data from their websites, and undertook observation, writing in my research journal. I also interviewed the innovators of each startup. My subjective viewpoint is that I wanted to understand the development of the technology and then make the theoretical links between the emerging technology and the professional practice of archiving, which is the novel and unique contribution of my thesis.

VIRTUAL REALITY

Defining Virtual Reality (see appendix 1)

Virtual Reality is defined as the electronic, computer generated, emulation of reality, according to the Virtual Reality Society. [43] Virtual Reality and the promise of its potential has always been enormous. The idea that a piece of technology such as a headset that a person wears like a pair of goggles can take us anywhere, 'real' or fictional is one of postmodern wonderment. As Matthew Schnipper point out in his article *Seeing is believing, The state of virtual reality,* that Virtual Reality offers "the same escapism peddled by drugs, alcohol, sex, and art - to break off the shackles of the mundane through the metaphysical transportation to an altered state".[44] Schnipper points out, that though made from electrons, Virtual Reality is, "at its core is an organic experience". For what is s[t]imulated by machine

[43] Virtual Reality. (2017). What is Virtual Reality? - Virtual Reality. [online] Available at: https://www.vrs.org.uk/virtual-reality/what-is-virtual-reality.html

[44] Schnipper, M. (2016). The Rise and Fall and Rise of Virtual Reality. [online] *The Verge*. Available at: https://www.theverge.com/a/virtual-reality/intro

within the confines of the Virtual Reality Head Mounted Display happens within the mind itself.

Immersive computer simulations allow human beings to experience and access phenomena beyond the organic, physical limitations. The ambiguous origins of Virtual Reality (and other versions of technologies able to generate an illusion immersive enough to constitute another 'reality') are traced by David Ewalt in his book, *Defying Reality: the Inside Story of the Virtual Reality Revolution*, which will be published in 2018. Scientists, engineers, programmers and gamers have always enjoyed the idea of immersion inside a digital landscape, but until recently, the vision simply did not match the means. The closest ancestor of the modern Virtual Reality (VR) Head Mounted Displays (HMD) come from the nineteen fifties, when a handful of visionaries saw the possibility for "watching things on a screen that never ends"[45]. But the hardware and software to support such visions simply wasn't available. The chunky visuals of the past lead to unsatisfactory results, but people pursued the idea, especially inside the US and other militaries, who have attempted to simulate immersive war experiences for years. When the PC boom began in the 80s and 90s, the idea of VR was again visited, with the rapid development of the possibilities of computer generated images, however the gap between idea and construction was too wide. By the end of the first decade of the twenty first century, existing VR headsets were heavy and cumbersome and suffered from low field of view, low contrast and high latency (i.e. the rolling vision was 'clunky').

> *The dream of virtual reality had been around for so long that most people in the technology community had given up on it. When we first met Palmer, we saw he not*

[45] Ibid

> *only continued to believe in the dream but also understood how to put all the key underlying technologies together to make it a reality*.
>
> Chris Dixon, quoted in *Forbes* January 19 2015

In a classic story-arc, a 17 year old called Palmer Luckey put together the first prototype Virtual Reality HMD in his parents' garage in 2010. The HMD was much lighter, had 3 dimensional stereoscopy, an amazing 270 degree vision and was wireless. In 2012, Palmer Luckey has a sixth generation HMD product, and he launched a company called Oculus VR in order to run a crowdfunding project to make the headset available for tech enthusiasts. Palmer did not initially see any widespread application in his HMD invention, but the big tech companies did. In March 2014 the Oculus Rift HMD was purchased by Facebook for 2 billion US dollars and Palmer's share was estimated at 700 million dollars. [46]

A consumer ready version of the Rift was released last year in 2016 but pre-production models have been available for developers to purchase in order for them to develop complementary software and programs.

Presently, there are multiple, large tech companies developing their own virtual reality HMDs, with the main products commercially available now being Facebook's Oculus Rift and HTC's Vive. Both these products currently have tethered headsets, which means there is a cable connecting the headset to the computer. This can cause small limitations on movements, but it means that the display picture quality is phenomenal. There are untethered headsets available, which utilise your own smartphone, whilst these are more affordable for

[46] Ruben, P. (2014). The Inside Story of Oculus Rift and How Virtual Reality Became Reality. [online] *Wired.com*. Available at: https://www.wired.com/2014/05/oculus-rift-4/

the general public; the technological limitations of the phone, and it's screen which is not built specifically for 3D viewing can leave the experience unsatisfactory. Development is currently underway for wireless HMD units with the same information transfer capacity as the tethered versions. Consumers require a moderately powerful and modern computer, which is able to run the VR software, and the headsets themselves are still out of most consumers' comfortable price range for such technology. But extrapolating from past technology trends, their price will decrease immediately as new developments are made. In fact, *Forbes* magazine reports that over 2.3 billion US dollars were invested into virtual and augmented reality systems in the 2016. And International Data Corp reportedly says that worldwide revenues for the augmented and virtual reality market will grow from $5.2 billion in 2016 to more than $162 billion in 2020.[47]

Oculus Rift personal tracking technology monitors movements through a camera, which are replicated inside the headset, Whereas the HTC Vive uses lasers which triangulate the position of laser sensitive nodes on the headset and hand controls. The HTC Vive currently allows for a slightly larger and more precise tracking area, but both products work incredibly well. With the tens of billions of dollars being invested in developing virtual and augmented reality technologies now and in the next few years, it is important to note, that concerning this technology we are only at the start of many breakthroughs in Virtual Reality development. The technology itself is now advanced enough to produce images indistinguishable from their physical copies, and new laser tracking means that movements are reproduced in real time inside VR. The headsets are now lightweight and commercially

[47] Ewalt, D. (2016). Forbes Welcome. [online] *Forbes.com*. Available at: https://www.forbes.com/sites/davidewalt/2016/11/02/inside-magic-leap-the-secretive-4-5-billion-startup-changing-computing-forever/#4aa7bf184223.

available, and online virtual reality content stores have followed, such as HTC's Vive/Stream website.

> *We are evolved to operate in 3D spaces. You can name and locate 1,000 things scattered around an apartment, but you can't remember the file structure on your computer or the files on your desktop. We are very good at remembering spatial environments. VR has the advantage of being able to plug into that*.
>
> Corey Ondrejka, 2016

In an article for *The Verge,* Ellis Hamburger interviewed Cory Ondrejka, the co-creator of popular online role playing game, *Second Life.* Cory is now Vice President of Engineering at Facebook. Ondrejka introduced Mark Zuckerberg to Palmer Luckey and spearheaded Facebook's acquisition of the company. When asked about Facebook's interest in Virtual Reality, Ondrejka stated that the Facebook mission is to "help make the world more open and connected"[48], this means enabling people to connect and communicate on personal levels and Ondrejka believes VR technology will help achieve this. The difference in quality between the technology of the groundbreaking Oculus Rift and previous attempts at virtual reality has meant problems of lag and the chunkiness of the virtual reality image have been overcome. A human brain can now process Virtual Reality as reality. With the Oculus Rift (and coming HMDs from different companies, SONY being Facebook's major competitor in 2017), Ondrejka says he "was able to cross that threshold into presence where your brain is saying,

[48] Hamburger, E. (2016). The Rise and Fall and Rise of Virtual Reality. [online] *The Verge*. Available at: https://www.theverge.com/a/virtual-reality/qa_fb

'Well, this is real', and that difference is fundamentally the difference between VR that's a promise and VR that's actually here".[49]

Ondrejka discusses the advantages to applying VR technology to your social life. When unable to attend a wedding of a loved one, you can expect to receive photo and video updates about the event, but with the invention of VR and 360 degrees capture technology, you could be able to attend the event as if you were there physically. Ondrejka is fascinated by VR's potential to change the interface of computing: Representing information spatially is a new and exciting concept, with many potential outcomes. There are no axiomatic presuppositions about VR and what it can and cannot be used for. We are in an era of experimentalism in postmodernity, tackling matters of reality and representation. When we play with notions of truth and reality, VR is the perfect console for our information game.

