Virtual Landscapes

A PRACTICE-BASED EXPLORATION OF NATURAL ENVIRONMENT DESIGN IN COMPUTER & VIDEO GAMES

VOL.I of II

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A thesis submitted in partial fulfilment of the requirements for the degree of.

Doctor of Philosophy

Declaration

I, Umran Ali, declare that the work in this thesis was carried out in accordance to the regulations of University of Salford, and is an original piece of research, except where indicated by reference in the text.

Signed……...

Date……...

Umran Ali

"I'm designing the outlands of my latest experience. It's a game to end all games: as the user, I want to feel Iike I'm there, on the game grid... to brace against the digital breeze whipping past my face, unforgiving and undefined. It feels like I'm on a precipice and I can see the promise land just across the way, there –a land when the biological and virtual worlds meet. Now all I need is a compass to navigate ever forward."

Kevin Flynn - Advanced Computer Programming, TRON: Legacy

Table of Contents – Volume I

Table of Contents – Volume II

List of Figures

List of Tables

Abstract

I offer this thesis as an original and substantial contribution to knowledge in virtual natural environment design practice within computer and video games, by identifying areas of strong/weak practice and to develop a new design framework that utilises a cross-disciplinary approach for practitioners/students/researchers. The thesis combines theoretical frameworks as well practical guidance within a new design framework for virtual natural environment design.

The themes relating to this work were examined through a contextual review that focused on previous professional practice as well as critical games produced during the last 30 years. The contextual review involved a detailed textual and visual-based historical survey of virtual landscapes, resulting in a practice-based exploration of virtual natural environment design in computer and video games. One of the main artefacts produced in this research, a three-volume book series titled *Virtual Landscapes*, presents for the first time these virtual spaces in a digitally enhanced manner through high-resolution panoramic imagery.

A review of existing literature and current practice revealed that virtual natural environment design has so far been driven by mainly aesthetic principles and hinted that future emergent design practice should involve a cross/multi-disciplinary approach. The research proposes a new design framework for the creation of virtual landscapes that uses Landscape Character Assessments amongst other elements of environmental design. *ShadowMoss Island* is a practice-based exploration of how virtual natural environmental design can incorporate elements from Environmental Psychology and Geology, as well as personal reflections and observational analysis based on a field trip. The research proposes that psychological elements added to this new design framework can radically improve the success and impact of the final virtual natural environment.

Another practice-based artefact, *MindFlow,* was created as a pre-production tool for the purpose of environmental design. The proposed tool enables the direct visualisation of collated multimedia (audio, images, video, annotations, design and decisions) in much more natural setting of a single visual space, allowing designers/artists to draw and influence the design and creation of virtual natural environments by bringing together all the different aspects in an intuitive and user-friendly manner. *MindFlow* helps solve the problem of designers/artists having to retain mental maps of image repositories structure by creating a single visual non-folder tree hierarchy virtual space.

The research has significance to both professional and pedagogic practitioners working in the area of computer and video game natural environment design.

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I would like to convey my sincere gratitude to my three supervisors whom I have been privileged to work with during the many years this study has taken to complete, and without which the work would have never have started or finished.

To my first supervisor, Professor Mathias Fuchs; my sincere gratitude for inspiring and motivating me during the early years of the research, and allowing me to work with you on several projects which were completely transformative as a practitioner, and served as the foundation for this study. I am still in awe of your creative insight, intellect and your passion, as well as how you engage with your students and those around you, with respect and sincerity.

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I would like to thank my dear wife Faiza for taking care of many things when I was busy with the research. To my dear children, Mariyam and Zayn, I offer you my eternal appreciation for being so patient with me, and I say this; I am sorry that daddy was always working, when you wanted to play or simply wanted a little bit of my time and I was unable to offer it, you were too young to understand why your father was always busy, but I hope one day you realise that it was to provide you with a better life and to honour what I've always taught you, to follow your dreams with passion and commitment.

Finally to my parents, I offer my sincere gratitude to my dear mother who allowed her sons to play and immerse themselves in computer & video games, never once dismissing them as a waste of time or energy, and to my father; I'm sorry you never lived long enough to see me complete this work, I hope you would have been proud.

Chapter 1: Introduction

The thesis is a practice-based investigation that proposes an interdisciplinary approach towards natural environment design in computer and video games. The purpose of this chapter is to provide an introduction to the thesis, the motivations in undertaking the investigation, as well as the research aims and objectives. A summary of both the theoretical framework underpinning the research and the scope of the research are provided. Finally the chapter concludes with an outline of the thesis as well as guidance in how to navigate the additional practice material.

In terms of language, the thesis makes extensive use of the first person since the investigation uses practice as a research method and within that framework it is important to reflect on the practice in order to guide the research through various challenges with a view to make an original contribution to knowledge.

In this thesis I will argue the current virtual natural environment design practice within computer and video games is not sufficiently developed to meet current or future demands. This will be demonstrated by identifying areas of strong/weak practice with an aim to develop a new design framework that utilises a cross-disciplinary approach for practitioners, students and researchers. The research will aim to propose theoretical frameworks as well practical guidance within a new design framework for virtual natural environment design.

1.1 Virtual Natural Environment

The term Virtual Natural Environment (VNE) is used extensively throughout the research. This research is located in the area of computer and video games, and subsequently, does not consider the use of virtual environment in the context of other areas such as animation, film or TV.

A Virtual environment is defined in this investigation as a computer generated representation/simulation of a space. This space can be a fictional or non-fictional space, where a user is able to navigate the space in a fixed (e.g. only along the X/Y axes) or free manner (e.g. along the X/Y/Z axes) and is able to interact with either the environment

directly or with another elements present in the virtual simulation. Virtual environments, in the context of computer and video games, may also allow the user, or the player, restricted, partial or free movement in this space.

These virtual environments can also range in type i.e. they maybe two dimensional (2D), three dimensional (3D) a combination of both (i.e. 2.5D) or include Augmented and Virtual Reality (AR and VR respectively).

Virtual environments can vary in complexity; they can range from simplistic simulations of space (i.e. using basic 2D shapes and colours to simulate a space) to complex realistic simulations of space (i.e. using complex 3D geometrical forms, colours, textures and physics to simulate an environment).

Given the above definitions, a virtual *natural* environment, is a virtual environment that attempts to simulate a natural environment or includes a strong use of natural elements. Natural elements for the purpose of this investigation are defined here to include anything and everything that is not the built environment or manmade. Natural elements include landscapes, geology (i.e. terrain), flora and fauna and/or environmental phenomena such as climate, weather and seasons.

These natural environment simulations may also be abstract or realistic and can be purely fictional or based on a real physical natural environment. Definitions of these and other terms are provided in the glossary.

1.2 **Motivation**

The motivation for undertaking this research has come from a combination of personal professional practice, reflection and observation. The three significant strands that motivated me to undertake this investigation were:

1. **Professional practice:** my practise as a designer and artist over the last decade has involved undertaking a range of technical and creative problems at the forefront of artistic and commercial practice. Many of these challenges are only ever partially solved or left fully unexplored due to project limitations such as resource constraints. For a practitioner, these 'unsolved' challenges can be frustrating, and after a number

of projects a number of residual tasks, both creative and technical remained, the majority of which concerned how to create more immersive and meaningful virtual environments. This investigation provided the opportunity to explore these issues whilst developing creative and technical skills that were not limited by a budget or constrained by a client brief.

2. **Personal Interest:** The natural world, in particularly scenic landscapes, has captivated and held my attention for many years and as a result I have been an active and keen walker, as well as developing an interest in nature landscape photography. I am also a keen and passionate video game player, and advocate for the transformative power that video games offer. After having played video games for over 30 years, I noticed a growing trend in how natural environments in games were growing in numbers and popularity but also how often they failed to capture the range, beauty, impact and reality of the natural world. This observation prompted a strong urge to conduct an initial review of natural environment design in computer and video games in order to see if my 'hunch' - that game developers were struggling to develop this embryonic design discipline - was correct; this was later on proven to be the case. The drive to research this area was motivated purely by observations, reflections and conversations with game developers.

3. **Reflection on Teaching Practice:** I am an active Higher Education academic who has developed, written and taught on a range of programmes in the areas of creative and digital media, with a specific interest in computer and video games theory and practice. For over a decade I have taught on a games degree, and taught games design and production. Teaching and reflection on my practice revealed that the theory and practice for virtual environment design was minimal and underdeveloped; hence purely on this aspect alone there was a strong rationale for undertaking the investigation.

1.3 **Research Questions**

1. How have VNEs evolved in CVG over the last 30 years in both technological and design innovation and what has been (if any) the dominant design paradigm?
2. How have VNEs been perceived and experienced in games in CVG over the last 30 years
3. Can the intangible essence of natural landscapes be distilled into a structural production-based framework for virtual landscape design?
4. How can one employ a practical approach to natural environment design which goes beyond the dominant paradigm exemplified by narrative/visual driven design?
5. How can one create a framework for VNE designers that incorporates (external design and otherwise) traditions but remains connected to the reality of games production?
6. How can one go beyond the current paradigms in organising and managing multivariate contextual reference data in the pre-production phase of creating of a virtual environment?

1.4 **Research Objectives**

1. To conduct a literature and contextual review in order to explore the evolution of VNEs in CVG over the last 30 years focussing on technological and design innovation and to identify what is the current dominant design paradigm.
2. To examine how have VNEs been perceived and experienced in games over the last 30 years through reviewing the literature and a wide range of games.
3. To examine and define 'landscape' into a structural production aligned framework for virtual landscape design. This step involved a literature/contextual review, creation of artefacts and the development of a proposed design framework.
4. To propose a practical approach to natural environment design which goes beyond the narrative/visual driven design and. incorporates a multi-disciplinary approach connected to the reality of games production

5. To test the proposed VNE design framework through a practice-based process. This involves the creation of a NVE for a game.

6. To propose, develop and evaluate a new method for organising and managing multivariate contextual reference data for the pre-production phase of creating of a virtual natural environment.

7. To disseminate the research findings and practice outcomes of this study to a wider audience (researchers, games, developers, students, etc.) in order to gain feedback and generate discussion.

1.5 **Scope of the Research**

This thesis is not an in-depth analysis of where computer are video games are situated within society or related media; instead it proposes a practical model of how informed environment design can be achieved and incorporated in the creation of VNEs for games. It highlights the need for further exploration of games design, specifically environment design and encourages practitioner-academics, game developers and students to experiment with alternative theories and methods including using an interdisciplinary approach.

The thesis does not focus on areas such as narrative design or gameplay which already constitute a significant proportion of established research in video games. This research is located in the area of virtual environment design (both theory and practice) and is grounded in using practice as a method and as a focus for positioning the outputs of the research. Therefore, the design framework proposed by this research (composed of processes, tools and guidance) is intended to assist academics, students and practitioners in viewing games from an alternative perspective, and developing them from an informed position through the use of landscape architecture and aligned subject area.

The thesis does not look into virtual environment design as a general concept and specifically chooses not to explore virtual environment design in connection to the *built* environment as this would have expanded the scope of the work significantly. Even though the work has relevance to virtual built environment design it is not focused upon it.

The thesis does not focus on the aesthetics/visual elements of natural environment design, although there are several instances in which this is relevant to discuss and explore, it does so on a superficial level. The focus remains on developing a wider and more comprehensive design approach, process and practical implementation of VNE design. It is also not an analysis of games design or environment design in general as it looks specifically at VNE design within the context of computer and video games.

1.6 **Thesis Outline**

1.6.1 Theoretical Framework and Literature Reviews

The thesis does not entirely follow a traditional approach of presenting the literature review in a single chapter. Although it includes a literature review chapter at the beginning (Chapter 2) it also offers the relevant literature for each study in the corresponding chapters in order to maintain coherence and flow and not to overwhelm the reader by forcing constant referral back and forth between chapters in order to understand the different concepts presented in each study.

Chapter 2: Literature Review

This chapter is presents a 'traditional' literature review. This chapter is not meant to provide a review of the entire spectrum of computer and video games research but is specifically located around games design. This is explored from a historical perspective, tracing the evolution and emergence of games design as a discipline. Games design is explored as a field of inquiry and as a practice, and related concepts such as *gamespace*, *gameplay* and *level design* are explored to illustrate the changing nature of the embryonic discipline. Contemporary (2010 onwards) games design, specifically (focused on environment design) is then explored in relation to emerging trends, specifically architecture-informed games design. This leads to the identification of the gap in the theoretical and practical knowledgebase in VNE design and the justification for the investigation.

In addition to the main literature chapter, the three studies also contain an appropriate localised literature review:

- Chapter 5: The relationship and perception between environment and landscape
- Chapter 6: The importance and meaning of landscape
- Chapter 7: Interface & design metaphors

Chapter 3: Research Methodology

This chapter presents the research methodology strategy and techniques. The purpose of the chapter is to describe and justify the overall research strategy and the range of methods used, specifically focusing on using practice as research.

1.6.2 Studies

These chapters present preliminary studies (carried out before the research begun) as well as series of full studies conducted as part of the investigation.

Chapter 4: **Reflection on Foundation practice**

This chapter presents a critical analysis through reflective practice of my foundation practice, and arose as a direct result of recommendations in undertaking practice-based doctoral study as revealed and discussed in Chapter 3 (methodology). The chapter specifically looks at issues cantered on VNE design theory and practice, and by applying an action research orientated approach, identifies problems and further questions in order to drive and inform the nature of the practice studies (Chapters 5, 6 and 7).

Chapters 5, 6 and 7 are presented as three studies exploring specific areas of VNE design. A standardised methodological approach was used in order to create a unified and coherent structure that allowed me to systematically work through research problems, whilst offering potential readers a structure that would be clear and comprehendible. The structure is as follows:

1. Identify issues, problems and concerns derived from the previous work (either a study and/or the literature review)
2. Undertake a problem-specific literature and contextual review Use practice as a primary method to explore the problem
3. Analyse, discuss and reflect on findings
4. Draw conclusions, offer recommendations and identify further questions/issues/ problems to be explored in the subsequent chapters.

Chapter 5: Virtual Landscapes

This chapter presents a study that was designed to explore and illustrate the history and current state of VNE design theory and practice. VNEs across a range of computer and video game platforms and genres were visually analysed and the evolution and development was illustrated using panoramic photography and virtual field trips as a research method. The output of this study was then analysed and reflected upon and a series of observations were made about the process of VNE design. This was then used in conjunction with the specific literature review to create an initial VNE design framework. Finally a range of outputs was created in order to disseminate the work and gain insight into how VNEs were perceived and experienced by a broad range of individuals (i.e. gamers, members of the public and professionals from other subject areas).

Chapter 6: ShadowMoss Island

The rationale for this study arose from the interim findings and outputs from study 1 (Chapter 5: Virtual Landscapes). This chapter presents an exploration of the meaning of landscape in a wider context, and then using an interdisciplinary approach attempts to further develop the theoretical framework for VNE design created in study 1 by testing the framework through practice, after which an evaluation was made to guide any refinements. This new framework was developed further by infusing John Ruskin's '*Go to Nature*' dictum and by Edward Relph's notion of '*placeness*' into the work. Finally an experimental game was created in a contemporary games engine. *ShadowMoss Island* is a practice-based exploration of how the VNE design can incorporate elements from environmental psychology, such as '*placeness*', landscape architecture/ planning (i.e. landscape character assessments) and *biophilic* design. This was evaluated in order to assess whether the produced VNE was enriched by the observational analysis and qualitative reflection based on a field trip to Moel Siabod in Wales.

Chapter 7: MindFlow

This chapter arose through the exploration of study 2 **(**Chapter 6). *MindFlow* underpins *ShadowMoss Island*, and is another practice-based experiment, and was created as a pre-production/design tool and workflow for organising and presenting reference material for virtual environmental design. The proposed tool intents to enable the direct interactive visualisation of collated multimedia (audio, images, video, annotations, design and decisions) in a much more natural setting of a single visual space, allowing designers/artists a single visual point from which they can draw and influence the design and creation of VNEs in order to enable a greater synergy of different aspects to come together through user defined relationships. *MindFlow* aims to solve the problem of designers/artists having to retain mental maps of image repositories structure by creating a single visual non-folder tree hierarchy-driven virtual digital space from which they can organise, synthesise and be inspired by their contextual research. A prototype was created in Microsoft Silverlight and mock-ups created in Abode Photoshop serve to illustrate the intended design. *Mindflow* is composed of two components: a tool for organising visual and non-visual reference material, and a supporting framework for pre-production in the form of written guidance.

1.6.3 Scenism & Conclusion

Chapter 8: Scenism

This chapter unifies the work into a single idea or entity. A range of tools, processes, artefacts and extensive recommendations were made in the course of the research and this chapter presents a final 'artefact' which was created as a result of the exploration around landscape design, both physical and virtual. This chapter discusses how the disparate elements can be brought together to form a unified and coherent construct, one that communicates the research in a more manageable and intuitive manner. The chapter concludes with presenting '*Scenism*' as the embodiment of the proposed VNE design framework.

Chapter 9: Discussion & Conclusions

This chapter reflects on the entire investigation and summarises the main findings of VNE design. A critical analysis and reflection on the research methods and an outline of the limitations of the research is offered. Further questions for future work are also presented in this chapter. The final contributions of the research are then discussed.

1.7 How to navigate through the thesis

The accompanying exegesis to the practice-based research follows a structure that may require guidance for the reader. The written materials and practice are interconnected on several levels, and are not to be considered as separate elements; they are bound in meaning, in flow and in purpose, and as such they will need to be engaged as a coherent body of work. The original contribution of the thesis will be contained in the nexus between the written text and artefacts. The following are recommendations on how the work should be considered and 'read', and suggests a basic roadmap of how the work should be digested:

1. Read Chapter 1: This provides the context for the investigation
2. Read Chapter 2: This is the 'main' literature review from which the theory for NVE design was derived.
3. Read Chapter 3: This provides an overview and detail on the chosen methodology, its justification and proposed use in the creation of artefacts
4. Read Chapter 4: This introduces the *Virtual Landscapes* study and sets the context for the artefacts (books)
5. Have a look at the *Virtual Landscapes* Vol 1-3 books (ebooks)
6. Look at the *Virtual Landscapes* external media drive folders of panoramic images.
7. Use the PivotViewer *Virtual Landscapes* tool.
8. Read Chapter 5: This examines the *ShadowMoss Island* Game
9. Play the CryEngine 3: *ShadowMoss Island* game, and or watch the *ShadowMoss Island* trailer.
10. Read Chapter 6: This examines the pre-production (concepting) stage for VNE design
11. Use the *MindFlow* prototype and/or watch the *MindFlow* Deepzoom video
12. Read Chapter 8: This introduces the culmination of the research
13. Read Chapter 9: This introduces the final discussion, limitations of the research, conclusions, contribution to knowledge, and a list of recommendations of future work.

1.8 **Digital Artefact Guide**

The accompanying exegesis has a range of digital work, including outputs and working files associated with it. The following lists a description of the digital media folders supplied on the external media drive.