The impact of Virtual Reality

Although a very recent invention, the consumer ready HMD has already begun to infiltrate the entertainment and sports industries, engineering, gaming, science and education. Those interested in the future have seen the immediate potential of VR technology, and have attempted in to immediately capitalise on this development. (Corey Ondrejka talks about the "killer apps" currently being developed for the Oculus Rift that will take VR into many domains of human enterprise.) Following is an indication of some of the many ways VR is making its way into popular culture and society.

[49] ibid

1) Entertainment and Sports (see appendix 2)

It's safe to say that VR's most obvious and most popular useage is in entertainment and sports. VR is changing the way we experience media, events, and video games. In 2016, Fox Sports Live streamed a college football game in VR for the first time. The game between Ohio State and Oklahoma streamed live via Fox Sport's new Virtual Reality app, which offered viewers the ability to either watch the action from a "virtual suite" in the stadium, or switch between multiple on-field perspectives. There was also an option to watch the regular live stream within the VR, presumably to follow the action in a more directed way when you get tired of having to figure out where to look. The number of sporting events to watch in VR is increasing, and include boxing and car racing[50]. Giving viewers a front row seat, or on-track perspective gives VR the spectator edge over other platforms.

Not only can you watch your favourite team play, you can see your favourite band in concert. In 2016, through NextVR's partnership with Live Nation, VR users were able to attend a concert in VR. The band *Thievery Corporation* made VR history by performing for a live audience, as well as live streaming through VR for an audience at home. Amy LaMeyer reviewed the experience on the website *Virtual Reality pop* and stated that "for a new technology, it was surprisingly good! I'll admit it- I got up and danced. I may have even clapped and whistled. This is the future and I'm eagerly awaiting more."[51]

[50] Spangler, T. (2017). Fox Sports Inks 5-Year Virtual Reality Pact With NextVR. [online] *Variety*. Available at: http://variety.com/2016/digital/news/fox-sports-virtual-reality-nextvr-daytona-500-1201708198/

[51] LaMeyer, A. (2017). Virtual Concerts — a New Way to Experience Music – Virtual Reality Pop. [online] *Virtual Reality Pop*. Available at: https://virtualrealitypop.com/virtual-concerts-a-new-way-to-experience-music-903a7d7a651

Virtual Reality technology cannot replace live entertainment, but is offered as a complementary aspect to the experience. This type of technology makes live entertainment much more accessible to those with disabilities, who are often unable to attend live performances or games. Multiple spectator angles give pristine views, whilst not having to navigate a large crowd. Side stage cameras, as well as on field cameras enable the VR viewer more access than a live attendant, which is a potential advantage of the medium. Immersing yourself in lively and exciting experiences is a privilege to the able bodied and neurotypical; VR, aside from it's blatant entertainment value, can advantage the disadvantaged. The ability to immerse yourself in popular culture, with the option to remain in the safety of your own home, makes high energy entertainment a lot more accessible than it previously was.

The passive element of spectating sports and music has now become immersive and so has active involvement in an immersive environment? Virtual Reality gaming is beginning to take off, with extremely popular online store Steam now selling VR games, along with Viveport, the online gamestore complimentary of the HTC Vive. Steam supports all makes of HMDs and most games are able to be played by both Oculus Rift and HTC Vive. Most game developers are not able to acquire the funding to develop full length, narrative rich gaming experiences, so most of the games available are a bit of a tasting platter of what this technology is able to do. Virtual Reality gaming now has new immersive elements which rely on whole body movement, and not just fine dexterity through external controllers like the game format we have grown used to over the last 20 years, so the games being released are small and attempt to refine the methods in of how the user interacts with their virtual environment.

The most popular VR game on Steam (by number of positive reviews) is called *The Lab* and ironically enough, it is a game based on the 'mini-game' format. Which means it is a game made up of a number of smaller games, each with different gameplay and objective. Game developers *Valve* who are responsible for the incredibly popular games *Half-life* and *Portal* created this VR experience to accompany the release of the HTC Vive. The game is made up of "eight completely unconnected VR games"[52] which all showcase a different aspect of VR gameplay. David Jankins, writing for *Metro.co.uk* states that: "From a technical perspective *The Lab* is hugely impressive, effortlessly proving the potential of every aspect of VR. What it doesn't do though is counter the impression that all current VR games are just thinly-veiled tech demos". But in that sense it succeeds perfectly, and Jankins says that anyone can come away from T*he Lab* believing "that virtual reality is going to change the future of, not just video games but society in general".

Other games are using the experience of total immersion to creative visually stunning and emotive experiences. Games such as *Adrift, The Climb, and Everest VR* create VR worlds for you to explore and get lost in. These games in VR are called "walking games", for the actual interactive element is less developed, and they are more focused on creating hyper realistic environments for one to immerse themselves in and marvel at. Either based on fantasy environments, or real, but unreachable to the average human, these games show just how far technology has come in simulating illusionary forms.

[52] Jankins, D. (2017). *Game review: The Lab is Valve's new VR game for HTC Vive*. [online] Metro. Available at: http://metro.co.uk/2016/04/13/the-lab-htc-vive-review-valves-guide-to-virtual-reality-5812957/

2) Learning (see appendix 3)

Learning through computer based technology has been widely accepted as a standardised and reliable pedagogical tool. Whether it be technical concepts or analogue skills which then may be applied to physical situations, the computers interactive element can greatly increase knowledge acquisition, especially for active learners. Utilising Virtual Reality technology's immersive capabilities opens up more potential paths of knowledge acquisition and higher-order understanding. Spacial concepts can be fully visualised, and parameters can be broken down. Complex biological processes, invisible to the naked eye, can be brought into physical and observable states due to VR. Neuroscientists at GE have used the technology to traverse the anatomy of the human brain. "It's a very interactive and intuitive way of visualizing complex, multi-dimensional neuroimaging data," Sandeep Gupta from GE Global Research told Mona Lalwani reporting for *Engadget*. "A neurosurgeon could use tools like these to get a complete view of lesions and possible impact of surgery on brain networks and function. The most immediate benefit of the Neuro VR system is perhaps in training for neuroscientists."[53] Virtual representations of the brain's processes, through transmission between neurons, is explored in this aesthetic and abstract experience. You can download the game, titled *GE Nuro* from Steam's online store, and see inside the complex recess of the mind.