Chapter 4-Foundation practice: A range of foundation practice work.
Chapter 5-Virtual Landscapes: Digital ebooks & Interactive PivotViewer Application & Video
Chapter 6-Shadowmoss Island: ShadowMoss Island Game & Video Trailers
Chapter 7-Mind Flow: Mindflow Prototype
Digital Thesis: Full Digital copies of the thesis including appendices

Chapter 2: Literature Review

2.1 Introduction

The research is concerned with both the evolution of games design, the emergence of gameworld and gamespace and the resulting shift in the roles of games/level designer as other design traditions such as architecture were introduced into the field.

In order to provide a context for the research I intend to look at the following areas. **Figure 1** illustrates how these areas relate to each other.

- Games Design- with a focus on Level Design
- Gamespace with a focus on gameworlds
- Architecture with a focus on Landscape Design

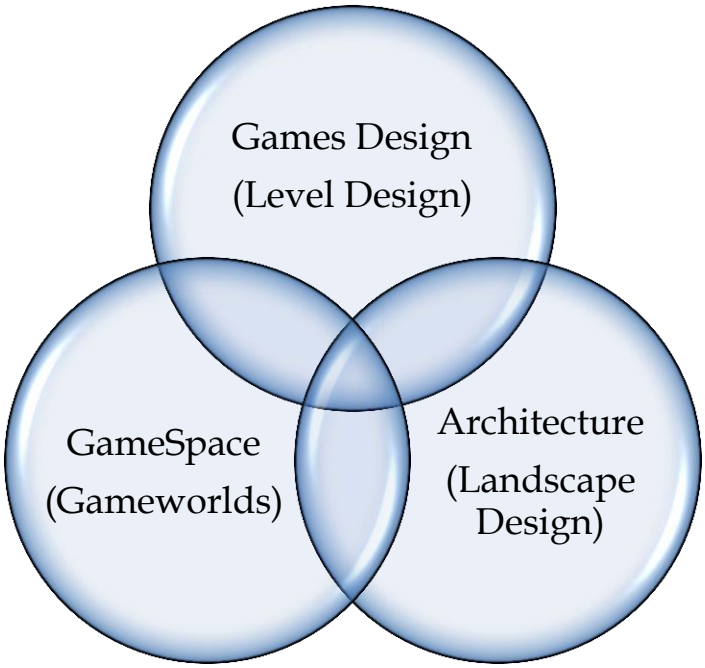

Figure 1: Literature Review Domains

2.2 Structuring the review

The structure of this chapter is as follows:

Section	Area of Review	Description
2.3	**Emergence of Video Games**	Review of the history of the medium
2.4	**Technology & Design**	Review and definitions of the rate of technological advancement, relationship between games technology and design
2.5	**Games Design**	Review and definitions of the emergence of games design as a critical aspect of the user experience (gameplay) and games development and the shift from scientific (computational) to visual-driven (aesthetics) design. A history of games design and the role of the game designer is also provided.
2.6	**Gameworlds**	Review and definitions of the concept of gamespace, gameworlds and implications for game design including an overview of openworld is provided.
2.7	**Gamespace**	Review and definitions of the concept of gamespace, gameworlds and implications for game design including an overview of openworld is provided.
2.8	**Level design**	Review of level design is offered, including the emergence of the level design role, a discussion on defining what level design is and an indication of the evolution of the role.
2.9	**Importance of Architecture**	Discusses the importance of architecture in video games and Virtual Worlds and the current and future use of architecture in video games
2.10	**Architecture and Games Design Theory**	**D**iscusses the use of architecture in the context of games design
2.11	**Contemporary Games Design & Architecture**	Reviews contemporary approaches to games design that are derived from an architectural perspective
2.12	**Architecture and Games Design Practice: The Witness**	Reviews the design process for a contemporary game using an architecture informed approach , The Witness
2.13	**The Future**	Early indicators of future trend in games design
2.14	**Identifying the Gap**	A summary of the gaps in the knowledgespace

2.3 Emergence of Computer & Video Games

2.3.1 Introduction

Computer & video games today have become, one of the most revolutionary forms of contemporary entertainment, whether it is mass-market explosion of bland sequels or the hyperreal crash physics of racing games such as the hyperreal media culture surrounding virtual figures such as Tomb Raider's Lara Croft, the nature of video games has placed them in a unique position.

Computer & video games are an enigma; embodying both the characteristics of post-modern media culture video games are often sold on the premise of ground breaking visuals (i.e. emphasis on style at the expense of substance and content), based on premises that exist outside history and time (i.e. confusions over time and space) but also demonstrate unique characteristics such allowing consumers to have unique experiences within a set product.

2.3.2 Background

As of 2015, Britain is a world leader in computer and video games production; the global games market is estimated to be worth over £80 billion by 2018, with the UK games market contributing £2.48 billion in 2015, and was ranked as the sixth largest in the world (Newzoo, 2015). The UK game market also consisted of just under 2000 video game companies employing ~10, 000 game developers (Mateos & Bakhshi, 2014), making it by far the largest software employment field in Europe. The UK computer and video games industry already exceeded cinema box office takings as well as spending on the rental of DVDs and video in 2009 (Chatfield, 2009).

Contemporary (2015) computer & video games are more complex than ever. The average game now utilizes several thousand assets drawn from a wide variety of art forms, original orchestral musical scores, rich environmental and character art drawn from traditional drawings, paintings and sculptures, and recently even dance (in the form of mime) have been incorporated into video games via motion capture for realistic human animation. One of the video game genres, the RPG (Role Playing Game) now increasingly uses detailed narrative scripts developed by specialized writers. Added to all this is the

unique interactive elements that ties together these forms into a potentially new one. However despite the rapid growth of digital games, they are still not truly understood nor recognised by society. As Salen & Zimmerman (2004, p.20) argued that *"The culture at large does not yet see games as a noble, or even particularly useful, endeavour. Games are one of the most ancient forms of designed human interactivity, yet from a design perspective, we still don't really know what games are".*

2.3.3 Section Summary: Emergence of Games

- The medium of games is only ~ thirty years old and has only just emerged in comparison to more established media forms (i.e. film) so it can be argued that it is still in the black and white era.
- The language, grammar, tools and process in games development are still emerging as it is in the embryonic era as a medium (Salen & Zimmerman, 2004; Schell 2009).
- Video games are primarily a practice-driven, entertainment-focused field, that only in the last decade has contributed to shared knowledge emerging through either academic studies or shared professional practice (Salen & Zimmerman, 2004).
- There is a significant number and range of games if viewed as artefacts, however there is limited understanding of both the impact of these artefacts (Salen & Zimmerman, 2004).

2.4 Technology & Design

Video game technology has largely developed incremental advancements based on 'generations' of consoles from the early Magnavox Odessy in 1976 marking Generation 1 to the first home consoles systems in the third generation (e.g. Nintendo's NES, Sega Master System), and the fifth generation which marked a significant expansion of games technologies, game genres and mass market appeal (e.g. Sony's first PlayStation console emerged during this era) to the modern day eighth generation in 2015 (e.g. Microsoft's Xbox One, Sony PS4).

Sony's PlayStation as a technology exemplifies the advancements in capability of game technology over the console generations. Figure 3 illustrates an analysis of its hardware from the first (PS1) and the last (PS4) consoles reveals a significant advancement in its core

hardware technology. **Figure 2** demonstrates the rapid advancement of Sony's PlayStation hardware architecture.

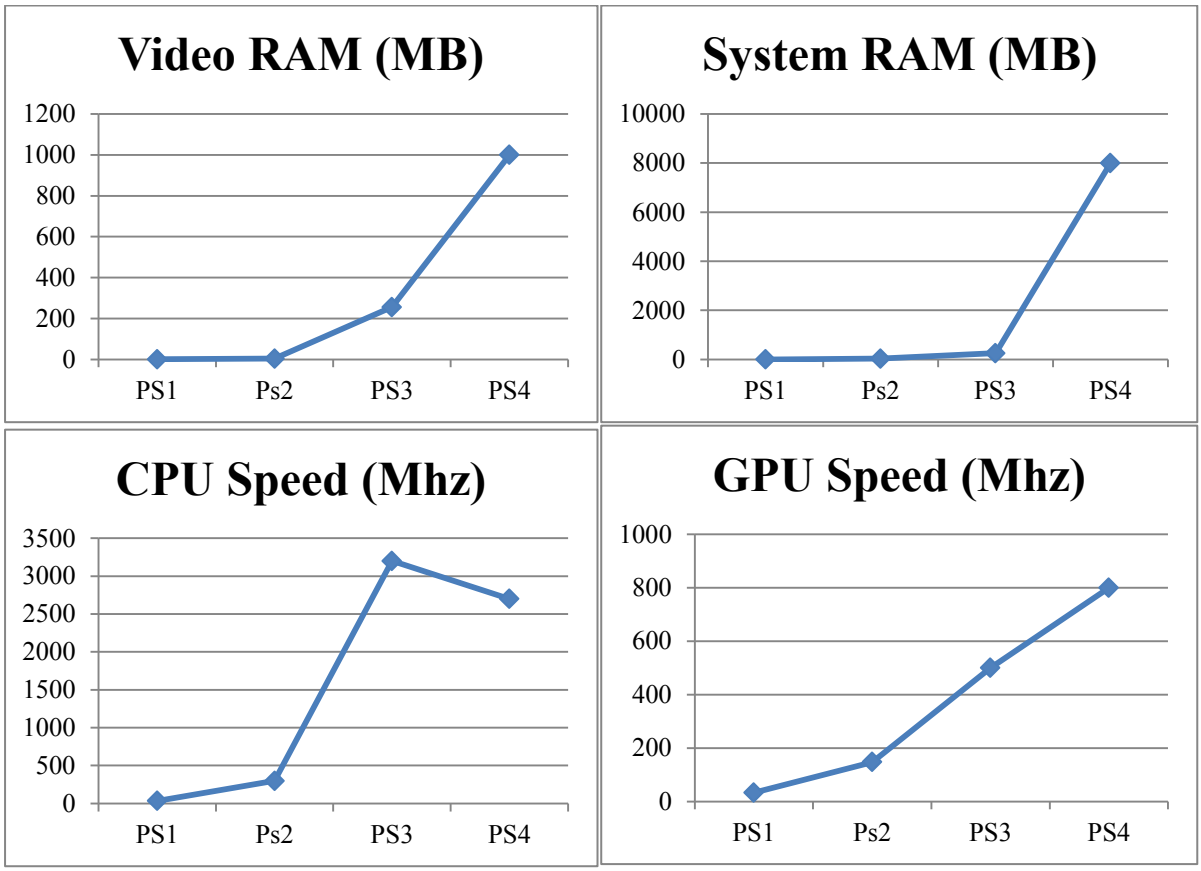

Figure 2: Sony PS1 to PS4, CPU/GPU/System & Video RAM Comparison.

Computer software has also seen an almost equivalent increase in complexity, capability and sophistication despite its relatively short lifespan. **Figure 3** illustrates the visual changes in games software from a graphical perspective in only two decades. The evolution of the main player character from the game *Wolfenstein* is shown in 1992 and in 2014. From 32x32bit pixel resolution with 256 colours to full 3D models with a variety of individual 2,000 pixel texture maps just for the character's head, coupled with shadow maps, realistic hair and lighting to name a few of the graphic technologies. The evolution of games software in only two decades is clearly apparent (Orland, 2013).

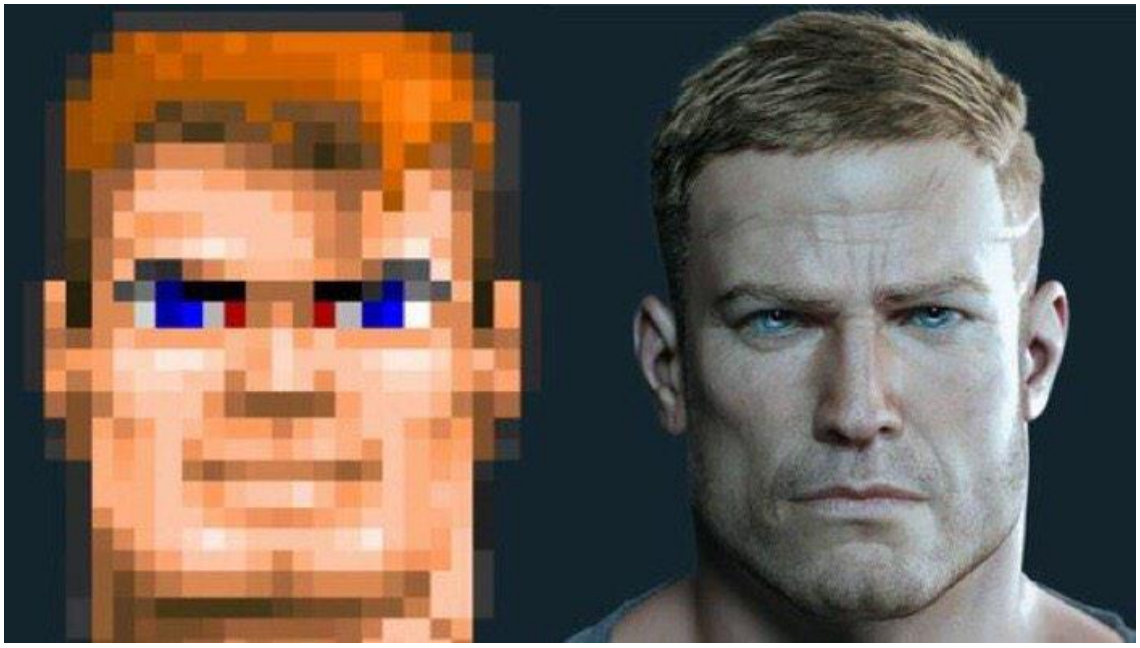

Figure 3: Wolfenstein player character comparison: 1992 Vs 2014 (Source: Gamesradar, 2016)

If we consider video games purely as a construct then digital computer and video games can be considered to be a product of two components: technology and design.

- **Technology** (consisting Hardware/Software technologies)
- **Design:** Games Design

Games technology can be broken down into two key areas:

Hardware: Digital hardware technologies have grown exponentially over the last few decades, from the early home computers to the emergence of arcade systems that made the shift from entertainment venues to home use - the revolution of the home game entertainment systems.

Software: Software technologies have also rapidly evolved over the last several decades, in line with hardware advancements. Originally game specific 'engines' were developed for each game title, making the transition to becoming middleware solutions. Hideo Kojima, former designer at Konami Interactive, (creator of the *Metal Gear Solid* series of games, which has spanned over three decades) is one of the world's most celebrated and acclaimed game designers, in his keynote speech at the Game Developers Conference in 2009, he discussed the design philosophy driving the design of the *Metal Gear Solid (MGS* part of the MGS series of games that is synonymous with his name, and the stealth genre within video games. Kojima elaborates on his perspective of the relationship between games

technology (hardware and software) and games design. Kojima (2009) discusses the advancement of the early MGS games were in line with the technological advancements, as the technology grew (this was mainly in the forms of hardware developments such as the MSX to the MSX2 or Sony's PlayStation 1, 2 and 3 platforms) the design grew, with the design hurdle being represented by what Kojima refers to '*barrier/wall of impossibility*'. However there came a point where the technological advancement ceased (i.e. no new platform change) but he was tasked with a 'mission impossible' utilising the same hardware to create a new experience/game. Kojima's innovative solution was to design around the problem using games design to overcome the 'wall of impossibility'.

This approach continued until the development of MGS3 on the PS2, where due to the long life cycle of the platform, Kojima was forced to innovate again, this time choosing to focus on both the software and the design of the new game in order to create a new deeper and more immersive experience. Kojima's response was to create his own 3D games engine (software) in order to make the shift from a closed to an openworld environment (a theme followed again in his recent MGS game in 2015 (which will be discussed later in the chapter), this ultimately helped Kojima evolve his design significantly.

Figure 4 illustrates Kojima's design philosophy and uses the metaphor of climbing a wall to illustrate his argument; the 'foundation' is the game's hardware, with the software technologies (i.e. games engines) as the second layer (represented as the box), which would get you closer to jumping over the wall of impossibility, but the final step of games design (represented by a ladder) is what is required to finally overcome the challenge.

Kojima also notes two distinct types of games design: *Designer-Driven* games design and *Technology-based* games design:

- **Designer-driven Games Design**: Kojima states this is/was his philosophy until recently, where given the foundation of hardware, designers would innovate in order to solve the gap.
- **Technology-based games design**: Kojima argues is a recent trend in western games design that relies on games software to bridge the gap between the foundation that games hardware provides and the final layer of games design used to solve the design problem.

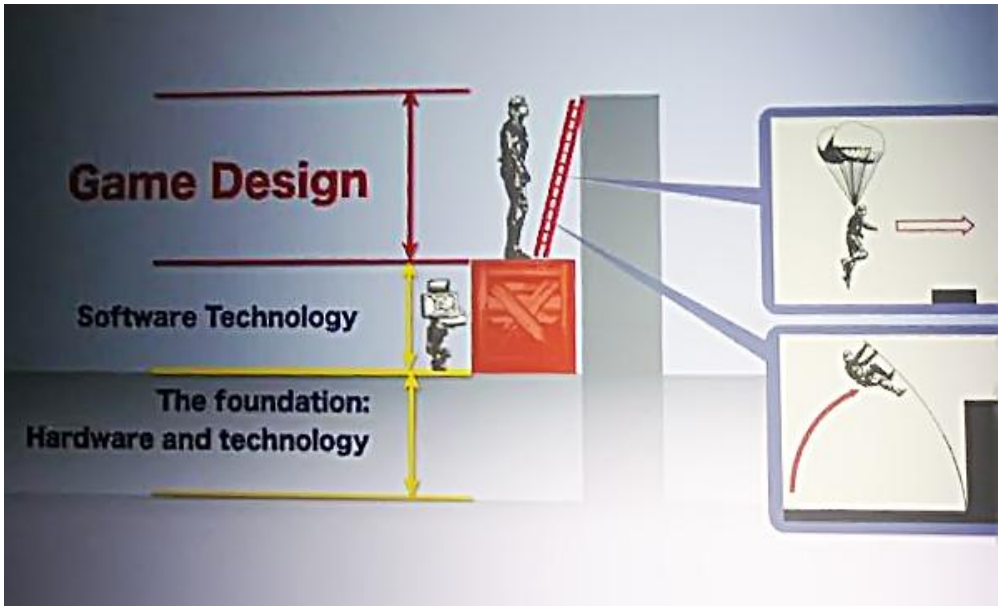

Figure 4: Kojima's Hierarchy of Technology & Games Design (Source: GDC 2009)

Kojima summarises his argument that in '*making the impossible possible*' in game production in order to confront barriers of impossibility developers must use a structured combination of hardware design, software capability and designer-driven game design.

Adams (2009, pp.33-34) also discusses the different influences on games design and specifically lists:

- **Art-driven**: Adams states art-driven games are rare and exist to show off someone's artwork and aesthetic sensibilities
- **Market-driven:** These are games where developers have chosen to develop for a certain market and design is focused on increasing sales.
- **Designer-driven:** Here the games designer retains creative control of the game and the production is tightly controlled and directed by the game designer. Adams has a somewhat negative view of a designer-driven approach as it ignored play-testing or other external input.
- **Technology-driven***:* These are games created to sell or promote a particular piece of software technology, often a games engine. Adams (2009) cites *Crytek*, developers of the *Cryengine* and *Crysis* game series. These games were created to demonstrate a particular new feature or range of features in a new piece of software and to convince other developers to use the software technology (as middleware) in the development of their games. Console manufacturers also use technology-driven

games to promote a new platform on launch. The problem with technology-driven games is that gameplay and creating an enjoyable experience are often secondary to demonstrating the functionality of the software.

Kojima's (2009) model of the relationship between technology, software and design is an original conceptualisation of three forces: hardware, software and design that are driving games development, and one that places design at the forefront of innovation and evolution of games as a medium. Salen & Zimmerman (2004, p.1) also reinforce this perspective that design is at the forefront of the different elements that constitute the elements of modern video games and they state *"powered by the big bang of computer technology, game design has become a very big deal and the source of some provocative questions about the future of art and entertainment*". It would therefore be a reasonable position to hold that reviewing the progression of both technology and games design and their contemporary state and importance may give us insight into future directions games development may take, as well as any current deficiency or need.

The aim of this research is to focus on design, specifically games design as opposed to software or hardware technologies, although in some instances it may be appropriate to analyse software/hardware technologies driving or used within games design, the focus will remain on games design methodologies, both current and indications of future trends.

Given the importance of games design in determining the user experience, The following section provides an insight into the elements of games design; the diverse role of the game designer as stated the aim of the thesis is to offer new insight and knowledge into the area of games design, In addition critical terminology such as gameplay, immersion will be defined and discussed as they form a critical foundation of the discussion and arguments that follow later in the literature review and subsequent chapters.

2.4.1 Section Summary: Games as a construct

- Games can be described as a combination of the result of two main components: technology (hardware/software) and design (Kojima, 2005).
- Technology is no longer a significant barrier in limiting user experience (which is achieved through design).

- New technologies such as VR and AR are impacting and require potentially new design paradigms especially considering the use and impact of space.

2.5 Games Design

2.5.1 Defining Games & Design

Games design both in and outside the games industry remains the most enigmatic of all game development disciplines. Many still refer to the *'black art'* of game design, a mystical discipline that is more art than science. However contemporary usage of 'games design', a term with many meanings often refers to 'digital games design' - a relatively new phenomenon. In order to attempt a definition of games design, we will take a step back and look at a wider definition of design by Salen & Zimmerman who state "*Design is the process by which a designer creates a context to be encountered by a participant, from which meaning emerges*" (2004, p.41).

However, it is only recently that the field of games design has emerged as a discipline, as Salen & Zimmerman (2004, p.1) state "*For hundreds of years, the field of game design has drifted along under the radar of culture, producing timeless masterpieces and masterful time-wasters without drawing much attention to itself without, in fact, behaving like a 'field' at all*". This is arguably due to the emergence and rapid rise of digital games and their global impact on society and culture.

A review of the literature on games design reveals the following definitions from established game practitioners/theorists:

> "*The focus of a game designer is designing game play, conceiving and designing rules and structures that result in an experience for players*" (Salen & Zimmerman, 2004, p.2)
>
> "*In games, the designer is the person who often conceives the original ideas, puts them on paper to present to others (in the form of a design document or rough demonstration) and supervises the transition from design to a working video game*" and "*Game design is primarily about creating and interconnecting all the elements that make up a game - the mechanics - and creating an appealing world in which to house them*" (Byrne, 2005, p.2)

"*The [game] designer's role is the same: create the ideas and rules that comprise a game*". Rogers (2014, p.14)

"*Game design is primarily an artistic process, but it is also a technical process. The game designer pursues grand artistic goals even as she grinds through mountains of code*". (Crawford, 1983, p.45)

"*Anyone who makes decisions about how the game should be is a game designer. Designer is a role, not a person*" (Schell, 2009, p.xxv)

"*Game design is what determines the form of the gameplay*" (Rouse, 2001, p.xviii).

From the definitions we can see key elements of games design begin to emerge, namely: *gameplay, experience, games design as multidisciplinary technical and artistic process.* Therefore to summarise, we can define games design as:

A technical and artistic process in which systems and rules are designed in order to serve the function of gameplay.

2.5.2 History of Games Design

Modern games development has strong foundations in computer science; early games were the result of a lone programmer's efforts, level designers and game artist roles did not exist, design was often a secondary consideration and art and music were even less developed and extremely limited due to technological limitations. Bleszinski (2000, p.1) states that "*Programmers were the 'one stop shop' of game creation; they were the ones responsible for designing, producing, and finishing products*", which is echoed by Byrne (2005, p.9) who explains that "*In the heyday of the video arcade in the 1980s, many games were designed, programmed, and decorated by a single person.*" This was possible since the complexity of games was such that this was a manageable task by a single individual, however the rapid evolution of computer and video games would rapidly see this practice change.

The works of practitioners/theorists Andrew Rollings, Ernest Adams, Chris Crawford and others in the early 1990's advanced the programming centric games development to one that was far more focused on graphics (aesthetics). Whilst the work of the earlier pioneers in game design theory "*advanced the field from purely computational to an aesthetic practice*" as Totten (2014, p.3) states, it also positioned games/level design to mainly practice/aesthetic

considerations, which I will argue later was perhaps detrimental to evolving games design closer to its true potential.

Katie Salen and Eric Zimmerman, both core members of Gamelab (a development company), in addition to extensively writing and practising in the field of games design discuss the emergence and need for games design theory in their book *Rules of Play - Game Design Fundamentals* (2004) commenting on both range of game design methodologies and their grounding. They state (p.1) that "*More recently, within the field itself there has emerged a Babel of competing methodologies… few of them have attempted to ground their insights in a general theoretical system*". So why do games, considered by some to be nothing more than entertainment requires a theoretical framework? As Salen & Zimmerman argue despite the rapid evolution of games technologies "*games have remained creatively stunted*." (ibid, p.1) and the reality of modern games development is sadly limited to intellectually stunted, childish or adolescent games. One can argue that this due to the education and training of early game developers, many of whom learned 'on the job' as opposed to studying games design in a formal manner, however this is changing due to acceptance and proliferation of games design as a subject of study within education, particularly higher education over the last decade.

Salen & Zimmerman perspective on games design theory is also echoed by Schell (2009, p.xxv) who states "*at present, there is no unified theory of game design, no simple formula that shows us how to make good games*" illustrating a startling revelation: a critical aspect of gameplay i.e. what the user experiences, which is created through games design is not driven by an established body of knowledge and as Salen & Zimmerman (2004, p.1) state until recently designers interested in games design theory would be "*forced to stitch together a set of perspectives from sociology, anthropology, psychology, and mathematics, each of which brought its blindman's view of the elephant, and none of which considered games as a creative domain*". A possible explanation is that the bricolage approach was required until sufficient discourse and critical analysis took place in the field of games design theory leading to the development of theories around games design.

Schell (2009, p.xxv) in her book *The Art of Games Design: A Book of Lenses* paints a wonderfully rich picture drawing similarities between modern games design and the early days of alchemy (which ultimately led to modern chemistry), and how the emergence of a pivotal figure, Mendeleev and his periodic table transformed the subject, before which

despite using "*incomplete, sometimes incorrect, and often semi-mystical*" rules early alchemists were able to still accomplish things analogous to ancient alchemy "*Game designers await their Mendeleev. At this point we have no periodic table. We have our own patchwork of principles and rules, which, less than perfect, allows us to get the job done.*" Schell's analogy is fantastical and although some (such as Yang, 2005) have argued against a grand monolithic theory of games design, given the field of digital games design is only a few decades old, with time it is logical to assume that this 'periodic table' of the elements of games design will emerge as the medium of computer & video games, matures and develops, and the existing patchwork of principles develops into an established and agreed upon body of knowledge.

Salen & Zimmerman (2004, p.2) also comment on the nature of games design as body of theory stating "*…because of its status as an emerging discipline, game design hasn't yet crystallized as a field of inquiry*" it is not unreasonable position to hold that the field of game design will eventually, given more time to evolve and develop, will become 'crystalized' and unified through perhaps the work of a noted individual or when the wider field of games design theorists becomes more established and reaches a critical point (one can argue the underlying studies in the field of game design theory is only no more than 30 years old and as such still in its embryonic stages) a consensus of what game design is will eventually emerge.

2.5.3 The Role of the Games Designer

Byrne (2005) and Salen & Zimmerman (2004) point to the reality of a modern game development: the role of defining games design is difficult given the collection of competing methodologies that all rely on various definitions of what games design is. In addition, the roles within games development, including game designer have never been clearly defined in comparison to other design disciplines. **Figure 5** illustrates the three closely linked aspects of modern games design: *systems, level and art*. Within each discipline there are myriad of sub-disciplines and depending on the particular task (i.e. environment design) one is able to see why perhaps positioning games design to one core discipline is problematic given the fragmentation and diversification of the role.

Figure 5: Domain of Games Design (Source creative.luiss.it)

If we take one particular role (e.g. environment design) we can see that it sits within Level design, Game Design and Game Art areas, so an environment designer would require skills and abilities specific to those core areas. Salen & Zimmerman (2004, p.2) illustrate the various roles a game designer might play as "*A game designer is a particular kind of designer, much like a graphic designer, industrial designer, or architect. A game designer is not necessarily a programmer, visual designer, or project manager, although sometimes he or she can also play these roles in the creation of a game*". However, they go on to state the games designer core focus and responsibility *(ibid,* p.2) "*…is designing game play, conceiving and designing rules and structures that result in an experience for players*".

Given the nature of the embryonic nature of the medium and the lack of consensus on what constitutes 'games design', another perspective is to analyse the role of games designer and the requirements/expected duties. *Creative Skillset*, a UK based, government supported skills body state[1] they act as a "*UK-wide strategic skills body that works with employers, individuals, trade associations, unions, learning and training providers, Government and its public agencies and other key organisations to ensure that the UK's Creative Industries have continued access now, and in the future, to the skills and talent they require*". Within their jobs roles they specify the requirements, role and responsibilities of a designer which are described[2] as:

[1] http://creativeskillset.org/about_us/what_we_do
[2] http://creativeskillset.org/job_roles/331_game_designer

- **Devise** what a game consists of and how it plays.
- **Plan and define** all the elements of a game: its setting; structure; rules; story flow; characters; the objects, props, vehicles, and devices available to the characters; interface design; and modes of play.
- **Communicate** this to the rest of the development team who create the art assets and computer code that allow the game to be played.

This description matches closely the variety of interpretations of the roles of a game designer found during the review. Although some discreet variances do occur, generally the core aspect of any games designer (as defined above) is to develop systems and rules which are designed in order to serve *the function of gameplay i*.e. a designers ultimate role is to *plan, devise and embed* the often magical and mystical element of *gameplay,* which will be discussed next.

2.5.4 Gameplay: Play and the Magic Circle

Games as a broader social construct/concept are a much older and established fundamental and ancient aspect of human civilisation; from the early 5,000 year old carved painted stones found in Turkey to contemporary digital computer games, games have been an integral part of all human culture.

The review has already attempted to discuss and define the concept of games as a construct of design and technology, however a second critical term that requires definition is *play*. Adopting a historical perspective on the notion of *play* would broaden the review to such an extent that it would become unwieldy and could very easily lose a sustained flow of arguments, so to maintain flow and coherence a contemporary perspective will be used as a starting point. Contemporary studies on play are often cited to have begun with Johan Huizinga work and in particular his concept of the 'magic circle'. The magic circle was a notion introduced by Dutch anthropologist Johan Huizinga in 1954, later adapted by a variety of game theorists such as Salen and Zimmerman, Jesper Juul and Ernest Adams, and since its reintroduction into modern study of (digital) play it has been widely discussed and accepted in game studies and game design research as a foundation for the importance of games.

Huizinga (1955, p.10) states:

> *"All play moves and has its being within a play-ground marked off beforehand either materially or ideally, deliberately or as a matter of course. Just as there is no formal difference between play and ritual, so the 'consecrated spot' cannot be formally distinguished from the play-ground. The arena, the card-table, the magic circle, the temple, the stage, the screen, the tennis court, the court of justice, etc. are all in form and function play-grounds, i.e. forbidden spots, isolated, hedged round, hallowed, within which special rules obtain. All are temporary worlds within the ordinary world, dedicated to the performance of an act apart".*

In his book *Homo Ludens* (1938) Huizinga argues that play is a meaningful and critical activity, and that play occurs within the bounds of a magical circle (Huizinga in this instance was referring to a physical space). Outside the circle everyday life, individuals would be faced with responsibility, fear, constant questioning, however on 'entering' the magical and transformative space of the circle, where another reality with a new set of rules, awaits the player. Huizinga introduced the concept of a *'playspace'* and one that was separated by a boundary from everyday life, where life was suspended on entering a new reality in order to be transformed and to take new meaning back into the real world, One can clearly see why many game theorists (especially those focusing on the aspects of play - who refer to themselves as *'ludologists'*) have used Huizinga's metaphor as a grounding in order to define and discuss the concept of play within games.

Two decades later, French sociologist Roger Callois, in his influential book '*Man, Play & Games*' (1961) argues and discusses the sociology of play and games and is arguably the first major study on the topic since Huizinga's *Homo Ludens*. Callois' work critically builds on Huizinga's early ideas of play (and in fact starts the book with reflection on Huizinga's work) arguing the defining of *play* is at best a difficult task given the range and depth, and variety of the forms it can take. Callois argues that there are six core elements of play:

1. It is free; there is no obligation to engage in it
2. It is separate; Occupying its own predefined time and space which is defined and fixed beforehand.
3. It is uncertain; the outcome cannot be predetermined
4. It is unproductive; neither good, wealth or anything else is created, players are returned to their original state after the game
5. It is governed by a set of rules that may suspend ordinary laws:

6. It is make-believe; players are aware of another second free reality, opposed to real life.

Callois then argues that games can be sorted into four unique categories (or rubrics as he refers to them): *Agon, Alea, Mimicry and Linx,* admitting that these 'rubrics' "*do not cover the entire universe of play*" (Salen & Zimmerman, 2006, p.130) but rather his terms are representative of four quadrants, with each rubric acting as a governing principle.

Callois places these rubrics on a spectrum that ranges from *ludus* (play that has structured rules and activities) to *paidia* (activities that are spontaneous and unstructured). Callois' early work is critical if one considers the historical roots of gameplay, and arguably, despite analysing gameplay from a sociological perspective, provided many game theorists a foundation on which to argue and build new definitions.

Contemporary usage of the world *gameplay*, similar to many terms within game development is still contested with no agreed upon definition. As Rolling & Adams (2003, p.155) argue there is still "*…no universally accepted definition of gameplay. Gameplay is an important, if nebulous, concept*". They continue the discussion on gameplay citing the most common of all responses in attempting to define gameplay are often self-reverential and that (*ibid*, p.155) "*describing gameplay without using self-reference is similar to trying to explain the concept of red without reference to colour. It is difficult to conceive, but not impossible*". Based on Sid Meier's (a long established games industry veteran) original deception of games as a 'series of interesting choices' they proceed to define *gameplay* as "*one or more causally linked series of challenges in a simulated environment*" (*ibid*, p.155).

This contrasts with Rouse's (2001, p. xviii) definition which he considers not to include elements such as the environments, which are common to other forms of media, but focuses around a critical and unique concept of interactivity, stating "*A game's gameplay is the degree and nature of the interactivity that the game includes*".

One of the difficulties that many game theorists, developers and gamers have in arriving at a universally accepted term is because *gameplay* is an intangible concept; it is an emergent and ethereal quality of an experience that a player may feel when playing a game and this aspect is not something located within a particular function (i.e. controls, interface) or within specific assets (i.e. character mode, audio, etc.) but floats across and within all

elements of a game. It is also a quality that is not inherently quantifiable and identical game experiences may result in vastly different levels of gameplay to different users.

Ermi & Mäyrä (2005) definition reflects the ensemble nature of gameplay as they state gameplay is an "*experience can be defined as an ensemble made up of the player's sensations, thoughts, feelings, actions and meaning-making in a gameplay setting*". The ethereal nature of gameplay is discussed by Rolling & Adams who refer to gameplay lacking of a singular entry-point (2003, p.155) "*Gameplay is so difficult to define because there is no single entity that we can point to and say, 'There! That's the gameplay'. Gameplay is the result of a large number of contributing elements.*"

Arguably one of the key aspects of gameplay is immersion, which will be discussed in the next section.

2.5.5 Immersion

So given gameplay is a critical experience that players can measure which many use to position and rank games against each other (i.e. "*you should play the other game it has much better gameplay*") and a quality developers/reviewers often seek and use to define the inherent value/quality of a game, can gameplay be quantified or broken down further into other attributes? Rolling & Adams (2003, p.155) by using borrowed medical terminology argue that one must use a deductive approach in identifying gameplay, or the lack of which "*can be deduced by examining a particular game for indications and contraindications of these elements.*"

However this is not a shared belief across players and researchers; an observation and experience that many gamers share is that an inherent experience of gameplay manifests as a deep connection with a game i.e. a player becomes completely engrossed into the gameworld, often losing track of time and/or the external reality as they become *immersed* in it. Murray in her ground-breaking book on interactive narratives '*Hamlet on the Holodeck*' (1998) interestingly defines immersion *as* "*…a metaphorical term derived from the physical experience of being submerged in water. We seek the same feeling from a psychologically immersive experience that we do from a plunge in the ocean or swimming pool: the sensation of being surrounded by a completely other reality, as different as water is from air, that takes over all of our attention, our whole perceptual apparatus*"(p.98). The term *immersion* is recognised by many

gamers as a key aspect of gameplay and game researchers such as Ermi & Mäyrä (2005) have also argued that immersion is one of the key components of the gameplay experience.

Immersion, is in many ways, similar to the concept of gameplay; it is a term used extensively when players, developers, theorists and researchers discuss the concept of games and the hallmark of gameplay; it is rarely defined and is interpreted differently dependant on the context. Many theorists have attempted to investigate immersion in games (Jennett et al, 2008; Cairns & Cheng, 2005) with varying success, all noting the difficulty in arriving at a firm definition of what constitutes immersion.

Brown & Cairns (2004) work on immersion is perhaps the earliest studies on immersion in games within game studies and argues that immersion occurs on three different levels. Ranging from the first 'lighter' level of immersion *engagement*, where a player must invest time, attention and effort in order to pass the first threshold. The second level of immersion *engrossment* is when a player's emotions are directly affected by the game, to finally to the deepest level of *total immersion,* where players feel a sense of '*presence*'. Brown & Cairns model of immersion is useful, as a grounded investigation it has a firm foundation (i.e. derived from actual player experiences).