Another game aimed at immersive learning is *Remembering Pearl Harbou*r made In commemoration of the 75th anniversary of the attack on Pearl Harbor. This was a TIME and LIFE original historical Virtual Reality project. The story is told in three acts, through the point of view of Lt. James Downing, who at 103 is the second-oldest living American veteran

[53] *Engadget.* (2017). GE's Neuro VR experience takes you inside a musician's brain. [online] Available at: https://www.engadget.com/2015/08/06/ges-neuro-vr-experience-takes-you-inside-a-musicians-brain/

to have witnessed that day. Users hear from Downing, and interact with realistic VR versions of artifacts, iconic photography and archival video to get "a unique understanding of one of American history's defining moments"[54]. The emotive element for learning history is important. With the ability to personalise such an event, with narrative history and physical objects, a greater understanding can come learning through the VR experience.The user has navigational (hence narrative) choice; instead of following a linear progression of objects and textual information, the user can choose to observe and listen at will.

Removing artifacts from their glass cases and frames, and placing them in a virtual replication of their original contextual environment, will help people contextualise themselves in comparison to such an environment. Studying subjects such as anatomy and history are now becoming more stimulating and emotive due to the invention of VR, helping give users different forms of perspective. Studies are beginning to be conducted on the effectiveness of virtual reality learning, but the consumer ready product has not been around long enough to make any grant claims. Despite not understanding VR's full learning potential, Virtual reality HMD's are being used in other fields of experimentation.

3) Psychology & Science

Virtual Reality is being used in psychological experimentation; it's immersive and hyper real qualities allow scientists to recreate certain environments and control the variables. Lots is being done to explore this immersive aspect in relation to environmentally and situationally caused trauma. In 2012 a group of psychologists tested the efficacy of Virtual Reality Exposure Therapy (VRET) in the treatment of Post Traumatic Stress Disorder (PTSD) and as

[54] *Time.com*. (2017). Go Behind the Scenes of LIFE VR's 'Remembering Pearl Harbor'. [online] Available at: http://time.com/4586598/life-vr-pearl-harbor/

VR was just as effective as traditional exposure therapy. VR may come to be considered to be the first-line treatment for PTSD. [55]. VR allows for greater patient engagement, and greater activation of the traumatic memory, which is necessary for the extinction of the conditioned fear.[56] Being able to recreate not only the environment in which the trauma was caused, but also simulate the actors and actions in the simulated environment, means that a total illusion can be created and accepted by the mind, resulting in effective psychological treatment.

Another example of scientific work is being done with VR is as a method of attenuating pain during medical procedures. Gold, Belmont & Thomas published their research in the journal *Cyberpsychology and Behaviour* in 2007 and stated: *"*Over the past ten years virtual reality has been shown to be a powerful clinical tool for a variety of medical, psychological, and behavioral applications. In particular, VR has been used with great success to manage acute pain in patients undergoing routine and invasive medical interventions".[57] Being able to 'trick' the brain into believing it is elsewhere, and in another situation, distracts greatly from the pain of a medical procedure because the brain is unable to focus its perceptive power on something it cannot perceive.

I have documented instances in different professional fields where VR is used for entertainment, learning and scientific purposes. Understanding forms of technology that appeals the the contemporary consumer (user) is vital for cultural heritage specialists. Being up to date with technological innovations and trends is important for the cultural heritage

[55] Gonçalves, R., Pedrozo, A., Coutinho, E., Figueira, I. and Ventura, P. (2012). Efficacy of Virtual Reality Exposure Therapy in the Treatment of PTSD: A Systematic Review. *PLoS ONE,* 7(12), p.e48469.
[56] ibid
[57] Gold, J., Belmont, K. and Thomas, D. (2007). The Neurobiology of Virtual Reality Pain Attenuation. *CyberPsychology & Behavio*r, 10(4), pp.536-544.

industry. Understanding such technology now means that we may utilise these features when creating new content for our galleries, museums, libraries and archives. I have shown on a surface level the appeal and everyday use of VR in our postmodern world, but a deeper understanding is needed when applying this technology to such things as cultural heritage. Why is it that immersion and illusion appeal so heavily to our human psyche? Our escapist tendencies as a whole, such as drug use, art, literature, and the internet, all appeal as a departure from reality. The VR on offer today can transport you to the hyper real or ultimately fantastical.

Theorising VR and its Role as a Tool for Cultural Heritage learning

With the ability to finally step away from the screen, or step *Into* the screen, our point of observance is no longer static, or even linear, possible points of perception are now astronomically numerous. With Virtual Reality our eyes become no longer our only point of informational input, with audio and kinetic senses now engaged by Virtual Reality technology. The capabilities of Virtual Reality's immersive image and sound production are engaging the postmodern consumer (user). Although attempting to find academic sources which discuss and theorise contemporary Virtual Reality practices was more of a challenge than I first expected it to be. There is a reasonable and well versed amount of content which accompanied the beginning of 3D imaging, from the 80s, 90s and early 2000s. The abundance of published writings starts to diminish around 2005 and I am yet to see an emergence of theoretical discussions surrounding the new HMD systems. The development of this advanced technology has come so rapidly that many have not had time to ruminate and publish on its philosophical and etymological meaning. Theorising has been done about the 'promise' of Virtual Reality and its 'possibilities', but since these possibilities have actualised

themselves with technologies advancement, the humanities driven academic discussion appears to have halted. Thus all the peer reviewed, and published articles used to theorise this technology in terms of cultural heritage, have largely been drawn from material written before 2010.

How can archivists utilise the qualities of Virtual Reality in the preservation and education of cultural heritage? The history of immersive virtual reality can be closely linked to that of the panorama.[58] In 2003, Oliver Grau published his book *Virtual Art, From Illusion to Immersion* that traces how new virtual art fits into the art history of illusion and immersion, using examples from the past, drawing especially from the Victorian Era. Grau argues that "installing an observer in a hermetically closed-off image space of illusion did not make its first appearance with the technical invention of computer aided virtual realities". Grau states that "in each epoch, extraordinary efforts were made to produce maximum illusion with the technical means at hand".

As Sarah Kenderline points out in her chapter *Speaking in Rama: Panoramic Vision in Cultural Heritage,* the rich technical and socio cultural record of the panorama (in its broadest sense) embraces the history of perspective and representation from early as cave paintings, through the development of the painting illusions of Baroque and Renaissance, on to the machinery of the Great Exhibitions in the nineteenth and twentieth centuries. Humans have a need for immersive and perspective altering experience and learning, and this has coincided with much of modern history. Therefore our transition to Virtual Reality as our tool

[58] Kenderline, S. (2007). Speaking in Rama: Panoramic Vision in Cultural Heritage Visualisation. In: F. Cameron and S. Kenderline, ed., *Theorising Digital Culture Heritage: A Critical Discourse,* 1st ed. Cambridge: The MIT Press, pp.301-333

of maximum illusion is completely justified in this digital age. Virtual reality reinforces the idea that breakthroughs in technology often emerge from the pre-existing fabric of cultural discourse. Kenderline (2007) gives many instances exemplifying how Western society seeks immersive exhibition, spectacle and illusion, and how we desire changing perspectives, aspects of immersion and user interaction. Her hopes were that VR could help the user engage in narrative structures and exchange with virtual bodies in order to foster cultural heritage awareness and education. The projects which are currently running or underway concerning virtual reality in cultural heritage, are doing just that and more.