As the power of game technologies grew so did the trend towards realistic game graphics (Low, 2001) driven by the notion that increased realism would deepen immersion. Within games design theory and practice there are strong indications that inconsistency in a game's realism can negatively impact on immersion, so in order to achieve a more immersive experience one must create a consistent and therefore more believable world for the player to inhabit. Boron (2007, p.31) discusses the commonly held assumption on the relationship between greater realism resulting in greater immersion and that it *"…still holds true…many games have and are still advancing in this direction. As processing power improves, a digital game's graphical output will increase, and the result will be an improved simulation of reality in whatever genre the game belongs, be it fantasy, sport, driving simulation or so on".*

However achieving believability (though realism) is not an easy task and many developers focus on aesthetic realism rather than functional or scientific realism, which is due to the increased capability of games technologies and the ease at which games can be sold/marketed based on graphical quality. As Byrne (2005, p.4) states *"On a visual front, level designers use the same art of illusion to create spaces that feel much bigger than they really are"* and

until simulation can replicate the level of immersion in reality designers will rely on visual illusion to "*create believable and enjoyable game spaces*" (*ibid*, p.4).

Games design includes roles/tasks concerned with a plethora of sub-areas, mechanics, gameplay, narrative, etc. however one critical function of all these is to establish the 'magic circle' as Davidson et al. (2007, p.56) state "*Game designers don't simply tell stories; they design worlds and sculpt spaces*", and (Walz, 2010 p.12) states "*…game design is thus not just about the 'Rules of Play' anymore, but also about the 'Rules of Place*'. The review so far has indicated that one important aspect of game design is creating environments, gamespace and places as a critical consideration for the modern games designer, this introduces us to the increasingly important aspect of modern games design: the creation of *gameworld* and *gamespace* which will be discussed below.

The issues around game immersion have also stimulated a large amount of theorisation and debate. Ermi and Mäyrä (2005) attempted to analyse the components of immersion (i.e. challenge, sensory. imaginative) in '*Fundamental Components of The Gameplay Experience: Analysing Immersion'*. However the 'space' element only formed a small component of the framework, which essentially tries to develop a conceptual framework of immersion by reductionism. Although he proposed the space element is only a minor part of the immersive experience, the framework is useful in attempting to separate the many layers that make up game immersion. Brown & Cairns' (2004) work in immersion simplifies the elements into *engagement, engrossment and total immersion*. What is interesting is their methodology in using grounded theory to capture emergent themes and identify concepts which could be developed into a theory, rather than the traditional scientific process which is the reverse (a theory that is tested by data). The final model created from three levels of immersion offer a more practical framework for 'measuring' immersion.

Cairns & Cheng (2004) in their paper '*Behaviour, Realism and Immersion in Games'* take an interesting view in analysing immersion since they argue inconsistencies do not break immersion once it has been achieved. They "*found that poor coherence could be a barrier to immersion, once immersion has been achieved coherence is not necessary*". Their results were gathered through an experiment (created in the Unreal engine) however a potential flaw in the experiment was the element they chose two variables, aesthetics as well as the physics of the world) and the statement that inconsistencies do not break immersion once immersion

has been achieved which I find problematic since the required level of immersion, needed to achieved to break free from inconsistency, would be a difficult level to test.

One of the methods in which immersion can be achieved is through the creation of a coherent systems and spaces in which the player resides, i.e. the gameworld, it's components and the growing scale and complexity of these worlds, and the resulting impact on game designers will be discussed in the following section to reinforce later discussion and arguments that follow in the literature review and subsequent chapters.

2.5.6 Section Summary: Emergence of Games Design

- Games design has emerged as a critical aspect in defining a user's experience of a game, through phenomena of gameplay (Adams, 2009; Schell 2009; Crawford, 2003)
- Games design overlaps with other elements of games development such as environment art (Yang, 2015).
- Games design can be broken down into smaller discreet areas of design such as level/environment narrative etc. (Byrne, 2005).
- Games design is still being explored and defined as a discipline - it is still considered to be the last unsolved 'black art' in games production (Salen & Zimmerman, 2004).
- Games design is now the last step in creating user experience or meeting the potential of the medium (Kojima, 2009).
- Games design moved from computational-centric (1970's) to graphics-centric (90's) position and it is moving away into something else…and that something else could include spatial design (Totten, 2014; Aarseth, 2007). Especially problematic in games design teaching materials in environment design; all about game art (Yang, 2005).
- Games design is focused on immersion; one aspect of games design is world design which includes level design which in turn is about the environments/landscapes and game spaces.
- Contemporary game designers are not fully able to satisfy the increasing demands required by modern games as they are too diverse, broad and require specialist knowledge.
- One of the key aspects of gameplay is immersion, and designers rely on visual illusion to create believable game spaces.

2.6 **Gameworld**

2.6.1 Gameworld Dimensions

Game designers are responsible for more than the creation and implementation of systems, rules and mechanics within a game, they are also responsible for how the game feels and how the player experiences it, which is experienced through gameplay but delivered via a variety of forms i.e. the characters, the sound, the narrative); all the constituent elements of a game create an imaginary space, a 'magic circle', that the player enters and becomes immersed in. These imaginary or representational worlds can be described as the *'gameworld'* and can have a relationship to reality either representational (i.e. realistic simulation) or abstracted (i.e. purely fictional). Sweetser (2008) argues that gameworld is composed of two elements: the environment (the virtual space) and the game objects (entities that exist within the environment). Rolling & Adams (2003) attempted to analyse the concept of gameworld, which was later expanded upon by Adams himself in his revised edition of '*Fundamentals of Games Design'* (2009).

Adams (2009) argues that the gameworld has two functions. One function is to act as a commercial tool or a hook to draw in players as it provides a context for a potential player to understand what the game may entail, as game mechanics maybe too abstract to explain without a setting. The second function *"is simply to entertain in its own right: to offer the player a place to explore and an environment to interact with"* (*ibid,* p.85). Adams primary and secondary functions appear to be well founded; providing players with an established context for game mechanics is a recognised game developer strategy i.e. utilising a well-known IP to provide a context for abstract game mechanic.

This concept of a gameworld however goes beyond the assets/elements that a game is made from; it can transcend the sum of its parts and become something far bigger. Adams discusses these various dimensions of a gameworld:

1. **Temporal:** This dimension refers to the passage in time within the game and ideally should be experienced in more than a visual manner i.e. in game characters going to sleep and shutting virtual shops.
2. **Emotional:** This dimension concerns not only the in-game simulated emotions of the player, but also the emotions the designer intends to evoke in the player.

3. **Ethical:** The games internal ethical system; these are partially derived from the real world and can help create a more believable game.
4. **Physical Dimension:** The majority, if not all games use a simulated physical space; Adams argues that this is even applicable to game genres that would appear to be problematic such as the text adventure which use the concept of 'rooms' to guide the player through the imagined gamespace. This dimension, he argues has a significant impact on the final gameplay and it comprised of three sub-elements:
    - Spatial Dimensionality: A range of spatial types, 2D, 2.5D, 3D and 4D are discussed and illustrated, interestingly Adams discusses the concept of 4D spatiality; a 3D space that can vary over time and offer different gameplay experience, citing the *Legacy of Kain* games as an exemplar of 4D spatial gameplay. He also argues that the choice of spatial representation (2D, 2.5D or 3D) must be chosen to serve gameplay/entrainment purposes.
    - Scale: Refers to absolute and relative sizes of objects, if they conform to real world objects then distortion should be minimal unless the game is purely abstract. Distortion may also be used to enhance the game experience.
    - Boundaries: The digital nature of a gameworld means that due to resource limitations that the world will eventually have an edge, which if not properly designed can break immersion; this can be solved with replicating natural boundaries (i.e. sea around an island) in order to restrict the player and maintain immersion.
5. **Environmental:** This relates to the world appearance and the atmosphere of the game, whereas the spatial dimension defines the properties of the gamespace, the *Environmental* dimension defines what is actually *in* the space and consists of two important aspects: the *cultural and physical*. Cultural refers to the in-game beliefs, values and attitudes of the virtual populace and includes the games backstory/narrative.

Adams (2009, p.97) argues that the physical surrounding is largely an aesthetic consideration: *"it's most helpful to be an artist or to work closely with one"* and that designers should not neglect the natural world as qualities of the real environment such as weather, climate patterns, flora and fauna all help to build a distinctive virtual environment. He spends time detailing the aspects of the real world that when replicated all help to create a

'coherent world', as the tone and the mood of the game is set by the physical surrounding, he then goes on to explain that sources of inspiration should be as wide as possible citing examples from across art and architecture, history, anthropology and literature.

What Adams is essentially referring to when he discusses the physical and environment dimensions of the gameworld is *environment design*. If we follow Adams' assertion that the environment design has a significant impact on gameplay as only one element, the design of this environment is of sufficient complexity to warrant its own role and game practice/theory literature would be extensive, and in fact is what occurred as games development grew in complexity and scale and a new genre, the '*openworld*' game, appeared, which will be discussed in the next section in order to demonstrate the changing role of the game/level designer and the emergence of game 'architects'

2.6.2 Openworld Games

Openworld games are phenomena that have recently come to the forefront of modern games and are the result from both an increase in capability of games technologies coupled with players' demand of larger gamespaces in addition to more freedom in these spaces. As discussed before gamespaces evolved from early text space to basic 2D to scrolling 2D to pseudo 3D to full 3D spaces. During the early emergence of 3D gamespace, spatial boundaries (i.e. restricting player movement to certain sections within the space) were often present and used to restrict the player due to technical limitations (memory resources) and design constraints (lack of content required to fill space due to the cost of creating it).

However '*openworld*' does not simply relate to unrestricted movement in 3D space and some have argued earlier 2D games, for instance Nintendo's critically acclaimed *Zelda: A link to the Past* (1991) demonstrates the 'requirements' that are often attached to classify a game as openworld.

Liz England, a senior game designer, in her presentation at GDC 2015 '*Transitioning From Linear to Open World Design with Sunset Overdrive*', illustrates the differences between linear and openworld (**Figure 6**). England argues that in a linear structure, events, locations progress in a linear fashion (represented by the nodes labelled A, B, C, etc.) players can only access or visit these spaces (levels/locations) in a sequential and fixed order (i.e. A to B to C to D). This is opposed to an openworld system where players are free to visit any 'space' in

any order they choose e.g. starting from any location (A) users are able to access any of the other gamespaces (e.g. B. C. D. E) in a nonlinear fashion. Bethesda's *Elder Scrolls* games (e.g. Daggerfall, Morrowind, Oblivion) exemplified the openworld genre. England also notes that for the production of *Sunset Overdrive*, the following shift occurred to design for the openworld gameplay:

- *Game designer role* whitebox spaces, prototype gameplay, define visuals (with an artist), add layers (FX, audio etc.) bug-fix and polish
- '*World builder*' role: Whitebox spaces, adds traversal layer i.e. designing critical path and flow, connecting spaces in the gameworld together, split area into 'blocks', hands-off these block spaces to specialists (i.e. combat, mission etc.)

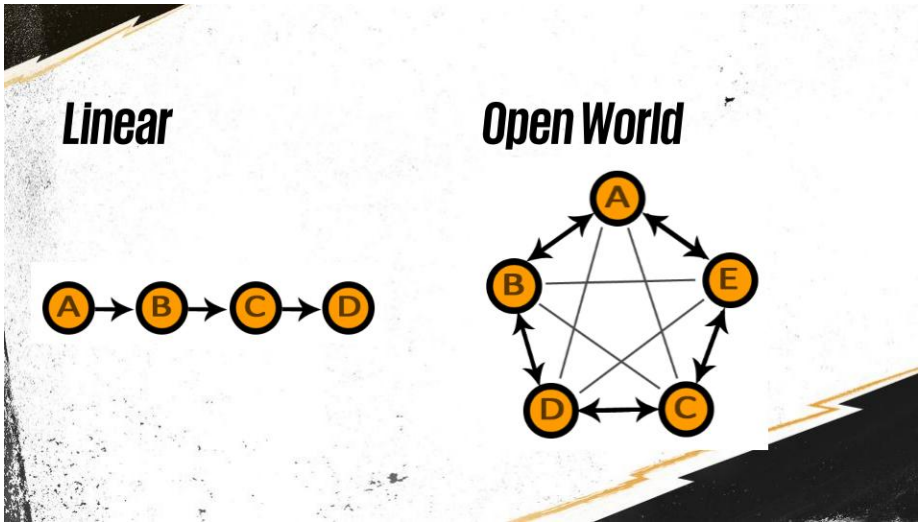

Figure 6: Linear Vs Open World (Source: GDC Presentation, England, 2015)

England emphasises spatiality and movement as key considerations for the new role of a 'worldbuilder' (as opposed to a designer) in these new openworld designs.

The proliferation of *openworld* games has also been matched by the rapidly expanded size of these open worlds; contemporary games have seen these openworld spaces increased exponentially over the last 15 years. **Figure 7** illustrates the expansion of these spaces in several popular openworld games from 2001 to 2010, with *Grand Theft Auto 3* (2001) having a total world size of 3sq miles to *Just Cause 2* (2010) at over 400sq miles (Mandal, 2014). This increase in size is also met with an increase in 'agency' (meaningful interaction) as players were able to interact with the environments in a variety of new ways. **Table 1** lists several

popular games and the respective size of their gameworlds in square miles/kilometres, the huge expanses of modern gameworld spaces.

Table 1: Comparison of Game world Sizes

Game	Size of gameworld
World of Warcraft – before Burning Crusade	80 sq miles/207 sq km
Operation Flashpoint: Dragon Rising	135 sq miles/350 sq km
Star Wars Galaxies	200 sq miles/518 sq km
Burnout Paradise	200 sq miles/518 sq km
True Crime: Streets of LA	240 sq miles/622 sq km
Just Cause 2	400 sq miles/1,036 sq km
Asheron's Call	500 sq miles/1,295 sq km
Test Drive Unlimited	618 sq miles/1,600 sq km
Fuel	5,560 sq miles/14,440 sq km
Guild Wars Nightfall	15,000 sq miles/38,850 sq km

A review of the Game Developers Conference (GDC) keynote speeches and seminar presentations over the last several years reveals that openworld has increasingly become a noted topic for all development disciplines ranging from art, design and production. This is in addition to news/review sites (i.e. Wired, Gamespot, IGN, Gamasutra) covering the emergence of growing trend of openworld games.

If we adopt a games developer perspective in order to focus on the current state of actual openworld development and design, two particular presentations are of importance to this study. The first came from the games engine developer Epic (creator of the Unreal engine) titled '*Creating the Open World Kite Real Time Demo in Unreal Engine 4* (Unreal Engine, 2015) and the second one from Nate Fox, a senior developer from *Sucker Punch* titled *'Building an Open-World Game without an Army'* (2010) which illustrates current design and technology trends.

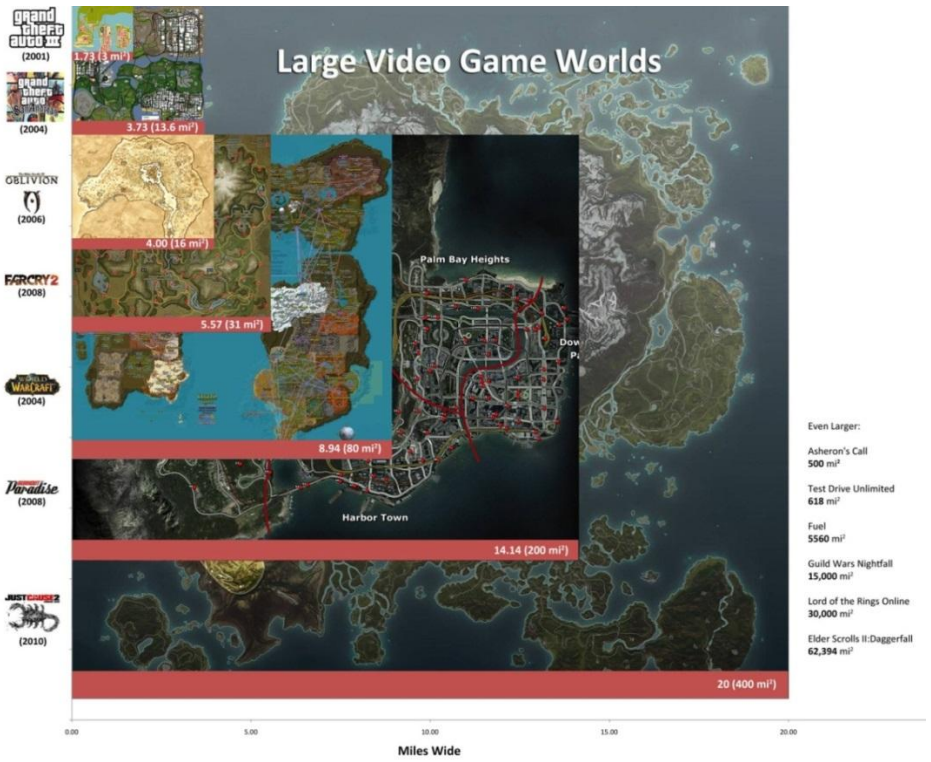

Figure 7: Comparison of Progression of Openworld games (Source Hexapolis.com 2014)

Epic's keynote (Unreal, 2015) illustrates contemporary natural openworld games production. What is immediately obvious is the technical complexity and capability of modern games engines. The demo (created in Unreal 4) demonstrates amongst several things, dynamic global illumination, procedural vegetation, AI driven fauna, advanced high resolution large-scale terrain and texturing. It is evident that the technology is able to deliver incredible photorealistic openworld environments, any legacy issues of technology acting as a constraint/barrier to delivering a rich experience appear to have been largely passed. One criticism is that *Epic's* demonstration is grounded in the aesthetic (i.e. how the world looks) and technical (how it works) as a foundation; this is not surprising as *Epic* business role is as a middleware vendor (i.e. selling the Unreal engine to other developers) and not as a games developer, however no mention of the design of these spaces from a gameplay or architectural perspective is offered.

In reviewing contemporary commercial games development, an analysis of several of the biggest commercial successes of 2015 (e.g. Konami's *Metal gear Solid 5*, Bethesda's *Fallout 4*, Techland's *Dying Light*, Bungie's *Destiny*, Ubisoft's *Assassins Creed: Victory*, Rocksteady Studio's *Batman Arkahm Knight*, Avalanche Studio's *Just Cause 3*, CD Project's *The Witcher 3*,

Ubisoft's *FarCry 3*) in addition to several high profile games of 2016 (Nintendo's *Zelda Wii U,* Tom Clancy's *The Division*) reveal they all feature openworld as a key gameplay aspect, with the majority again using the representations (either real or fictional) of the natural environment in the gameworld setting.

Developing 'Openworld' games given the complexity noted above and sheer size of the virtual environments does however present a significant challenge for game development studios, especially 'AAA' development. Nate Fox, a developer from *Sucker Punch studio's* discussed some of the openworld design considerations in his keynote presentation *at GDC in 2010* (Fox, 2010). He mentioned the several key user expectations in openworld games namely:

1. **Giant Game World:** Fox argues that players expect large open worlds, with the ability to traverse without restriction, however there are two possible pitfalls for developers to consider: openworld games are expensive to build, but they require spaces that need to be exciting, failure to provide this will make the gameworld appear to be "bland" and "anaemic".
2. **Areas for Discovery:** Here Fox argues that the expectations of an openworld game are a strange contradiction; players are given an openworld from the onset but expect closed areas of the game, they are able to discover through exploration, failing to provide this creates superficial games.
3. **Diverse Visuals:** Finally Fox argues that openworld games need to feature different places for the player to visit and whilst replicating real-life environments is to be avoided (only referencing city architecture) as they are homogenous, failing to do this results in an environment that can feel repetitive.

It is interesting to note that the from origins to modem day of openworld games (e.g. Sucker Punch/Epic's GDC demonstration; all of the games featured in Figure 8 and over 50% of the games features in Table 1, feature natural landscapes and/or natural architecture either as the dominant gameworld setting or as a significant game area/locale within the game. Despite the emergence, increasing trend and success of openworld games (many of them featuring natural environments), there appears to be little practical or theoretical discourse or guidance offered from a design perspective as the majority appears to be art-driven.

Given the rapid expansion of technologies in delivering these ever expanding gameworlds into openworlds, the demand for larger and more complex environments, which

are comprised of ever growing 'levels', the role of game designer was required to be fragmented again. From the single lone programmer to the emergence of a game designer, another area and role emerged; the level designer. As Byrne (2005, p.10) states "*…because of the explosive increase in complexity and in expectations of modern interactive entertainment, it's not uncommon to find production teams of 30, 50, or even more than 100 developers working for years to complete a single title. In such an environment, work is divided up into very narrow specializations, and more often than not one of these specializations is…the level designer*". Bleszinski (2000, p.1) notes that gaming will head in a variety of new directions and the head of the vanguard of the revolution will be level designers noting the importance of the role in games development since they "*are quickly becoming some of the most important members of a development team*".

However the singular role of 'level designer' has already disappeared given the rapid expansion of the complexity of games, both which correlate as Bleszinski (2000, p.1) states "*There is a direct correlation between the detail that a technology is capable of and the amount of ownership that one designer has over a particular level. With Moore's law holding true (processor speed doubles every eighteen months) and 3D accelerators constantly raising the bar the detail that game engines are capable of is staggering. It is simply impossible for one driven person to build the necessary amount of detail into level locations in the allocated time*". He also notes an interesting term for these new level designers, and that given the ever changing pace of technology and the emergence of picturesque 3D environments the need for "*digital architects*" has appeared.

Huizinga's *Magic Circle* can be regarded as a playspace, and within the area of digital games this is been referred to as '*gamespace*,'. The history of gamespace focusing on a select few critical theorists will be discussed below; in addition a core aspect of gamespace '*spatiality*' and its significance will be argued highlighting the importance of space and its relationship games design

2.7 Game Space

2.7.1 Defining Gamespace

In order to discuss and analyse the importance and emergence of the *gamespace* we should review how it is both defined and perceived. A review of the relevant literature revealed the following definitions:

"*A game's particular spatial framework*" (Tadsen, 2015, para.1)

"*Playgrounds that exist only on the screens of computer monitors and televisions*" (Salen & Zimmerman, 2003, p16)

"*Virtual environments in which actual events occur: areas are explored, discoveries are made and gaming literacy is increased*" (Tadsen, 2015, para.5)

"*Is an environmental context for the active creation of meaning*" (Tadsen, 2015, para.5)

"*The defining element in computer games is spatiality*" (Aarseth, 2007, p.44)

"*Spaces that both embody gameplay and facilitate the player's journey through it, allowing him or her to better experience the game's mechanics*" (Totten, 2014, p XXIV)

2.7.2 History of Gamespace Theory

In order to analyse how the concept of '*gamespace*' has emerged the review will adopt an historical perspective and review key texts that attempt to define the concept of gamespace.

Jenkins & Squire's work (2002) focuses on the idea of game as contested spaces. They argue that rather than viewing games from the traditional perspectives (as narrative, cinematic or participatory narratives), they should be viewed as *spatial art* and as such should be grounded in landscape art, architecture, gardening and park design. They postulate on the nature of games as narrative "*If games tell stories, they do so by organizing spatial features*" (p.1). This notion of spatial art and alignment to areas such as amusement park design laid the foundation for what later becomes a key aspect of gamespace i.e. environmental storytelling which Jenkins (2007) and Worch & Smith (2010) explore in depth.

Jenkins & Squire's paper develops an argument for considering games as contested spaces, citing how early games (such as Pac-Man to first person shooters) used the idea of contested space as gameplay: this was not a secondary design consideration but in fact the games were built around it. They support their arguments with strong cases studies and critically recognised exemplars of games design and go further and draw on notions from environmental psychology suggesting that "*game designers design spaces or objects for their games which offer players certain affordances*" (2002, p.2) again demonstrating the expertise that both authors have into the field, psychology and games design becomes a developed area of discourse many years later. The paper discusses one of the key aspects of gamespace namely

spatial exploration, and how influential designers such as Shigeru Miyamoto (the designer of Super Mario) would chart his virtual gamespace in physical (blueprint) form in order to 'play' the gamespace. The authors argue that one of the functions of gamespace is to guide players through the world carefully balancing the designer's intention of leading the player against the player's own wish to explore and not be contained and or controlled.

Interestingly they also note the work of Brenda Laurel and the *Secret Paths in the Forest* (1997) game, highlighting the use of a virtual natural environment to allow female gamers "*promising possibilities for contemplation rather than mastery*" (*ibid,* p.8). Jenkins (2006) expands upon Laurel's intentions behind creating the game in his book '*The Wow Climax: Tracing the Emotional Impact of Popular Culture*', in the chapter on gendered playspace he notes "*Laurel initially sought to design a 'magic garden', a series of 'romanticized natural environments' responsive to 'girls' highly touted nurturing desires, their fondness for animals*" (2006,p.203). He followed up by analysing British game designer, Peter Moleneux's work, and his childhood inspiration in creating games such as *Black & White* in which we see the impact of a player's choice which "*have clearly defined consequences which are made manifest on the physical environment, much as the Romantic artists used landscapes to express allegorical or moral visions*" (Jenkins & Squire 2002, p.7).

Jenkins & Squire also argue that as technology advances so does the potential for creating new more complex spaces and the exploration of photorealistic imagery and realism, citing the work of Warren Spector and the game design in *Deus Ex (Eidos Interactive, 2000)* that in well-designed game environments (what he refers to as *possibility spaces)* amongst other factors, space should be is designed to have multiple routes of entry and exit in order to embed a sense of presence into the game.

Jenkins & Squire then move onto considering the aesthetic influences in gamespaces ranging from expressionism to romanticism and postulate that "*as game designers dig deeper into these artistic traditions, they may develop more emotionally evocative and meaningful spaces*" (2002, p.7). Jenkins & Squire make an important observation about the origins of many game designers and their visually grounded philosophy since "*many game designers are recruited from art schools*" (2002, p.7).

Jenkins & Squire's early work on gamespaces in this paper is truly revolutionary; the criticality of notions such as *gamespace* and *spatiality* as a defining concept is made clear, a concept which is picked up several years later by noted game theorist Aarseth (2007) and

other noted game theorists but here Jenkins & Squire's perspective of viewing games as spatial art (as opposed to devices for narrative or play) and that they should be grounded as such on architecture/landscape art is presented as a powerful and original perspective one that over the last decade has continued to grow and appears to be increasingly important in modern design. This perspective is what also grounds this research study, and one that is further explored and developed.

Wolf (2002) presents a typology of computer gamespaces and is one of the earliest studies that attempts to classify the different spatial representations/configurations found in games. These categories at the time were well-reconciled with the range of games available, however given the expansion of gamespace, Wolf's typology does not cover the range of gamespace genres that exists nowadays, nevertheless it is still a useful foundation for perhaps looking at early gamespace typologies (**Table 2**).

Table 2: Wolf's (2002) Typology of Gamespaces

One screen, contained.
One screen, contained, with wraparound.
Scrolling on one axis.
Scrolling on two axes.
Adjacent spaces displayed one at a time.
Layers of independently moving planes (multiple scrolling backgrounds).
Spaces allowing z-axis movement into and out of the frame.
Multiple, nonadjacent spaces displayed on-screen simultaneously.
Interactive three-dimensional environments.
Represented or "mapped" spaces.

'Rules of play: Games Design Fundamentals' (2004) was a ground-breaking collaboration between Eric Zimmerman and Katie Salen, both game theorists and game practitioners. The notion of gamespace is not discussed as a main theme but is addressed under '*Games as Narrative Play*' (chapter 26). In discussing the impact of spatiality on narrative they state *"the organization of spatial features in a game is critical to the design of a game's narrative space of possibility" (ibid,* p.14).

Salen & Zimmerman do not consider *gamespace* to be a recent phenomenon since they mention that games have existed in the real-world spaces, the electronic revolution merely introduced new gamespaces. The authors echo Adams' (2009) perspective on the impact *of spatiality,* within the study they discuss space in the abstract/metaphorical sense but later discuss gamespace in the literal sense. Interestingly they move from discussing the *space* of possibility (citing acclaimed games designer Warren Spector's 'possibility spaces') into narrative *place,* one of the first works on game theory that notes (although as a passing reference) the relationship of space and play in the context of digital games.

Espen Aarseth, a noted ludologist, discusses the concept of spatiality and the relation to real space in his essay '*Allegories of Space: The Question of Spatiality in Computer Games' (2007).* Aarseth's opening line "*The defining element in computer games is spatiality*"(p.44), lays down his position on the importance of space in video games, which he refers to as spatial practice and proposes *that "both representations of space (given their formal systems of relations) and representational spaces (given their symbolic imagery with a primarily aesthetic purpose)*" (p.44). Aerseth suggests that games can be classified on their implementation or representation of space; this is not an unusual position to take, however Aarseth believes that "*Games celebrate and explore spatial representation as a central motif and raison d'être*." (ibid,p.44) more than time, more than events, actions or goals and more than characterisation, and that innovation is taking place in spatial representation, since nothing "*much has changed over the last two decades."*

Aarseth then discusses space, and here Aarseth provides an insight into why he is considered one of the most cited and respected contemporary game theorists. Aarseth, in discussing the concepts of space and place, cites the work of philosopher Anita Leirfall, and the criticisms she makes of cyberspace theorists who confuse notion of space and place. Aarseth states "*a place is always a limitation of, or in, space. Place can never exist independently of its spatial origin*". (*ibid,* p.44). His consideration of space and place reduces a 'place' to a sub-element of 'space' and is somewhat a reversal of a traditional architectural notion of 'place' being, such as Edward Relph's (1976) theory of place and placelessness. Aarseth's theorizing appears to be first within games literature to discuss this critical aspect of place and space, and whilst he does not develop it further (in perhaps developing principles guiding games design and practice) it is still a notable early occurrence in the subject of gamespace.

Aarseth uses the works of two philosophers, Henri Lefebvre and Anita Leirfall to ground his notions of space, place and spatiality. By using the two different spatial

philosophies he attempts to reconcile and unite them into a useful frame of reference; his essay can be viewed as more of a philosophical discussion on the concept of gamespace, rather than a developing/proposing guiding principles or a typology/taxonomy of gamespaces similar to Wolf (2002) or Boron (2007).

Aarseth analysis is also fairly limited as he refers to only two actual games, Myth and Myst in order to illustrate his theory, the games in question are now over two decades old, given the pace at which the medium has progressed (as of 2015) the diversification of spatial representation in games has evolved significantly (i.e. immersive virtual reality technologies such as the Occulus Rift is one particular example) introducing new experiences for players and with this, new design problems.

Aarseth finally argues that "*computer-generated landscapes makes them quite different from real space, and controlled in ways that are not inherent to the original physical objects they are meant to represent. This makes them allegorical: they are figurative comments on the ultimate impossibility of representing real space*" (ibid, p.46). He also states "*gameworld design must defer to gameplay design*" (ibid, p.47) clearly signposting his belief that the gameworld (including the gamespace) is there to serve the function of gameplay.

Aarseth ultimately suggests that games are allegories of space as "*they pretend to portray space in ever more realistic ways but rely on their deviation from reality in order to make the illusion playable*" (*ibid*, p.47).

Boron (2007), in his essay 'A *Short History of Digital Gamespace')* presents a typology of computer gamespaces. He lists 15 separate categories, from an historical perspective the work is grounded and focused on particular game exemplars and the discussion within each gamespace is limited to describing the representation of space within the game; there is very little discussion or expansion of his ideas. Boron (2007, p.31) comments on the relationship between immersion and realism: "*The assumption that greater realism equals greater immersion still holds true, and many games have and are still advancing in this direction. As processing power improves, a digital game's graphical output will increase, and the result will be an improved simulation of reality in whatever genre the game belongs, be it fantasy, sport, driving simulation or so on".*

Stephen Walz (2010, p.124) interestingly notes the difference between environments found in games and other media in that "*games create sustainable environments that go beyond*

the realm of film and television". The work focuses on notions of space and spatiality, and suggests an analysis framework for investigating gamespace. Walz uses his framework to critically discuss 'playgrounds' and maps out the dimensions of conceptual gamespace from a game research perspective by reviewing major research advances in the field of game studies and game design, as well as architecture and urban planning. These dimensions are: *locative, representational, programmatic, dramaturgical, typological, perspectivistic, qualitative, form-functional, and form-emotive* (*ibid,* p.117).

In reviewing types of playspace (nature) Walz states "*player plays against himself and against nature's architecture*" (*ibid*, p.165). He illustrates a key point in regards to the relationship between natural landscape architecture and gameplay: that the environment itself functions as an opponent. Walz concludes by relating the gamespace dimensions to the playspace dimensions (player, modality, kinesis, enjoyment, context and culture). His analysis and discourse on gamespace are incredibility detailed, his methodology is clear, his arguments and notions are grounded on both strong theoretical foundations and his review of the relevant areas of study are in-depth.

If we are to review the most recent work on architecture, gamepspace and landscape, Phillip Penix-Tadsen's (a specialist in contemporary Latin American cultural studies) forthcoming book titled '*Cultural Code: Video Games and Latin America'* (2016) is the most published work on the subject and discusses landscape and gamespace in the context of Latin American game design. Penix-Tadsen argues that gamespace is not an easy concept to define in an absolute manner due to the *"broad range of spatial frameworks that have been used over the history of the medium"* (2015, para.2). These have include text adventures, early 2D fixed planes, pseudo 3D, full 3D open world and now VR and AR environments. In his analysis he uses video game artefacts to illustrate the theoretical concepts of how gamespace functions in video games. Penix-Tadsen, similar to Wolf (2002) and Boron (2007) presents a taxonomy of what he refers to as "*prototypical spatial frameworks of video games*" as each of these types *"have unique implications for the gameplay experience*" (2015, para.26). This typology/taxonomy of gamespaces is similar to previous work undertaken by Wolf (2002), Boron (2007) and Crawford (1983) but is substantiality more narrow.

These include:

1. **2D Planes**: A game that employs a flat space (i.e. x, y coordinates)

2. **Miniature worlds**: Interestingly Penix-Tadsen includes the control of several characters rather than a single one in this classification; the game may be two dimensional or use an isometric perspective
3. **Platformers**: A game where players progress over platforms and experience is derived via repetitive manoeuvres.
4. **3D Environments**: A game where players are able to move freely or where spatial exploration is constrained in some manner in exploring and interacting with a world. He argues that 3D environments are now the dominant spatial framework for modern mass market games and include openworld (sandbox) games.

Penix-Tadsen argues that players 'inhabit' gamespaces and in doing so build cognitive maps, as they progress through exploration, build experience and convert the complex cognitive map into an 'inhabited space'. He goes on to further discuss interesting relationships between game events and the concept to eventual space and ultimately how gamespace is "*an environmental context for the active creation of meaning*" (2015, para.5). He concludes his analysis by stating that spatial frameworks have a "*profound effect on a video game's potential for creating a meaningful experience for the player*" (2015, para.28) and that each gamespace has its own peculiarities that have implications on a game's ability to entertain, challenge or emotionally impact the player. He cites numerous games within his analysis however they are culturally linked to Latin America. Whilst this does not preclude his work being applicable to gamespaces, the wider cultural context may have an impact and as such needs to be considered.

As discussed above gamespaces are complex experienced spaces and as such game theorists have argued external principles of spatial experience (buildings, architecture, landscapes, landscape design) should be applied and are a far more appropriate perspective from which to design these spaces from. The traditional role of game designers and/or level designers I would argue are now not able to fully satisfy the demands required by modern gamespaces as they are diversifying, and increasingly using current paradigms of games design will struggle to meet the new capability and demand. Given the evolution of gamespace and the early indicators we are entering a new era (emergence of VR and AR gamespaces), the demand and the capability of modern games technology to deliver new possible experiences, but can external disciplines be grafted or embedded to develop new paradigms of design to meet the ever growing demand?

In order to investigate this, the review will first look into the role and importance of level design, providing a brief history demonstrating how the role is changing to meet expectations and demands of the growing medium and then examine the divergence and diversification of contemporary games design theory and practice, further highlighting the growing importance of the role of architecture within level design.

2.7.3 Section Summary: Gameworlds & Gamespace

- Game space has evolved significantly over the last 30 years from simple limited 2D fixed size space to massive 3D spaces to completely immersive virtual reality spaces (Wolf, 2002; Boron, 2007)
- Technology has changed the nature of gamespaces faster than games design is able to effectively use this new freedom and new challenges and potential as it's more closely aligned with natural world.
- Gamespace creation is currently more the domain of artists and not designers (Jenkins & Squire, 2002).
    - Game spaces are experienced spaces and as such principles of spatial experience (building, architecture, landscapes, landscape design) can be applied and are appropriate (Jenkins & Squire, 2002)
    - Game spaces have implications for other design elements beyond an artist's capability and visual style; impact can include implications for narrative and storytelling (Jenkins, 2007, p.56).
- Games are increasingly becoming openworld, massive and complex; this is set to change further with the advent of VR and AR technologies (Fox, 2010; England, 2015).
- The openworld games are utilising representations of existing and/or fictional natural environments to create new persistent gameworlds.
- Game designers are struggling to satisfy the demands required by modern gamespaces as they are too diverse, complex and are growing on an exponential scale due to lower technological constraints.