Critics may warn against the 'Disneyfication of culture', but looking at it contextually, the heritage sites when begun, must have employed the most advanced techniques of the time to show their collection, now these techniques are considered 'classical'. Arbitrary rules of display unify most cultural exhibits, with a linear progression of artifacts, images and texts. Andrea Witcomb (2007) discusses in her chapter *The Materiality of Virtual Technologies: A New Approach to Thinking about the Impact of Multimedia in Museums* the impact that new technologies and multimedia presentation have on museum exhibition. Stating that most discussions centre around the use of multimedia in museums have polarised assumptions about the virtual and material world. The material world "carries weight" - with aura, evidence, the passage of time, the signs of power through accumulation, authority, knowledge and privilege. Whereas the virtual, multimediated world is perceived as "the other", and is seen as surface, temporary, ephemeral, and popular. This polarity is rarely disputed, but the significance concerning each other is. The introduction of multimedia exhibits to the world of cultural heritage can be seen either as a threat to the established culture and practices of the

museum complex, or as an opportunity for reinvention and to ensure a cultural heritage site's own survival into the twenty first century.[59]

For those who see these changes as a threat, can see that threat as a loss of aura and institutional authority, a the loss of ability to distinguish between the real and copy, the death of the object, and the reduction of knowledge to information. Those with positive stances see such changes as enabling new democratic associations emerging around museums and other cultural heritage sites. Witcomb (2007) states that "the loss of institutional authority equates with the need for curators to become facilitators rather than figures of authority, an openness to popular culture, the recognition of multiple meanings, and the extension of the media sphere into the space of museum". This way of thinking is a very much postmodern approach to the new role of cultural heritage sites. It is no longer adhering to the strict criteria of modernity, archivists working in cultural heritage sites can curate in response to demand, not traditional method. Witcomb (2007) ruminates about the role that multimedia tools play in cultural heritage sites defining the problem as the how multimedia is seen primarily as a tool for interpretation and rarely as a material expression in its own right. Understanding that multimedia can be seen as a material form of expression opens up new spaces for thinking about multimedia in new ways, that go further than the offer of a mere extension of a point of information. Multimedia (such as Virtual Reality) can be used a tool to explore the "affective "possibilities of objects, recognizing the way in which objects and multimedia installation, are able to engage the emotions of the viewer (user) to produce deeper, and more profound

[59] Witcomb, A. (2007). The Materiality of Virtual Technologies: A New Approach to Thinking About the Impact of Multimedia in Museums. In: F. Cameron and S. Kenderline, ed., *Theorising Digital Cultural Heritage*, 1st ed. Cambridge: The MIT Press, pp.35-49.

knowledge as an outcome, a knowledge that will reflect "shared experiences, empathy and memory". [60]

Cultural heritage sites are there to support society and it's commutative acquisition of information and culture. Since the digitisation of society is already in process, and only predicted to increase exponentially, it seems only natural for the cultural heritage practice to reflect these changes. Cultural heritage sites concern themselves with helping citizens make sense of the chaotic world. So, how is constant change going to be interpreted through static and linear presentations of knowledge? The ways in which knowledge is curated and displayed for public consumption, have not been free from bias, and typically adhere to specific analytical frameworks and pedagogical interests. New technologies disrupt previous practice and strain is put on the traditional systems of interpretation. The advantages is that electronic technology now allows us to create more immersive and emotive environments, privileging the role of interpretation itself. In postmodern times, the modern nation can educate itself to serve the interest of it's citizens. For they themselves, and not the land they stand on, or the things they own, but their skills and knowledge are now the greatest asset of the collective.

In order to better understand how Virtual Reality has the potential to change the cultural heritage practice, we can see, from previous developments in the history of technology, that other inventions have changed the presentation of heritage drastically. Walsh's (2007) chapter titled *Rise and Fall of the Post-Photographic Museum: Technology and the Transformation of Art* discusses the changes which took place in the museum industry

[60] Ibid p.36

accompanying the invention of the photograph. During its initial development, photography was more well received than the invention of the world wide web.[61] While it may be assumed that photography immediately affected the classical methods of image production in reality the opposite was true. Much of the refinement of photographic technology consisted of making sure that the camera was able to capture the established, Renaissance idea of linear perspective. The new ability to capture scenes in incredible detail took society by storm, and portrait photographs became a sought-after commodity. Walsh states: "Besides such tiny details, the other thing that photographs seemed to capture, almost miraculously - was truth itself". The photographic process was initially perceived as free from any subjective manipulation, in that images were recorded perfectly by registering an emanation (light waves reflected by objects), and produced by scientific process (chemical development). Photographs soon became the standard evidence, especially concerning history, leaving the battle paintings of the past in aesthetic obscurity to be appreciated, but not taken as fact. Once photography improved to an accepted standard for capturing reality, galleries and museums began to transform the exhibitions. Artistic images were now able to be captured at a standard of recreation that satisfied both art critics and the general consumer (user) and photographs played a defining role in the study, dissemination, and appreciation of art.[62]

Walsh (2007) has classified museums established before the invention of the photograph such as the Louvre, London's National Gallery, and the Hermitage, as pre-photographic museums, founded on existing collections of artifact and curiosities assembled by individual collectors, learned societies, and/or ruling dynasties. Located mostly in palaces, cathedrals, or

[61] Walsh, P. (2007). Rise and Fall of the Post-Photographic Museum: Technology and The Transformation of Art. In: F. Cameron and S. Kenderline, ed., *Theorising Digital Culture Heritage*, 1st ed. Cambridge: The MIT Press, pp.21
[62] Ibid. p 23

repurposed state buildings these collections reflected the tastes of a collector rather than attempting to portray a national message or meaning through systematic collection and appraisal. The post photographic museum, much like photography itself, alternatively, set out to capture everything. In the 19th century, the "substrate" of a museum changed from housing an existing collection, to a place where new collections were to be assembled.

Walsh (2007) uses the example of the South Kensington Museum, now known as the Victoria and Albert, as a leading example of post-photographic museum curating. The Crystal Palace Exhibition in London in 1851 was the inspiration behind the South Kensington Museum which took a 'World's Fair' approach to the collection, wishing to represent all cultures and industries of the globe at once in an entertaining manner. Walsh records the South Kensington Museum has two goals in mind: "To elevate public taste, especially the taste of British manufacturers, and to elevate society though the morally beneficial influence of great art". Photographs (and plaster casts) were seen as suitable, acceptable and 'truthful' reproductions of reality.

Photography also changed the ways in which cultural heritage sites process, document and record artifacts. Photographs now accompany artifact acquisition and administration, with images able to record preservations the condition of the artifact. And the fact that images were able to be reproduced and distributed in large numbers made the originals more valuable and more precious in their existing physical state. Pre-photographic museums often did not want to display damaged artifacts, which meant that many pieces were restored before display. After mass adoption of photographic technology, pieces were able to be left in their original state, and restored copies could be made. This practice continues with archival

practices today. Photography allows us to respect original order and appreciate contextual information on a surface level. With X-ray imaging and scanning, more is able to be learnt about an artifact, and its process of creation, which then allows more educated attempts at restoration or re-creation. The invention of photography means originals keep their contextual information intact, and then technology is used to realise, and accentuate their significance. In a number of cases, photographic reproduction has allowed artworks and other objects to transform from "precious objects into sacred icons of deep quasi-religious power"[63]. After a lifetime of observing reproductions, the original becomes sacred in its own way. Tourists wait for hours in the Louvre to glimpse the Da Vinci's Mona Lisa for themselves, but when faced with the piece, they take a photograph. Perhaps this is a function of our visually literate functionality and the fact we have moved to become an image based society.