2.8 **Level Design**

2.8.1 Defining Level Design

In order to expand on the terms and attempt to consider the impact of level design, first we need to consider some key definitions of level design:

> "*Level design is the thoughtful execution of gameplay into gamespace for players to dwell in*". (Totten, 2014, xxiv)

> "*Level design is the process of constructing the experience that will be offered directly to the player, using components provided by the game designer…..Level designers take the game designer's general plans for levels and make them specific and concrete*" (Adams, 2009, p.359)

> "*Every game takes place in an environment, and that's what level designers must provide - putting the "ground" in playground. A level is really a container for gameplay*" (Byrne, 2005, p.7)

> "*All a level designer does is arrange the architecture, props, and challenges in a game in ways that are fun and interesting - Level design is just game design exercised in detail*" (Schell, 2009, p.343)

> "*Level design is as much an art as it is a science; it requires artistic skills and know-how as well as an extensive technical knowledge*". (Bleszinski, 2000)

Ed Byrne is a level designer at Amaze Entertainment, that have produced games such as the *Harry Potter* series and UbiSoft's *Splinter Cell;* his book '*Game level Design*' (2005) discusses the fundamental principles, concepts and definitions of level design for artists and designers since "*level design is currently one of the fastest-growing disciplines in game development. Level design has often been discounted as an offshoot of art or design, but the craft of creating game levels has many unique challenges, principles, techniques, and rewards all of its own*". Byrne indicates the rapid expansion of games development and fragmented and diversified the roles in games production that arose "*out of a need for specialization within game production teams*" (p.9).

The definitions above reveal both a shift in the responsibility from the game designer to the level designer as well as the subservient relationship between the overall game designer and the role of a level designer whose role is to detail and implement the overarching games design. Byrne also points to the critical role that level designers bring to the modern

development teams as the player ultimately experience the game through its levels (p.3). The above definitions reveal key terms that emerge as constituent elements or considerations of level design; significantly these are *gameplay, gamespace and environment/architecture.*

The term 'level' has its foundation in early video games history. Early arcade game used the term 'level' to signify a specific section of the game, a slice of the entire game experience that would often culminate in a final obstacle or fear to accomplish (such as defeating an enemy boss); these missions/stages would enable the developers to both plan incremental levels of difficulty and challenge in each of these stages, and for players to keep track of their progression and accomplishment, knowing the total number of 'levels' in a particular game enabled gamers to share an early collective oral scoreboard (i.e. having reached Level 10 out of 10 indicated mastery of the game).

Rogers (2014, p.197) provides definitions for the term 'level' that change depending on the context of the word:

a) Indicates a specific location of environment within the game (i.e. the jungle level in *Goldeneye*)
b) Used as a counter by a player to indicate progression (i.e. reaching level 20 in *Candy Crush*)
c) Used to indicate the rank and progression of a player based on experience or game score (i.e. reaching level 29 in *Destiny*)

However contemporary games have broadened to now cover an extensive range of genre, with Stahl (2005) listing eleven main categories, whilst Adams (2009) lists nine and Crawford (1983) lists twelve, so any definition should be applicable to the entire range in order to be a useful generic definition. So given Byrne's (2005) definition appears to be most easily reconciled with the array of game genres and level structures; he states "*At its most basic, a level is simply an environment for gameplay"* (p.7).

Contemporary usage of the term in games development is due to several reasons which Byrne (ibid, p.10) discusses:

1. Within larger games development, levels allow the developers to break up the game experience into discreet blocks which can be geographically or narratively sectioned.

2. To allow developers to work in parallel on a game, similar to a film shoot, segments of the game (referred to as levels) can be created and worked on out of sequence, and then brought together in final build.

Byrne (ibid, p.3) also illustrates the core disciplines of level design. **Figure 8** illustrates his perspective of level design as a funnel, and as a "*point of convergence for programming, cinematography, audio, art, and design*".

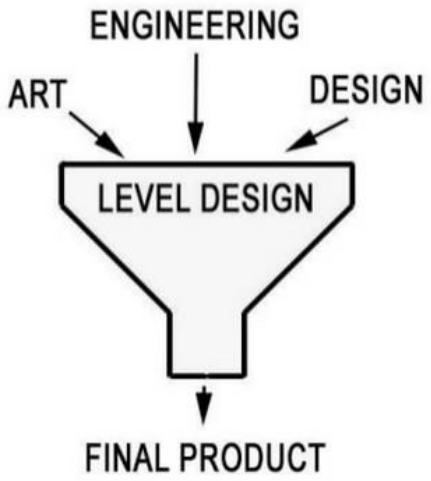

Figure 8: Elements of Level Design (Source: Byrne, 2005)

Byrne (2005, p.4) also states one of the core areas of work for a level designer is the virtual environment within the games, however in order to create these now more extensive and bigger environments, level designers "*must have some measure of artistic or architectural sense*". However these must be balanced against the needs of gameplay and is a constant struggle that modern level designers face. He also notes that the role of level designer, given future trends of games becoming more complex and therefore requiring more content will fragment again, given the focus on gameplay since now *"many teams are adding art support staff to help shoulder the burden of creating engaging aesthetics and allowing the designers to focus on the play experience"* (p. 4).

As noted previously games design and level design (not to be used interchangeably) are still an emerging discipline, embodying a range of different interpretations, which has become more complicated since the range of contemporary games development now spans between areas. These can be broadly categorised as follows::

- **AAA**: Commercial games development, often made up of several studios working internationally on games where development teams can range from 50-400, budgets rivalling and in fact in some circumstances surpassing the budgets of Hollywood Blockbuster films or even the GDP of some countries (WOW) and with production schedules lasting several years.
- **Indie**: Often non-commercial, experimental, avant-garde 'casual' games development industry that has significantly smaller budgets/teams sizes (thousands to tens of thousands of pounds as opposed to millions).
- **Serious**: Academic or other organisations appropriating games technologies.

One study presented to the Game Developers Conference in 2015, an internationally renowned annual conference for games developers, attempts to present the dimensions of contemporary level design in games as a grounding to indicate possible future trends. Robert Yang, an indie game developer, academic and writer, in his GDC 2005 keynote presentation '*Level Design Histories and Futures'* (2015) proposes that there are four possible dimensions of contemporary level design:

1. **Level design as materials, construction and data:** Yang's first dimensions located level design as a production term i.e. "*LEVEL = a bunch of data (asset) that references a bunch of other data (other assets)"*
2. **Level design as profession/industrial process:** Yang attempts to define the term of 'Level designer' noting that every studio determines their specific version of what the role is and should be, and that his definition is "*as a role/identity defined mainly by the needs of mass industrial (AAA) game production*". Here Yang illustrates his point in the difficulty of defining level design by making a comparison of level design jobs, not across developers but within a single AAA developer *Crytek* from 2001 to 2008 to 2012, one thing is apparent the role has grown significantly, diversification of role into 'technical level design', a new term and role that has emerged in the games industry as a "*bridge between level design and other departments that are more technical*". He also notes the term 'level designer' has been fragmented into several smaller roles in modern 'AAA' games development; the traditional role and term is no longer sufficient to encapsulate the range of actual job titles in games development: tech level designer, level scripter, level builder, level architect, lighting designer, combat designer ,encounter designer ,quest designer, content designer, etc.

3. **Level design as formalist theory of virtual architecture:** Yang proposes there are two ways to design:
    - The "wrong way" is designing room-by-room similar to an art-test or a diorama i.e. environment art. Here Yang Illustrates his point with reference to a well-known art test (often referred to as the *harbour environment art test*)
    - The "right way" to designing is to follow a process of sketching, blocking-out, grayboxing, rough-out, and then to iterate.
4. **Level design as politics and community dialog**: Here Yang argues that form does not follow function but rather *form follows worldview* given there is always a context as Architecture is political citing the controversy around Maya Lin's winning design for the American Vietnam memorial and the Reagan administration's racist response once her identity became known. Yang argues that one should build for the public in a sustainable manner with community input.

Yang concludes with his ideas of the three possible future of level design:

Industrial: mainstream fixed grammar design to drive specialized labour. This is the current and main ideology of the AAA games industry. Yang uses examples of Valve's Vista's and Ubisoft's Rational Game Design, as examples of *Monolithic design formalism* which is dictated by the developers. Yang also proposes that within the Industrial level design future, level design will become completely production orientated and that hyper specialisation (referring to Ubisoft's Ed Byrne) of level design will occur (amusingly citing the fictional level design role of a "junior rock rotator").

Cyborgmachine: collaboration tool assisted human-procedural hybrid. Yang's second possible future is where many formalisms (i.e. grammar/tools) of design will exist side by side and be utilised depending on demands of the particular type of game. He proposes that the human-machine authorship would expand as technology orientated level design would be the key driver.

Local postmodern: process-oriented social practice, heavily conceptual. Yang's final category proposes that level design will become truly democratized, local level design becomes the dominant paradigm where top down AAA formalism is no longer the main ideology driving level design and that the local player community determines the design

grammar in a process orientated design; consultation with the community is key. Yang also offers a critique of this possible future as "*slow, labour-intensive, unpredictable*".

Yang's final conclusion is that the traditional notion of level design is dead, since it is no longer a large singular monolithic practice, but rather what he refers to is *Intersectional level design,* one that utilises as many design traditions as possible depending on the context, one of the design traditions that has appeared to align with the growing demands of level design particularly well is Architecture, and the impact and importance will be discussed in the following section in order to further support the main arguments of the thesis.

2.8.2 Section Summary: Level Design

- Level design is a convergence for programming, cinematography, audio, art, and design
- The role of Level design is to detail and implement the overarching games design.
- The significant constituent elements of level design are gameplay, gamespace and environmental architecture.
- The role of 'level designer' has been fragmented into several smaller roles in modern 'AAA' games development; the traditional role and term is no longer sufficient to encapsulate the required range of tasks in games development
- A unified Monolithic level design is unlikely to emerge however *Intersectional level design*, one that utilises as many design traditions as possible depending on the context is more likely (Yang, 2005).

2.9 The Importance of Architecture

The review so far has looked at the early notions of architecture in games, however the critical importance of using architecture both for the discipline itself and for the games industry has not been fully discussed.

Jon Brouchoud (2013), one of the founders of ArchVirtual a company specialising in VR design and technology in his article '*The Importance of Architecture in Video Games and Virtual Worlds'* discusses the current and future use of architecture in video games. Brouchoud has grand vision for virtual architecture as something that "*might break free from the bonds of*

physical and budgetary limitations and become something so much greater" (2013, para.9) and argues the benefits of virtual game architecture over physical architecture:

- Virtual game architecture can be dynamic, interactive and respondent to real-time inputs and stimuli, only limited by the architect's imagination.
- Virtual game architecture is far more resilient and 'shareable' than its physical counterparts; traditional architecture is limited by its physical nature i.e. single lone instance that it fixed to a single point in time and space, however virtual architecture can be shared on mass and entire gameworld, replete with a variety of virtual architectures can be stored on a small hard drive that fits on a single palm, and whereas a physical building will eventually fail he argues that "*500 years from now, there's a good chance you'll still be able to play an old copy of Skyrim, but what will be left of the physical city artifact that exists today? They'll be ruins at best*" (*ibid*, para.29).

Brouchoud echoes Aarseth's (2007) opinion of the power or architecture/space in that it is able to tell a story, evoke emotions and impact player experience more than other aspects of a game, and without an equivalent approach in its design, gameplay will never reach its full potential. However Brouchoud (2013, para.9) is critical of the usage of architecture in current games development referring to the use as a "*largely a knee-jerk regurgitation of some of the worst habits and vestiges of real world design practice, littered with cliché and after-thought design gimmicks*". He posits that perhaps this is due to designers assuming that players either do not care or are not able to perceive the subtleties of architectural design, and only in some instances there is evidence of careful design "*toward a deeper, more powerful (and meaningful) player experience*" (*ibid*, para.10).

Brouchoud does however recognise the nature of real world games development, recognising the intentions of the designers versus the reality that many often face as it progresses through actual production or as he states "*go through the measurable*" (*ibid*, para.14) and by the time the game has moved from the initial designer's concept to a working prototype (often referred to as an alpha) it may well have lost its magical essence. Brouchoud summarises his beliefs about the power of games and the impact on traditional architecture, believing that one day, virtual Architecture will surpass the constraints and boundaries of physical architecture as it "*holds the potential to evoke an even deeper connection to [Christopher] Alexander's 'quality without a name'; becoming almost transcendental*" (*ibid*, para.26), and that

virtual environments deserve to be recognised as more than a support mechanism, but rather a focal point, the raison d'être of a game, in line with Aarseth's (2007) belief.

Brouchoud beliefs are echoed by Schell (2009, p.3) who states games designers "*…will be designing more than buildings – you'll be designing whole cities and worlds. Familiarity with the world of architecture, that, understands the relationship between people and spaces, will give you a tremendous leg up in creating game worlds*" and by Davidson et al. (2007, p.13) whose views on the future of architecture and game design align with Brouchoud in both disciplines feeding off each other in a mutually beneficial manner "*…creative worlds [architecture and game design] could benefit from a mutual exchange: by emulating the complex conceptions of space and design possibilities of the former and by using the expertise, interaction, immersion and spatial fun of the latter. Game designers and architects can forge the future of ludic space-time as a new form of interactive space, and they can do so in both virtual gamespaces and physical, architectural spaces; this is the 'next level'*".

So given architecture appears to be aligned and useful as a complimentary subject, what are the major theories or contemporary usage of architecture in games design theory? This will be discussed in the next section.

2.10 Architecture and Games Design Theory

The use of architecture in the context of games design was perhaps first communicated by Ernest Adams in the long standing and widely recognised game development website '*Gamasutra*'; which is dedicated to the art and business of making video games. In the article '*Designer's Notebook: The Role of Architecture in Videogames*' (2002) Adams proposes architecture in games has both a primary and secondary function. He states *"The primary function of architecture in games is to support the gameplay"* (para.7). This is done by defining the challenge in the game and the four main ways in which it occurs are:

1. **Constraint:** Architecture sets boundaries that are established to limit the freedom (i.e. movement) of the player
2. **Concealment:** Architecture can be used to conceal objects or players from the player
3. **Obstacles or tests of skill:** Architecture can be used to create physical puzzles that can be overcome either by logic or hand-eye coordination; these can come in the form of a chasms, cliffs or trapdoors.

4. **Exploration:** Adams states this is different to the third as "*exploration challenges the player to understand the shape of the space he's moving through*" (*ibid*, para.12).

The secondary (highly valuable) function of architecture in games is as Adams states "*to inform and entertain in its own right*" (*ibid*, para.20). He then proposes seven ways in which this occurs/achieved:

1. **Familiarity:** Existing real world locations offer cues to virtual world counterparts functions, but these familiar locations should meet player expectations; breaking this would amount to 'cheating'
2. **Allusion:** Referencing real objects or styles, borrowing from the physical world in order to take advantage of pre-existing emotional connections
3. **New worlds:** Gameworlds can often be pure fantasy, at the risk of the player losing emotional resonance and becoming confused, subtle architectural cues (such as naming) can provide additional context.
4. **Surrealism:** When connected to gameplay architectural surrealism, it can help create a sense of mystery and help establish the context for rules of the gameworld.
5. **Atmosphere:** Aesthetic considerations can inform how the player will feel
6. **Comedic effect:** Not all game world require the use of serious architecture and can be created to evoke emotions aligned to gameplay
7. **Architectural clichés:** Similar to familiarity, architectural clichés are in essence the 'hyperreal'; they use stereotypes to set player expectations and the scene quickly.

Adams' does not discuss how the categories for both the primary and secondary functions of architecture were derived i.e. observations through personal practice, experience of playing game where the phenomena were observed, so given this and the lack of appropriate examples of existing games to support his arguments (single instance of games were used) it is difficult to say that at the time this was an accurate representation of the usage of Architecture in games, over 14 years later, his notions are difficult to align with the reality of current usage of architecture in games.

Adams (2002) also falls into the common pitfall of only interpreting 'Architecture' as habitat (buildings) hence there is no discussion of 'landscape' or 'nature' 'wilderness' in reference to games design, however there are a few instances of the word "landscape". In his conclusion, Adams refers to Architecture "*meaning both landscapes and structures*" (*ibid*, para.29) but then does not discuss landscape architecture in any capacity, which is unusual

given that Adams earlier in the article discusses and cites experience of the impact of natural spaces and the difficulty in presenting these types of experience in games. He states "*Games do have a problem portraying outdoor spaces. Because of the limitations of looking at a monitor, we can't create sweeping vistas or panoramas that feel like the real thing. If you've ever tried to photograph the emptiness of a desert or the Great Plains, you'll know what I mean*" (*ibid*, para.7).

Adams concludes with noting his belief that architecture is as important as character design defining the player's visual experience of the game, as it has greater implications for providing the player with valuable information i.e. location, future events and in some instances informing possible player actions. Adams concludes with remarks about the future of games art education (an unusual term since the article is centred around games design and not game art) in that artists should *"routinely study Viollet-le-Duc and Vitruvius, Gaudí and Gropius*" (*ibid*, para.29) all seminal figures in traditional Architecture, with a view to ultimately making better games.

So far the review has identified the growing importance of Architecture as a discipline that appears to be naturally aligned to the growing demands level design, given the emergence of new roles such as world architect, however given the rapid evolution of games design and development the following section reviews contemporary (2015) games design & architecture theory and practice in order to demonstrate the current 'status quo' and identify and any potential 'gaps' in emerging games design theory.

2.11 Contemporary Games Design & Architecture

Given the rapid evolution of games as a medium and the emerging discourse around games design methodologies and theoretical frameworks in order to continue the analysis of the evolution of design with a view of identifying future trends, we must look at contemporary approaches to games design that are derived from an architectural perspective.

During a review of the literature on architecture and game design Christopher Totten's work (2014) was identified as the most recent academic/practice study concerning Architecture and games design. Totten is a 3D game designer and animation professor who studied architecture and authored the book *'An Architectural Approach to Level Design'* in 2014. The book originally started out as Totten's thesis for his Master degree in MA in

Architecture, which started out as a whim after playing Valve's *Half Life game*[3]. Totten followed this up with emails to a senior level designer at Valve (a games development company recognised across the world for both its games (e.g. *Half Life, Portal*) but also its digital games distribution network *Steam*. Chris Chin, a former architect himself, guided Totten through the initial idea, which finally led to a book on the subject by Totten. The book is described by the publishers[4] as "*one of the first books to integrate architectural and spatial design theory with the field of level design.. It explores the principles of level design through the context and history of architecture, providing information useful to both academics and game development professional*".

A review of Totten's (2014) work revealed the following:

- The work is extensive in providing in-depth analysis and discourse of information and guiding principles on architecture and games design, at close to 400 pages, the work represents a contemporary landmark study in the field of architecture and games design.
- It is grounded in game design principles of long established and recognised game theorists such as Eric Zimmerman, Katie Salen, Andrew Rollings and Ernest Adams to name a few.
- History of Architecture: provides grounding for proceeding recommendations, principles in relation to games design. This is incredibly useful for novices, especially those from a gaming background to be inducted into what can be an overwhelming subject to enter.
- Non digital level design techniques: Totten offers advice and practical guidelines drawing upon basic architectural techniques
- A variety of level design workflows is discussed, including those from the industry (e.g. Nintendo Power magazine)
- The book offers an extensive overview, analysis and ideas on gamespace, both physical historic gamespaces such as the labyrinth/maze and emergent spaces. Totten also proposes an evolved form of the gamespace with ideas of 'reward space' i.e. earning a vista. This is perhaps Totten's greatest and most insightful contribution

[3]http://www.gamasutra.com/view/news/22240/Academic_Outlook_How_Game_Design_Can_Change_Architecture.php+architecture+degree+in+games&cd=4&hl=en&ct=clnk&gl=in&client=firefox-a
[4] https://www.crcpress.com/An-Architectural-Approach-to-Level-Design/Totten/9781466585416

within the study as the arguments he presents are strong, justified and are founded on long-established architectural concepts (such as the maze structure).