Pre-photographic to post photographic practices entailed many changes. Walsh indicates we are in the midst of another evolution, writing, "today we are in the era of the post-internet museum", and that "the advent of inexpensive digital imaging, the spread of the world wide web, and the ability of these two technologies to quickly and easily alter, publish, and distribute photographic images, has radically changed the old, post photographic hegemony.[64] " However, though all major museums and cultural sites have an internet presence, many have yet to respond directly to technological changes with shifts in their basic philosophy towards the display and interpretation of artefacts which remains similar to the static analogue photographs in the late nineteenth century. Museums and cultural heritage sites are being urged to move forward with technology, especially concerning image reproduction. Virtual Reality's immersive and hyper-real features now enable cultural heritage sites to reinvent the image or diorama, with the viewer able to be inside, and interact with social and

[63] Ibid. p30
[64] ibid

cultural and historical content. Photogrammetry techniques enable us to scan cultural artifacts, so that the viewer may now see them from close up, at all angles, and even handle these objects in "virtual" reality without the possibility of harm to an artifact itself.

Postmodernity encourages a multidisciplinary approach to issues, and in the current economy's transition to small and communication-rich business models cultural heritage sites can utilise the skills of many in order to create the most effective and engaging exhibitions and collections. In the next section, I will attempt to describe small businesses and companies concerned with developing Virtual Reality. These businesses have been doing work concerning Virtual Reality and cultural heritage sites have contracted these specialists and utilised their specific skills and knowledge in order to create unique learning experiences. Many cultural heritage sites are realising the potential for learning when utilising Virtual Reality, and have employed virtual reality specialists to create content for their exhibitions.

Case Studies

In my inquiry, I visited two small, Virtual Reality development businesses, one in Germany, and one in the Netherlands. I had previously met co-founder of the Berlin based firm Realities I.O when I was on an exchange semester in Munich, Germany in 2014. So my inquiry began there. When visiting the offices of Realities.IO, I met another VR developer Sara Lisa Vogl who, for her final university project, created the VR Planet `Whateverland'. I then personally contacted Dutch VR firm The Virtual Dutchmen after learning that they has created a Virtual Reality experience for the National Archives of the Netherlands, situated in The Hague. I visited their office in Wierden, and interviewed Roelof Terpstra, the Executive Director. A lot of the information I gathered about the work of these VR specialists can be

accessed on the internet, due to the nature of their digital environment. But seeing the scale at which they operate, and being able to experience Virtual Reality for myself, both in development stages and final product testing, was very useful in deepening my own understanding. Below I describe some of the projects undertaken by VR specialists in conjunction with cultural heritage sites and specialists.

Realities.IO (also see Appendix 5)

Realities.IO is a Berlin based VR developer specialising in photogrammetric techniques for creating realistic, high definition virtual space replicas of real places. Realities describes itself as letting "you explore a growing library of interesting and mesmerizing places from all around the globe in virtual reality that are explorable in photorealistic quality. Travel to places that were out of reach before, e.g. famous tourist sites, archeological and cultural heritages sites and lost places" (see realities.io). Their Virtual Reality experience can be downloaded from *Steam* for free at http://store.steampowered.com/app/452710/Realities/ Inside the program, you are transported to outer space, with an image of the earth in front of you. Using your controls you are able to manipulate the position of the earth, and choose one of many places to visit. You are then transported into the scene, which has accompanying audio of background noise as well as narrative information. You are free to move around the scene, using your controls to change your point of view. There are virtual pamphlets lying around which once selected, relay both audio and visual information about the specific scene you inhabit.

In concept, photogrammetry actually dates back as far as the 1400s when Leonardo di Vinci worked out the process of perspective and projective geometry. The process works by

compiling a numerous images taken at various angles, and calculating measurements in the geometry based on differences between them.[65] Realities.IO has taken this concept, along with all the advancements of the digital age, and successfully created amazing photorealistic scenes to "transport people to places they have never been, and could potentially never visit, in virtual reality." Virtual tourism may very well be the next big thing. Places where crowds are not allowed, may potentially be scanned by one individual, so that the rest of the world may see and perceive. CEO of Realities.IO Dominic Eskofier states: "We want to take people into the tombs of the Pyramids, the abandoned buildings in Chernobyl, into all the places they have imagined but never had the chance to visit".[66]

Virtual scenes are first created by first scanning the environment to be digitally recreated. Regular cameras are used to capture a series of images. Using these images, the VR specialists are able to create depth by calculating the distance between certain points. For shapes and detail such as furniture, they scan the object from all angles. The whole capture process takes about two hours, and then the images are fed into Realities.IO's custom build program. The process takes a few days in all for a single scene, but the photorealism is a true technological wonder. Will Mason, a journalist from *Upload* online tech magazine experienced the Realities.10 program and stated: "I found myself exploring details that I would never have paid attention to in real life. There is something about the medium that turns mundanity into spontaneity – crushed can on the ground and a broken TV".

Recently, Realities.IO has collaborated with German public-broadcasting institution WDR to turn one of Germany's most iconic landmarks into a VR destination. The Cologne Cathedral,

[65] Mason, W. (2017). This is Not a Still Photo: Realities.IO's Photogrammetry VR Scenes Could Change Tourism Forever - UploadVR. [online] UploadVR. Available at: https://uploadvr.com/realities-io-video-photogrammetry/
[66] Ibid

a UNESCO World Heritage site is now available to visit online from anywhere in the world, technology permitted. This VR tour also includes part of the Cathedral that are not usually permitted to visitors, giving the VR experience an added sense of excitement and wonderment, when you are 'permitted' into secret rooms and gated areas.

The wonderful thing about this technology, is that all you need is a camera to capture the images, and you are able to create a three dimensional virtual space. This technology in conjunction with Realities.IO's custom developed programs has expanding potential for capturing scenes in time and space, thereby implicating potential for a new type of archive. The work of Realities.IO reveals we could potentially archive spaces themselves, documenting their changes over time. For instance, Realities.IO has successfully created a virtual copy of a bathroom in Brazil, without having to physically scan the location themselves; they were simply sent photographs which were then able to be turned into a 3D space. This means that specialists all over the world, especially those with access to distant locations and potential out of bounds areas, are now able to share these places without having their physical sites exposed to the degradation of tourism. Users do need access to the headsets (HDMs) to fully experience these advances.

An article in *Motherboard* magazine reports that Realities.IO chiefly wants to use to use their tech for virtual tourism, thus allowing future HMD owners to walk about in distant or restricted spaces they may never see in person[67]. However, the company has also experimented with other uses for its technology, including using it to capture the layout of an archaeological dig site. This VR technology allows reality to be mimicked to such an extent

[67] Johnson, L. (2017). *Forget 360 Videos, Photogrammetric Virtual Reality Is Where It's At*. [online] Motherboard. Available at: https://motherboard.vice.com/en_us/article/forget-360-videos-photogrammetric-virtual-reality-is-where-its-at

that our own brains are completely taken in by the 'virtual' experience. Realities.IO has a promising future recreating the world inside Virtual Reality.

The Virtual Dutch Men (see also Appendix 6)

The Virtual Dutch Men is a small Virtual Reality firm based in Wierden, The Netherlands. With Roelof Terpstra as Executive Director, they custom make VR experiences, games and places for various contracted customers. In 2015, The Virtual Dutchmen were contracted by the Netherlands National Archive to "come up with an organized and intuitive method of presenting their archived photos to the public" (http://www.virtualdutchmen.com/case/photopolis/)

With over 10,000 photos to be used in the project, the solution was to create a virtual city, named *Photopolis* that visualised the archived pictures in a virtual city landscape. A broad and brisk virtual diorama of a city was custom made for the exhibition called 'Blikvangers' (eye catchers). Users were able to highlight individual buildings corresponding to the different subjects, and then be shown additional information of that group of pictures.