- Linking of emotions to level design (through survival instincts i.e. prospect and refuge). Totten connects level design to immersion and feeling, which many other game designers sometimes gloss over. His range of emotions is limited to primarily instinctual rather than the more developed range of emotions and is grounded on theories of human motivation (such as Appleton's Prospect and refuge).
- Sound and music: Totten does not limit his game design methodology to purely aesthetic (art) considerations but discusses the enhancement of level design through ambient sound and music
- Totten discusses the relationships between storytelling and gamespace: specifically environmental storytelling which is a recognised and critical aspect of how the environment can serve other aspects of the game and influence gameplay.
- Recognition of environment art's contribution to forming an emergent game narrative (i.e. creating the mis-en-scene)
- The importance of "Worldbuilding" and the concept of 'possibility spaces' (Salen & Zimmerman, 2004)

Totten's work presents the most advanced and up to date discussion in applying traditional architecture to level design. The work is ground-breaking and truly unique; he is one of the first (and only) architects working in the field of games development (as of 2015) to have written and developed an extensive discussion and argument on why architectural principles can and should be applied to the process of games design.

However despite the originality of the work, there are criticisms to be made of the approach and grounding of Totten's work. Totten's guide is not focused at practised-based methodologies, although he discusses workflows, the work is primarily aimed at presenting guiding principles of games design rather than an exact *how to* guide. The section on 3D workflows (introduction to engines) is merely that; a very basic overview of game engines' particulars, digital level design tools is reduced down to a couple of pages. What would have been useful is a step-by-step guide in applying the theoretical principles to an actual games design from concept to completion. There is no real discussion of a full pre-production to post-production practice-based development cycle, there is no link between Totten's architectural principles and either AAA or indie development, both of which can

have very different productions realties. Although Totten cites examples of actual games design across the 2D and 3D genres, there is little discussion on the difference between designing for 2D and 3D gamespaces (apart from camera considerations). Virtual and/or augmented reality games design is not addressed in any way, either as gamespace or as technology. This is somewhat understandable as the technology was only just remerging during the time of publication (2014).

The work is impenetrable at times, even with a basic understanding of architecture and an extensive background in games, in some instances is too abstract to connect to the practice of game design. There is little grounding of the work from a developer's or gamer's perspective; it is apparent that Totten, despite his declaration as a gamer is an outsider attempting to significantly impact a typically closed industry, using a grounded perspective or linking the theoretical concepts to existing games. The range of emotions covered by Totten when he addresses 'emotional level design' is limited to primarily instinctual rather than the more developed range of emotions and is grounded on theories of human motivation (such as Appleton's Prospect and refuge). There is little in the way of Totten's own feelings and experiences about space and architectural design from an artistic perspective.

There is very little reference to nature, the wilderness or the natural environment in the work, Although he clearly uses architecture throughout the book, it is heavily biased toward buildings and man-made spaces, '*landscape architecture*' is not discussed or even referenced once in the work. A counter argument would be that the work does reference and provide guiding principles for space as a generic concept that can be applied to natural landscapes, however natural/wilderness environments/landscapes are heavily featured both in games and as a subject in their own right within architecture and should have been addressed in at the very least a chapter; it is not clear if this was an oversight or due to Totten's intent. Games are references purely from a design point of view, not grounded in visual form (vast majority is diagrammatic) which potentially makes it difficult for gamers to enter through his perspective as an architect. Games and spaces are described in textual form relying on the reader to have played or experienced the space being referred to.

Although the above critique may appear to position Totten's work as ground-breaking, it would be unfair to state these minor criticisms detract from Totten's and the publisher's claim, which as one of the first books that talks extensively and specifically on games design and one that positioned architectural principles through the lens of a game designer.

Totten's work can be considered at the forefront of demonstrating the ever expanding domain of games design; it is successfully co-opting traditional disciplines, in this case architecture and games design. The book can be considered to be a leading study in the field of Architecture and Games design since it:

- Introduces new concepts that are applicable across any type of games design that involve space.
- Changes the way that gamespace is considered from a black art to a known combination of science and artistry.
- Opens up several interesting and unexplored areas of research
- Presents new methodologies and approaches for games environment design.

Totten's work arguably illustrates the most developed body of disseminated knowledge in the use and application of Architecture in games design. However one of the criticisms in the area of games design is that games design theory often inhabits a space that is separated and isolated from games design practise, i.e. games design theorists and game design practitioners often with opposing views and perspectives failing to develop consensus on issues such as the components of gameplay.

In order to further strengthen the justification for the study and to further reinforce any 'gaps' that have been identified in the review thus far the following section will critically analyse the process and development of a contemporary (2016) game (Thekla Inc. *The Witness)* that utilises Architecture as one of the key games design drivers.

2.11.1 Section Summary: Contemporary games design & Architecture

- Professionals are adapting and using other disciplines in games design; this will increasingly become more important in contemporary (post 2015) games development.
- Traditional disciplinarians struggle to enter the industry and practice/space of game design as a closed industry it is difficult to penetrate practice due to lack of understanding of the medium as well as the concept of gameplay can be difficult to align to other disciplines.
- Traditional discipline principles and framework are now being used within game design to increase immersion and deepen player experiences i.e. Character design and psychology (Isbister, 2012) and Christopher Totten and architectural games design

- Architecture is increasingly being used and recognised as a valid area of knowledge that is applicable and can be used to support more immersive and 'deeper' games design
- Architecture has been linked to games in both theoretical design (Totten, 2014) as well as and practical application (*The Witness*, 2016).
- Traditional architecture (buildings) is the most common application found in contemporary games design.
- There are no major or significant studies on natural landscape design methods in the area of computer and video games; despite evidence of design process contained in the end result i.e. in the form of game artefacts, there is however a recognition this is about to change.

2.12 Architecture and Games Design Practice: The Witness

2.12.1 Introduction

In development for over eight years, *The Witness* is a 3D puzzle heavily influenced by Cyan's 1993 classic *Myst*. Designed by Jonathan Blow, a designer who won critical acclaim for his first game in 2008, *Braid*, a 2D platform/puzzle game. *The Witness* was published and developed by Thekla Inc in 2016. *The Witness* is a 3D open world, puzzle-adventure game set on a fictional island, which sees the player explore and solve puzzles over 10 regions in order to reach the mountain; the ultimate destination and end goal of the game. The game is arguably the only identifiable instance of multi-platform commercial game that utilised landscape architects/architecture and games design and where the process and design behind the game is open to critique and discourse. There are several ways to analyse *The Witness* as a:

1. Through Play (ludic analysis)
2. Through textual analysis
3. Through triangulation of developer/collaborator/reviewer interviews

2.12.2 Cross Collaboration

Blow's approach in games design consisted of working with two different architecture firms with each firm bringing its own particular architectural expertise to the game's design:

FOURM design (for buildings and such) and David Fletcher Studios for landscape architecture. As Van Buren (2015, para 3) stated "*Architects and landscape architects know that a building is a mark on the land in a context. No building should be designed without considering the landscape it is a part of*".

This can be considered to be a remarkably risky and unique step for a games development company to take given the cost of bringing in these specialist firms in addition to the development to experiment in creating a new and untested architecture-driven design methodology, as well separating the two distinct areas of architecture: landscape and buildings. Deanna Van Buren, one of the founders of the FORUM design studio was one of the main architects on *The Witness* and described the experience as "*one of the single most creative and exciting experiences of [her] career*". (para 4). Recognising the pains of cross industry collaboration, she notes that when successful "*the results can generate beauty and innovation*" (para 2), ultimately defining her experience as "*gaming with gravitas*" (para 2).

2.12.3 Barriers to Collaboration

Van Buren (2015) also provides valuable insight into an architect's perspective of games/games design and development and possible reasons why collaboration had not occurred previously. She states that these beliefs held by developers and architects "*may be interfering with a collaboration that could both expand the design and development of physical architecture and video games as an art form*" (para 7), and focusses on the following:

- **Perception of Games and Industry:** "*Architects often don't play games or see how they can be of service. Many think it's all about coding and that we need to have this skill. I also think architects may not see the value of the video game industry and its products*" (para 5). Van Buren's sentiment echoes what many still express in established professions: they do not play or understand games nor the games industry and the development process. She admits that she herself was ignorant of games design and development prior to her experience on working on *The Witness.*
- **Perception of Architects:** Van Buren reflects on her experience on working with game developers and artists and stating that they "*think they do not need architects and do not understand their value*" as they are possibly perceived as 'outsiders as "*After all, they are not trained in the video game industry*" (para 6) or they "*just don't understand architecture or landscape design*" and this was not surprising "*given that it is a highly*

specialized field where people study for up to seven years in college to absorb and develop design skills" (para 6).

- **Resource Implications:** Blow admitted he had invested his entire fund from his earlier game *Braid* into the development of *The Witness*, which according to his latest blog[5] was over 5 million USD and that the "*$5million in revenue is not enough to recover it yet*"[6], There is unfortunately no mention of how much this specialist support costed Thelka Inc. but as Van Buren (2015, para 6) stated "*An architect's hourly rate is roughly that of a senior game artist*" , given the competitive nature of games development and the limited budgets, this would have serious resource implications in any games development budget and one that would need justification especially considering the 'known' value a senior artist would bring to any game project. This is further compounded by the perception held by many developers that may also perceive designers not being affordable. Blow's decision to utilise two specialist architect companies to explore and implement untested and unexplored design methodologies is as of yet still a gamble, if he succeeds then perhaps the games industry will become more receptive to his ideas given the lure of replicating his commercial success, if he fails then his innovative approach will perhaps not be explored in the immediate future by other developers, but will surely be labelled as a greater development risk given the precedent of *The Witness.*

2.12.4 Design Process

Blow expressed his intent in using architecture to inform the design of *The Witness,* again focusing on the idea of a 'designed space' (**Figure 9**), as Miller (2011, para.3) reports was the "*importance of designing a space that feels beautiful, minimal, and integrated with the goals of gameplay*". However given conventional design paradigms this is not an easy balance to find as the decision to bring in architectural principles into a game highlighted the natural tension presented by each discipline's intention and as Miller (*ibid*, para.5) reported it presented an "*interesting dilemma. Bring an authenticity to the game world, but maintain the goals of game design"*. Here we clearly see Blow referring to the intention of architecture (brining authenticity) against the goals of games design which he reported, noting the difference

[5] http://the-witness.net/news/2016/02/fun-sales-fakts/
[6] http://the-witness.net/news/2016/02/fun-sales-fakts/

between designers and architects as "*a carefully constructed flow of movement, interaction, and intention. Architects don't usually think that way*" (Miller, 2011, para.3).

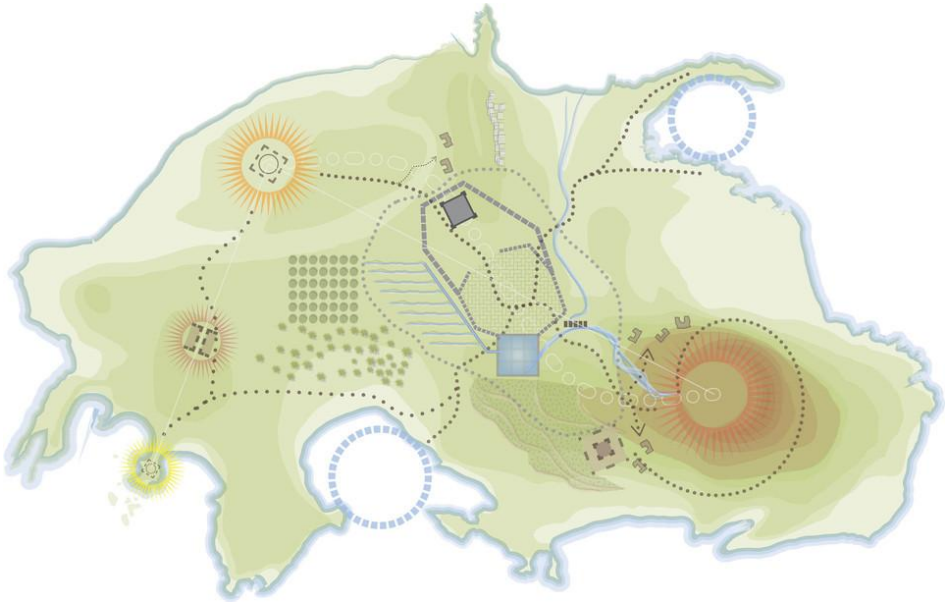

Figure 9: The Witness Island topographical design/map (Source Gamasutra.com 2016)

It is interesting to note that despite indications that the architects were involved from the very beginning of the design process, van Buren, one of the lead architects clearly indicates the architects were involved during the latter production and post-production phases (**Figure 10**), and only towards the every end of the pre-production stage. As Van Buren (2015, para.43) stated "*FOURM design studio [worked] closely with Fletcher Studio to develop the building and landscape together and return to Thekla with various options for consideration and the process often began from a prototype created by Jonathan Blow/Thelka, and only in some instances would prototypes be based on ideas originating from the two architectural firms*". The process of iterating the design of the environment was driven by the goals of *The Witness*: "*There's actually a lot of iteration and back and forth once the architects proposed what the design for a building or landscape needed to be. We go back and forth until we figure out what is going to work for the game*" (Miller, 2011, para.5).

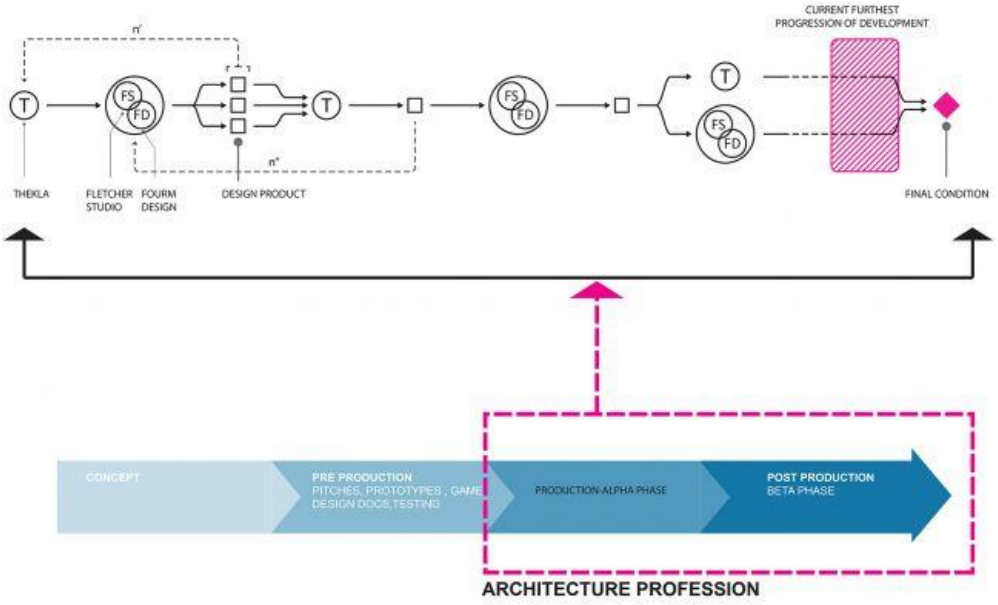

Figure 10: Overview of the Witness Production Process (Source Gamasutra.com 2016)

However the use of architecture went beyond aesthetic considerations as Miller (2011, para.5) reported: "*beyond giving the game world a more natural appearance, a deeper architectural sensibility …also allowed Thekla to draw closer links between the puzzles and the locations*"

Van Buren presents 10-point guide/pitfalls for game developers working without an architect to consider "*…that could be avoided with some design knowledge and application*" (2015, para.12). In her discussion of the experience and process used in making *The Witness*, to maintain the focus of the review only those that refer exclusively to building and not landscape /natural architecture have been omitted:

1. **Architectural narratives**: Argues that designers must consider real-world environments in order to deliver richer environments, rather than committing environments to a single period in time. Architectural narratives centre on the concept of embedding history (time depth) into virtual game environment in a non-verbal manner. The passage of time is used to "*create the narrative so the environments are a series of adaptively re-used buildings and landscapes beginning with prehistoric times to the present day and beyond*" (Van Buren, 2015, para.13)
2. **Integrating landscape and architecture:** In *The Witness*, the landscape architects helped us to understand the way the natural world develops and how to explore and adapt the

variety of amazing geological formations and bio zones to meet the needs of gameplay (**Figure 11**).

3. **Deploying materials and textures:** Van Buren recommends artists must consider the impact that properties of materials (such as texture types) have on the overall design in order to make more informed decisions about usage and deployment.

Figure 11: The Witness Island biome design (Source Gamasutra.com 2016)

4. **Scaling, proportion and style:** *Thatgamecompany's* critically acclaimed 2012 game, *Journey,* is cited as an example of consistent and coherent architectural design; one that demonstrates architecture that is "*accurate, consistent and in proportion to one another*" but at the same time as demonstrating realistic traits also helps create a fantastical world. This is achieved by consistency that gives the game a "*refined and holistic look and feel*" despite the aesthetic being distorted from reality; one is able to deviate from conventions of scale and proportion once these basic principles of architectural design are understood.
    1. **Characters and environment:** van Buren theorises that maybe the art style of the characters and the "*articulation of the environment*" if better aligned could "*improve the clarity and experience of the game*".
    2. **The space in between:** Van Buren recommends "*a diversity of spatial experiences definitely enhances gameplay*" (Van Buren, 2015, para.35).

Blow also wanted the central island in the game to have a sense of history outside the game world, as Blow stated "*What groups of people lived there, and what kind of structures did they build?*" (*ibid*, para.2) despite these not being core or highly visible parts of the final game (one would never really see these older civilisations or cultures), this 'time depth' aspect (a classification category in landscape character assessment) was a critical part of adding authenticity and gravitas to the final game (**Figure 12**).