The setup consisted of two seats which were placed opposite to each other in the exhibition room, each equipped with an Oculus Rift DK2. The user was able to navigate through *Photopolis* using an Xbox 360 controller. The exhibition emerged visitors in the photo collection in a inventive and new way of classifying and dividing information. During the time of the exhibition, The Virtual Dutchmen had the idea to digitally scan the exhibition space itself, so that it could be archived, visited and viewed in virtual reality. Using photogrammetry, they recreated the photograph exhibition with incredible clarity, and users were even able to view the Virtual Reality area where users 'played' *Photopolis,* which is

very meta. The Virtual Dutchmen have shown that Virtual Reality add dimension to any exhibition, and that it is now possible to save an exhibition space as its own archival artifact.

In 2016, The Virtual Dutchmen collaborated with artist Rene van Engelenburg under the initiative of Europeana, in a Virtual Reality project to present European cultural heritage in an innovative and engaging way. The product of this collaboration was the Big Art Ride, a virtual city filled with European art and monuments through which a user can ride a bike. The setup consists of two stationary bicycles each connected to the Virtual Reality program and a HMD. One bicycle was 'stationed' in the Netherlands, whilst the other 'toured' around Europe. The two users of the bikes could see each other in Virtual Reality, and were able to race across the virtual city. The experience was exciting and competitive, with the informative aim of connecting Europe, its art, and its people. Real bicycles 'fueled' the virtual bicycles: pedalling faster made the virtual bicycles go faster. The audience could influence the race and help a cyclist by pumping the giant bicycle pump or by ringing the giant bicycle bell: these actions both slowed the opponent down or stimulated the 'home team'. A special feature was that falling paintings that had to be avoided, this element added complexity to the race and contesters saw each other live after finishing the Big Art Ride by a video stream.[68] This gaming dimension was not only immersive for the contestant, but was able to be contributed to by the crowd, thus making it a communal effort and communal reward. The Big Art Ride was a highly successful and engaging experience for everyone involved, a true postmodern combination of recreated art treasures of Europe, bicycles, competition, VR and immersive electronic technology.

[68] The Virtual Dutch Men. (2017). *#BigArtRide: cultural heritage in VR - The Virtual Dutch Men*. [online] Available at: http://www.virtualdutchmen.com/case/bigartride/

At the request of the Museum and Visitor Centre Memorial 1815 in Waterloo, LiveTour5D created an impressive VR battle in a 6 square kilometre area, with 180.000 soldiers aided by 40.000 horses and 1,500 canons to show in VR how a British-German coalition led by the Duke of Wellington managed to beat Napoleon de Bonaparte.[69] LiveTour5D commissioned The Virtual Dutch Men to recreate the battle of Waterloo. This VR experience is only a few minutes long, but when the headsets are worn, the user is able to see the battle unfold before them.Being offered audio visual representations (electronic recreations) of past events, takes historical engagement to a new level. Since the launch of this program in JUne 2016, the LiveTour 5D website states that the *1815 Experience* has drawn widespread interest from the press and the vast majority of users have rated the service as "very good" to "excellent.[70]

Whateverland (see Appendix 7)

This is a site that I visited online as part of my thesis research. *Whateverland* is part of a larger game and expanding idea called *Lucid Trips. Whateverland* was developed in part by Sara Lisa Vogl, who presented this idea as a part of her university degree. The idea of *Lucid Trips* is to create a small galaxy of dream planets, where every planet has a different gameplay mechanism and art style. All planets are tied together by the locomotion concept and the distinct surreal atmosphere. In future releases, planets can also be build by the community.[71] The user travels around this virtual world simply as a pair of arms, able to fly and jump through space. The arms you are see mimic the movement in real time of your controllers, making you believe these VR arms are indeed yours. This individual style of gameplay is very effective and immersive, which gives *Lucid Dreams* an ethereal nature.

[69] Livetour5d.com. (2017).
[70] ibid
[71] Vogel, S. (2017). LUCID TRIPS - *announcing VR Art Gallery Whateverland*. [online] Vimeo. Available at: https://vimeo.com/130981221

The first planet in the *Lucid Trips* dream universe is *Whateverland. Whateverland* is a place, much like a gallery, where art can be viewed, but on this planet, you are able to interact with the art. Although the gallery features work from prominent and well known artists, users can also contribute content, meaning anyone is allowed to contribute their art into this virtual world. All artistic disciplines may be accounted for now with photogrammetry technology. Artists can create works manually then scan and upload them to *Whateverland.* There is also the capability of being able to purchase and 3D print the artworks from the site to make a physical souvenir from a virtual world. As co-creator Vogel states in an interview for *Motherboard* magazine: “Lucid Trips is a dream universe where people can slip into the dreamworlds of other people, we first wanted to make art visible from these completely new dimensions and perspectives that are possible through the medium of virtual reality".

Every day, new developments are happening in Virtual Reality, if you can imagine it, there is someone working on it. Seeing how various cultural heritage sites have already employed the use of Virtual Reality in their exhibitions, and events, may inspire others working in the profession to try the same. There is currently no definitive research on whether or not Virtual Reality enhances knowledge production, but studies are being undertaken. The relative newness of this technology means that many epistemological problems have not yet been solved, and much evidence is on a wait-and-see basis. But it is logical to assume that the immersive nature and entertainment value would surely add attraction to any exhibit.

Archiving Virtual Reality (see Appendix 8)

Developments in the area of Virtual Reality technology are fast paced and exciting. Like much of the tech industry, developments and breakthroughs happen daily, with the overall progressive speed of technology at a pace never seen before in human history. Technology specialists tend to focus on the future rarely taking time to consider the past; due to the nature of progression in the tech industry, the problems of posterity are not properly comprehended. Despite the fact we produce more data than ever, hardly any of it is being stored correctly with posterity in mind. The Virtual Reality industry is not exempt from this trend. The problem faced by a development community driven economy is that, with no centralised system of information sharing and storage, how are companies going to properly archive their work? Who is responsible for documenting the processes taken to achieve a certain goal? Just as archivists will need to outsource work to I.T technicians, I.T. companies will need to employ the specialist skills and knowledge of archivists to ensure their work and progress is not lost or forgotten. Technology specialists are going to need archivists as much as archivists need technology specialists. The issues of accountability in this 'sharing based' globalising economy are a whole other barrel of fish archivists will need to deal with. This thesis does not explore nor attempt to discuss the problems of responsibility and accountability. This discussion will only focus on the process of archiving Virtual Reality itself, and not the legislative issues associated with the new economic climate.

Physical Storage of Data

The storage used for long-term data archiving, in which the data will be very infrequently accessed, might be different from the storage used for backup and restore or disaster recovery, in which data needs to be frequently accessed or change[72]. Technology specialists are certainly able to handle their data which is in use, therefore this section will only concern itself with the data being stored for posterity.

There are a whole new plethora of issues surrounding archiving Virtual Reality and its associated technology used to experience it as opposed to other digital mediums. Jacqui North, the Program Deliverables Coordinator of Australia's National Film and Sound Archive (NFSA), points out in her article *The Realities of Virtual Reality* that the sheer magnitude of data produced by Virtual Reality is unprecedented compared with other medium. As she points out: "Just one five minute VR project can require up to one terabyte of data". To put that into perspective, the NFSA's digital collection currently grows at around 32 terabytes per month, and in total they hold around one petabyte of data (1000 terabytes). [73] Therefore, archiving Virtual Reality products requires industrial sized data storage facilities that are capable of handling such a large amount of data. This can be very costly, especially if an organisation is wanting to create their own physical site where data can be stored. Most developers opt to employ larger companies to store their data, such as Google, Dropbox or Amazon. These companies have the ability to store immense amounts of data, and for an adjustable fee, depending on your specific requirements, they will house an

[72] *Zetta*.net. (2013). Advances in Data Storage Technology: A Timeline | Zetta. [online] Available at: http://www.zetta.net/about/blog/history-data-storage-technology

[73] North, J. (2015). The realities of virtual reality | *National Film and Sound Archive of Australia*. [online] Nfsa.gov.au. Available at: https://www.nfsa.gov.au/latest/realities-virtual-reality

electronic archive at one of their sites through ‘cloud storage’, which is data transferred through the internet, to a physical site.

Due to the magnitude of data created by Virtual Reality, depositing data through the method of cloud storage is not entirely feasible - one Virtual Reality file can take up to one year to transfer at regular cloud speed. Cloud storage is feasibly used with documents and photos, and even audiovisual material, but only to an extent. Cloud storage can have problems with file corruption. Storage companies promise only the facilities to store data, and do not promise to ensure that the files are not corrupted or complete during the transfer process. Transferring through the cloud needs a strong and uninterrupted internet connection, and this too cannot always be promised. Weak connection leads to corrupted files. When discussing the problem of storage and hardware with Daniel Sproll, Chief Experience Officer, and co-founder of Realities. IO, he stated that Virtual Reality developers and designers are still utilising the massive data storage facilities of Google, Amazon and Dropbox; but are physically depositing their products to these places rather than transferring files through cloud storage. This entails bringing hard drives filled with data to the physical site of storage, and manually transferring data onto the available hard drives.

Proper archiving guidelines, especially concerned with digital files, usually require up to three copies of the same file, with two copies on site and one copy being stored off site. Due to the nature of VR, this protocol would quickly become very costly to follow, unless the price of data storage continues to drop. Looking at the trend of cost per gigabyte of flash drive storage, it is logical to extrapolate that data prices will fall as long as technology progresses. Mkomo.com has evaluated the cost of data storage over the last 30 years. In 1980, with only megabyte drives available, the cost of assembling a gigabyte of data cost over

$193,000 (USD). The evaluative data collected by Mkomo ends in 2009, with a gigabyte costing 7 cents USD[74]. New and improved flash drives are appearing regularly with more data fitting in less space for less money. But, as we are collectively realizing, resources are not infinite, and there is a theoretical plateau of development yet to be reached or even understood.

I would love to say that the issue facing Virtual Reality developers will be easily mended with improvements in data storage, but due to the developing nature of the field, I doubt this will happen. Virtual Reality will be at the threshold of whatever data capacities are available, for VR programmers create these games and immersive experiences according to what is possible. The higher the capacity for data production and storage, and the more extensive the Virtual Reality experience will be and become. Electronic 3D environments are limited (at this time) by processing power and hardware abilities. There is no foreseeable plateau of data production, if past trends are anything to go by. Therefore, Virtual Reality may be the most problematic field for digital archiving and data storage in the foreseeable future.

Methods of Storing Virtual Reality

Once you acquire the hardware needed, archiving Virtual Reality is not simply a matter of saving the file as a whole, such as a photograph or audio recording. Due to its relative newness, Virtual Reality is composed of many different file types and individually developed programs. To be stored for posterity, Virtual Reality must first be compartmentalised.

Concerning digital antiquity, the Archaeology Data Service (ADS) has published a guide to good practice, and have released some guidelines to archiving Virtual Reality projects. The

[74] Komorowski, M. (2017). *A history of storage cost*. [online] Mkomo.com. Available at: http://www.mkomo.com/cost-per-gigabyte

ADS states that the approach taken towards archiving VR will depend both on the technology that has been used and the nature of the project. There are currently some standardised formats of Virtual Reality such as VRML and X3D, but these are not set in stone and VR file formats will most likely be migrated and changed as computer hardware and software evolves. For projects centered around physical reconstructions of real sites using photogrammetry, such as the work of Realities.IO, archiving the original source files, such as the photographs used to create the VR is of vital importance. When discussing the archiving methods used by Realities.IO, Sproll told me of the importance of saving these original source files. But his rationale is not one of an archivist, he is saving such files not for historical posterity, but for the potential release of better and more efficient photogrammetry software, in which to input his raw data.

There are other, more complex, methods of creating Virtual Reality, which must also be considered by archivists. VR developers will need to consider carefully which aspects of a created world should be preserved in the long term and the best way to go about this. If the *look and feel* of a virtual world is important, does preservation mean attempting to keep the world running on its original hardware and software? Or is it sufficient to preserve the original source files with screen shots of the world and detailed documentation of how the world was created?[75] For many projects an acceptable alternative to archiving the VR world itself, which may be both difficult and uncertain for proprietary or non-standard formats, might be to break down the VR into its original source files. With this approach, the source files would be deposited in standard formats together with screen-shots of the world and a detailed description of how to put the elements back together to recreate the application. In

[75] Guides.archaeologydataservice.ac.uk. (2017). *Guides to Good Practice: Vr_6-3*. [online] Available at: http://guides.archaeologydataservice.ac.uk/g2gp/Vr_6-3

other cases, archiving the *look and feel* of the VR product (artifact), or world, may involve its emulation on future platforms. Archiving Virtual Reality in any format involves depositing the data files that make up the application with the project documentation and metadata records. Particular VR formats require the additional data and documentation listed below to allow for either emulated or re-creation of the application.

The complexity is that there is no standardisation of format of technique or creation of Virtual Reality, therefore there cannot be a standardised method or practice of archiving the VR product itself. This is why a multidisciplinary approach must be taken if we are to effectively handle these new and upcoming issues. Despite the relative complexity of other media formats, standardised practices enable archivists to effectively handle the archivization of most audiovisual content by themselves. But Virtual Reality is going to be a case of trial and error for some time, with effective practices only emerging though tested methods. Archivists now must communicate with content creators, from the moment of conceptual birth through to the final stages of production, to ensure that the creative processes, and well as the finished product are properly stored and accessible to future generations.

Continuum of the Archive

The idea that archivists must now be present through the life of a record, from its creation to its potential appraisal or destruction, is very much reflected in the current academic writings in the archival discipline. This can be seen with the preferential adoption of the records continuum model over the life-cycle model of record keeping. Postmodern thought manifested itself in the realm of archival science through the emergence of the records continuum model, first described in full detail by Australian Archivist Frank Upward in 1996.

This model has gained traction in the archival community, and can be seen as an appropriate reaction to the challenges faced by archivists in the 21st century. The Arts and Humanities Data Service of the UK states in its guide for archiving Virtual Reality that:

> Perhaps the best way of preserving virtual reality for the future is to consider archiving material from the start of a project and not just at its completion. Archiving virtual reality concerns not only the files that make up the world but also the original data files and supporting documentation such as the project report. The best strategy is for all of these digital data to be systematically collected, maintained and made accessible to users operating in very different computing environments[76]

Postmodern thinking, and its stance on the nature of communication, helps us see archiving in a new light, and to see its activity and functions, most of which went unnoticed, arise from the depths of the basement into the forefront. Tom Nesmith in his 2002 article *Postmodernism and the Changing Intellectual Place of Archives,* is excited by the adoption of postmodernist thought into archival science, and is a champion of its theoretical and practical applications. He states. "The postmodern outlook suggests an important new intellectual place for archives in the formation of knowledge, culture, and societies". Postmodern thinking invigorates archiving and helps us see past the idea that archivists simply receive, categorise, and house vast quantities of records that merely account for the actions in and of society. Archivists can now be seen as co-creators of records, as professionals who help shape the knowledge contained in records, and are thus co-creators of social memory. Archivists are far removed from the 'passive' Jenkinsonian picture of the past, with Nesmith

[76] Vads.ac.uk. (2002). *Creating and Using Virtual Reality: A Guide for the Arts and Humanities*. [online] Available at: https://vads.ac.uk/guides/vr_guide/sect61.html

claiming that "studying the archival process itself (and not just using archives in the familiar way to study things) is a vital aspect to the pursuit of *human* [italics mine] understanding'[77].

The study of archives is no longer solely taken up by working archivists wishing to apply theory to their practice, or to make themselves more effective in the workplace. Postmodernism puts archival institutions into the forefront of collective memory, with their institutionalised practices, not only shaping society, but in turn being shaped *by* it. Just like archivists describe the contents of an archive, we will now describe the *context* of ourselves and the institutions we represent.

Limitations of Virtual Reality and its Epistemological Problems

There likely will be many ethical and epistemological issues to emerge if Virtual Reality were to become as popular as the internet itself. Those who have strong views on what is 'natural' for humans to do, and what is not, will be tested by the realities of completely immersive virtual worlds. However, the future is here, and it is seemingly unstoppable. People are being born into a digitalised version of a postmodern world, and will only know of speed, progression, and advancement. They will not be scared if change is all they know. Virtual Reality does not promise and has never promised to *replace* what we consider the 'real'. VR does not encourage you to replace experiences such as travel, social gatherings, and visits to nature with virtual simulation. VR only gives you one option. Virtual Reality can be a tool to enhance reality, to help understand reality, and may very well stand as an acceptable version of reality one day, just as we have accepted 'on-line' actions to be just as valid as physical ones. Virtual Reality can be considered an additional experience.

[77] Nesmith, T. (2002). Seeing Archives: Postmodernism and the Changing Intellectual Place of Archives. *The American Archivis*t, 65(1), pp.24-41.

I will relay an anecdote told to me by co-creator of Realities.IO about some young children and their experience with Augmented Reality goggles. Augmented reality goggles are very advance technology, which give you the ability to observe real life scenes with virtual augmentation. You have the ability to decorate your own home with 3D shapes and figures, which can be precisely placed by you. When these children were given the goggles to play with in their own home, they had a joyous time decorating the house with pirates, unicorns, the 'poo' emoji, etc. After the goggles were taken away, the next day the children asked to have them back. They were asked why and replied with, "we forgot to clean up after ourselves". To these children, both these realities, the physical, and the new virtual, held a sense of weight and responsibility. They understood very well that the virtual world was only apparent through the goggles, but still felt it was valid enough to warrant 'putting away your toys'.

Humankind has never been particularly united when faced with adopting new methods of communication. Anything new is always met with critique. Even the adoption of written text to represent language, and communication, was an uphill battle. In M.T Clanchy's 2013 book *From Memory to Written Record,* he argues that literacy did not arrive as a norm in human culture out of some arbitrary desire to document thought, but simply became standardised by a need to *be* literate, due to the adoption of bureaucratic methods of controlling society.[78] The new type of literacy is being thrust upon us is dIgital literacy, which possesses a very real language of its own. And even the basic building blocks of

[78] Clanchy, M. (2013). *From Memory to Written Record*. Chichester, West Sussex, UK: John Wiley & Sons.

computer coding are now being taught at school a very young age, to ensure that future generations are literate in the new language.

There are many positives concerning the use of Virtual Reality technology in conjunction with cultural heritage, t such as the ability to 3D scan and observe objects/artifacts/spaces in great detail without having either it or the user to be present. A wider proliferation of detailed information means that experts from around the globe may study such objects/artifacts/spaces. This leads to a greater engendering process of our accepted 'truths'. Another positive aspect of Virtual Reality is that it is now possible to explore new types of data perception, with the added 3D spatial element. This gives us the ability to see things in less linear terms. Representing data spatially will allow to see that information more as a web or as connections to be shown through metadata tags, that can be spatially re-formed according to different criteria. This latter aspect in particular could be an interesting aspect to those who design online databases, or cultural heritage specialists who handle a multitude of artifacts.

Virtual Reality has not yet evolved enough to incorporate complete kinetic emulation to accompany the headsets (the HDMs). You can touch, but you cannot physically *feel* the weight, texture, heat (etc) of the virtual yet. There are kinetic accompaniments to virtual reality is design and make, but none that would constitute a complete kinetic illusion. The audio and visual output of the headsets, as well as the accuracy of the controls, does trick the conscious mind enough for your body to react, as if it were present in the Virtual Reality world. Those people who are concerned with the loss of physical meaning behind that which is present in VR, just have to think on how the photograph contributed to an even greater

appreciation for art, for communication, for history. Perhaps Virtual Reality will come to further confirm the significance of the 'real', and we will come to hold reality and realness in higher esteem than ever before.

Yes, a dystopian world where Virtual Reality has taken over, the planet is neglected, and humankind are living in their minds is not a pleasant scenario. This future is also highly unlikely. A digitally oriented cyber-future is nowhere in our path when members of society still require their basic needs to be met. There are still many millions of people on this planet still living without running water or electricity, with little or no mind to think about the 'advancements' in virtual reproduction. Things such as Virtual Reality technology headsets are only purchased by people with income that can incorporate luxury items so their true 'spread' is controlled by their consumer cost, as well as interest. This is why I have argued that places of culture and learning can benefit from use and incorporation of Virtual Reality technology. Libraries, museums, and archives have always given the public access to technology and information that they cannot get elsewhere. And displayed knowledge and information in a way that is stimulating, interactive, and user friendly. There are no presupposed ideas about what Virtual Reality can and cannot be used for, and cultural heritage sites may be the place to reasonable explore its educative potential. Postmodern users can prefer image based content over text, as well as being partial to new and exciting technologies. Places of learning that are 'fun' and 'exciting' will be frequented more often, leading those with classical standard to obscurity. By utilising Virtual Reality and its emerging possibilities, the cultural heritage will be firmly placing itself in the postmodern spaces of technology and change. And by giving users access to such technology, will encourage the thought that cultural heritage sites are as relevant as they ever were.

Conclusion

This thesis has explored a number of matters concerning the what a 2017 version of Virtual Reality *is,* and what it can be potentially used for, in relation to cultural heritage and also how VR can itself can be archived. Through the use of postmodern theory, this thesis has argued that that the relative success of cultural heritage in our ever growing digital environment is dependant on the ability to incorporate new ideas into the presupposed axioms of our trade. Utilising the plethora of technology as well as the specialised knowledge of Information technology specialists, will lead to the use of multidisciplinary methods of information gathering, sharing, presenting and storing. This leads to an overall richer and enhanced version of contextual 'truth' and knowledge.

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