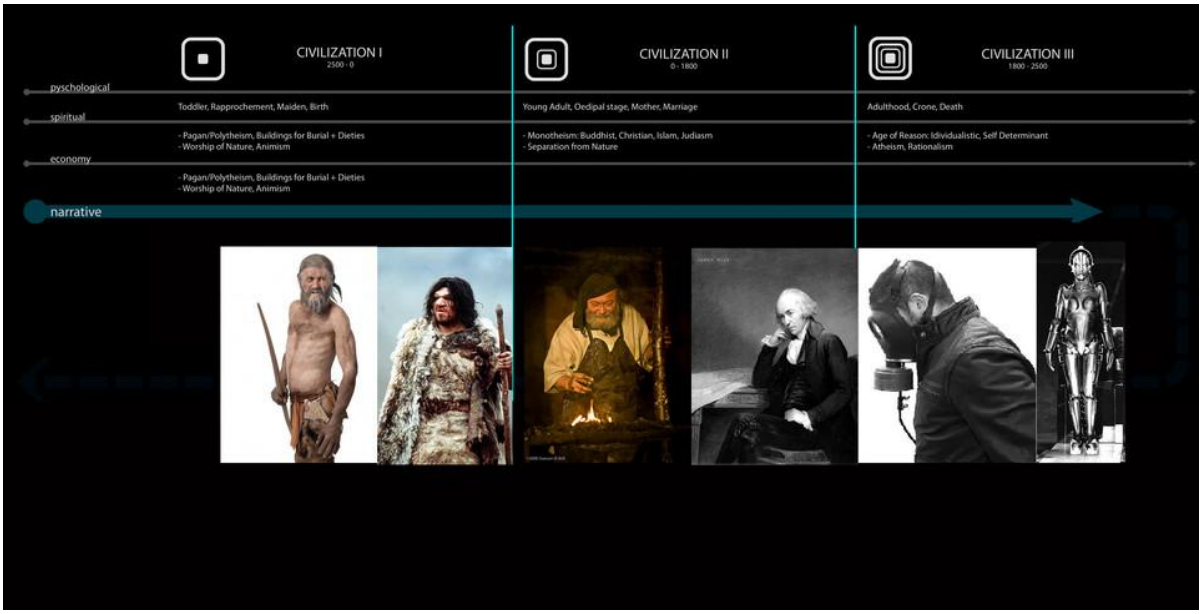

Figure 12: The Witness History/Narrative design (Source Gamasutra.com 2016)

Blow also discussed how the story in *The Witness* was linked to the architecture "*If you see the different civilizations that came to this island as embodying different philosophies …when they replaced a site….you start to get some idea of the amount of backstory that can be encoded into the world, nonverbally*" (Blow, 2011, para.4) i.e. the game's narrative integrating with the environment, once again reinforcing the concept of the gamespace architecture/ environment being capable of evoking and embedding story into the virtual environment (**Figure 13**).

Blow reiterates the importance of utilising smart architecture and paying attention to the details: "*Having smart architecture, it seems, really helps this process work, brings it alive. If you build a game where people are supposed to pay attention to details, but the details are wrong or naive or just don't have much thought put into them, then at some level the game just won't work*" (2011, para.6).

Blow emphasised the justification in using architecture-driven games design above aesthetic-driven level design, as players still retain knowledge of real experiences external to the game that they bring into the virtual gamespace in the form of stored mental patterns. *"Even if you don't know the first thing about architecture, you have been in enough buildings in your life that the deeper parts of your brain have distilled plenty of patterns about those building It can feel the difference in veracity between carefully-thought-out structural details – on the one hand – versus stuff that was just placed by a level designer to look cool"* (Blow, 2011, para.6). If these "patterns" match then believability (and therefore immersion) is increased, as Blow stated when he showed the game (as it was being developed) with these new architecturally informed design structures it "*made the game feel deeper, more serious"* (*ibid,* para.6).

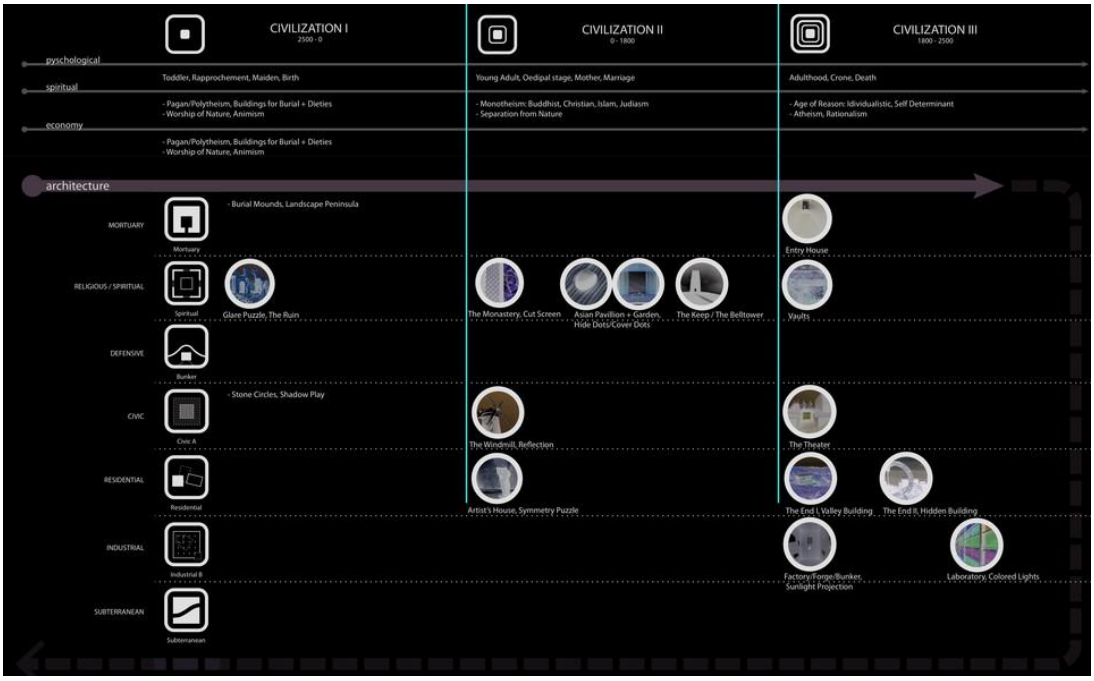

Figure 13: The Witness History/Narrative design (Source Gamasutra.com 2016)

2.12.5 Conclusion

Van Buren closes her discussion of her insight into *The Witness* arguing why designers should work with architects (2015, para 8), with her arguments falling into four key areas:

1. **Alignment of Professions:** Despite the outcomes of architecture and games being different van Buren argues that the tools and processes are similar in both professions, in addition to the multi-disciplinary client facing environment, which makes cross-collaboration "*easier to work with*". Van Buren argues that since architects

are already trained to work "*conceptually, iteratively and critically*" that adding them to a game development team is a natural pairing since both professions are aligned in practice in critical areas.

2. **Specialist Expertise:** van Buren recommends that developers working on a 3D game can benefit by thinking "*of space as more than just enclosure/envelope*" if they choose to work with an (landscape) architect since they attained in user experience, aligning gameplay with existing architectural principles is not a difficult task but elements critical to designing an immersive gameplay experience may be lost if developers do not choose to make use of an architect.
3. **Depth of Knowledge:** Architects have a depth and breadth in 3D environment design, one that may "*foster deeper immersion and enhances gameplay*".
4. **Impact of New Game Technologies:** Given the rapid technological change in gaming technologies (e.g. rendering, virtual reality), the need for architectural driven environment/games design is even more pressing in order to create more realistic or fantastical environments.

Van Buren also has wider expectations on the impact of authentic architecture in games as she believes playing well designed games will "*ultimately improve the visual literacy of our population*" (Van Buren, 2015, para 52) and subsequently envision of better real-world physical counterparts will grow as we "*[access] the power of video games to change the world around us for the better*" (para 52).

Van Buren's hopes for the future through the power of games technology reveal a powerful effect of videogames; this is someone who by her own admission was "ignorant" of video games from a personal (gamer) and professional (service provider/collaborator) perspective before her experience of *The Witness*, and after only a single collaboration, not only saw the value of the collaborating with an unconventional partner in an unexplored area in the hope of making a 'game with gravitas', but also this relatively new medium holding the potential to not only evoke passion and recognition of real-world physical environments, but to change the world around us. Van Buren's words reveal a deep transformative experience from working on *The Witness*; one from an 'outsider's' position.

2.12.6 Section Summary: Architecture and Games Design Practice:

- *The Witness* demonstrates a successful collaboration (in the form of consultancy) between a traditional architects (building & landscape) and commercial games developers.
- There was are several barriers to collaboration; namely *perception of games & the games industry outside the games industry, resource implications,* and the *perception of outsider specialists in games development.*
- Architecture can be used to bring authenticity to the gameworld whilst maintaining game design goals.
- Games design and Architecture are remarkably similar professions that align well, that share tools and processes in addition to the multi-disciplinary client facing environment and integrating them into a games production cycle is a relatively easy process.
- Architects can bring a breadth and depth of knowledge to games design that can foster deeper immersion and enhance gameplay.
- Given the rapid technological change in gaming technologies the need for architectural driven environment/games design is even more pressing in order to create more deeper and immersive gaming experiences.
- There are indications of the wider impact of authentic architecture in games, from evoking passion and recognition of real-world physical environments, improving the visual literacy of the world to subsequently envisioning better real-world physical counterparts ultimately changing the world.

2.13 The Future

Totten's work along with the design of *The Witness* mark a new era in contemporary (2015) environment design in computer and video games; one that is driven by traditional principles of architectural design. As we have seen games design emerged during the late 1970's and early 1980's as a response to the expansion of games. Digital games areas are constructed hybrid of design and technology, and game technologies, both hardware and software, have seen significant increase in capability over the last few decades.

Games design fragmented again due to the increased variety and expansion of gameworlds and the resulting gamespaces, into roles such as level designer and more recently with the emergence of openworld games, *world builder*. However, given the field and current development a unified Monolithic level design is unlikely to emerge, yet, *Intersectional level design*, one that utilises as many design traditions as possible depending on the context is more likely.

Game studies and in particular game design theory emerged during the 1990's, and as games grew games design has still not been crystalized as a field of enquiry due to its embryonic nature. However, despite innovations in games, development is stifled due to commercial pressure and constraints on resources. As Schell (2009) states: *"Making good games is hard, so developers keep their heads down, stay focused, and get the job done. They usually don't have the time to seek out new techniques, figure out how to integrate them into their games, and take the risk that a new technique might fail"* (p.xxvii).

One of the defining aspects of games is *spatiality*; however the perspective of games as a spatial art has only just emerged within game theory and has not been largely explored in practice. Architecture and game design appear to have many commonalties, and experts from both disciplines have begun to argue that the subject can be used to drive future innovation. However current architectural use within video games has largely focused on the notion of the built environment as architecture, despite the expansion and prevalence of natural environments in games, landscape architecture has been largely ignored as a potential resource driving the design of natural landscapes. Contemporary developments in commercial games development indicate a growing trend to utilise external design traditions, and other traditions to inform practice.

2.14 The Future: Identifying the Gap

The following 'gaps' in the knowledgebase have been identified:

- Natural environment design has not been explored from a theoretical perspective in video games
- Natural environment design has not been fully explored and developed from an a practical perspective in video games
- Landscape architecture driven environment design production processes (i.e. workflows and pipeline) are not as visible as other production processes in games development as such they cannot be openly challenged, critiqued and evolved and developed.
- There is an ever growing demand outside the games industry for practical guidelines and guiding principles in using games design methodologies (i.e. *gameifcation*).
- There is a lack of computer & video games design theory on the relationship between games as a space and games as places.

Chapter 3: Methodology

3.1 Establishing a Research position

At the heart of the research question is developing an appreciation and approach to the design and production of natural environments in computer and video games, as such it is imperative to establish the epistemological approach that would provide a firm grounding for the work as Crotty (1998) states: "*each of which implies a profound difference in how we do our researching and how we present our research outcomes*" (p.9).

Epistemology: the theory of knowledge embedded in the theoretical perspective and thereby in the methodology
Theoretical perspective: the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria.
Methodology: the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes.
Methods: the techniques or procedures used to gather and analyst' data related to some research question or hypothesis.

Figure 14 illustrates Crotty (1998, p3) breakdown of the research process into four key areas: epistemology, theoretical perspective, methodology, and methods.

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Figure 14: The four elements of the research process (*adapted from Crotty 1998, p3*)

Crotty (1998) proposed these elements of the research process inform one another and can be arranged in a hierarchical pyramid (**Figure 15**). The three main positions within

epistemology (objectivism, constructivism and subjectivism) were examined in relation to game and environment (landscape) design in order to establish which position I felt aligned with my practice and beliefs and one that allowed the research question to be fully (and sincerely) explored and answered.

However one must also be aware that aligning the research to philosophical position ultimately influences and drives the ontology and methodology. Norton (1999), discusses how the three are inter-linked: "*The three concepts of ontology, epistemology and methodology are related, in that epistemology is defined by ontology, and methodology is influenced by both ontology and epistemology*" (p.32).

As one surveys the literature in this area it becomes clear that recognising and stating one's worldview and personal epistemology becomes critical in framing the boundaries of the research as well as making clear the researcher's underlying assumptions about the nature of reality. As Henze (2006) states: "*A person's epistemological beliefs often stimulate, or in the alternative, set ceilings and limitations for learning and the development of critical thinking*". Henze articulates a key reason of defining our theoretical foundation and worldview for it is able to both stimulate and equally limit our learning and critical thinking.

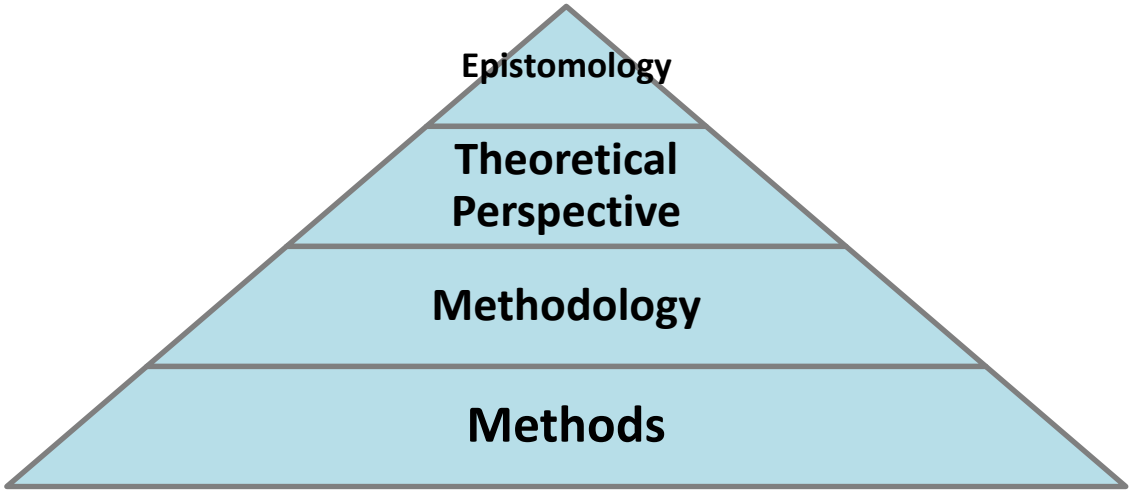

Figure 15: Hierarchal representation of the four elements of the research process (Source: Crotty (1998)

As a researcher and as an artist my worldview can be set by sometimes conflicting systems; My experiences mainly as a practitioner and academic in the fields of art and design, have meant my worldview does not follow or adhere strictly to one school of thought as is complicated by competing beliefs that have developed on a number of key experiences, of

which I discuss in my reflection on foundation practice (Chapter 4). However I will discuss two particular positions below.

As a designer my experiences have led me to believe that meaning is constructed through dialogue between the object and the subject; this is often influenced/driven by cultural or societal norms and practices coupled with one's own experiences. These design experiences align with one hiking expedition I undertook a number of years ago, where I was fortunate to be involved in a fieldtrip organised by the BMC to encourage engagement of BME communities with the natural environment. The project involved a trip to a particularly scenic area of Wales with a group of South-Asian (particularly Bangladeshi) participants. The project's intent was based on investigating the following: Why does a mountain wilderness hold different meanings across different cultures? Discussion with the climbers and locals revealed that aversion to the wilderness was mainly due to deep cultural and ethnic associations with the mountain wilderness environment (since the country of origin was particularly devoid of this type of wilderness). This resonated with all parties present and it made sense and aligned with the observable facts.

This behaviour was investigated by Kaplan & Kaplan (1977) which demonstrated environmental preferences/meaning can radically differ across different cultures. The study looked specifically at western versus African savannah landscape preferences and concluded they were radically different due to inherent affordance attributes that were negatively or positively perceived based on cultural experiences/associations (i.e. wooded area in a savannah type landscape often held threats such as lions and as such was to be avoided as opposed to western forests which offered habitat, food and shelter and as such were sought. This belief would firmly root my epistemological stance constructivism according to Crotty (1998)

On the other hand as a keen walker and landscape photographer my experiences led me to believe that objects such as landscapes have an intrinsic meaning that is separate and not dependant on the "*operation of an external consciousness*" (Crotty, 1998, p.8) and there is a transcendent quality to the natural environment. During a trip to Yosemite Park in the USA, I stood underneath the 800m falls, one of the highest in the world. The experience was profound and life changing; the immensity and power of the falls, the sound of the water hitting the rocks below, the immense refreshing and pressure felt by the cold mist hanging in the area, were all immediate. The falls had such a presence, and one that did not feel to be

constructed by me alone. This and many other experiences led me to believe it would be arrogant to assume that the waterfall and the wider world has no inherent meaning without an external consciousness; subsequently this belief would place me in objectivistic position according to Crotty's (1998) definitions of the three main epistemological stances. In fact Crotty (1998, p.8) defines an objectivist epistemology with a fitting reference to the natural environment: "*That tree in the forest is a tree, regardless of whether anyone is aware of its existence or not*".

I am torn between two epistemological stances; objectivism and constructivism; each stance is driven by particular experiences (culmination of beliefs and knowledge that I hold) I have detailed above, however these conflicting positions do not require to be resolved. Crotty (*ibid*. p.9) states epistemological stances are: "*not to be seen as watertight compartments.*"

The research is located within games design and the virtual environment; however contemporary (2015) game design studies is still an emerging field (Salen & Zimmerman 2004) and the area of environment design is almost non-existent, subsequently this makes the analysis and reflection of epistemological positions taken by peers in a similar field extremely problematic. However the research domain also partly lies in the more traditional discipline of landscape architecture. If we assume that landscape design in the physical world can be applied to the virtual spaces there is a wider body of knowledge from which we can investigate the impact of epistemologies in relation to role of environment /landscape designer; Calorusso (2002, Chapter 2) offers such a discussion in describing the various epistemological stances in relation to a landscape architects position/constraints as illustrated in **Table 3**. Calorusso (*ibid.* p.13) suggests that a landscape designer can only really be effective if they adopt a constructivist approach since objectivist-driven design simply becomes "*a matter of finding universally understood symbols*" and that "*the designer is merely a puzzle-solver*", which is most definitely a part of landscape design but it should '*extend beyond this limited role*' as opposed to if a constructivist approach is taken where meaning is "*constructed through the interaction between the site and the user*" (*ibid*. p.13). This is far more appealing as a philosophical stance as the role of design is "*to understand the nature of this interaction and encourage and shape it…*" (*ibid*. p.13).

Calorusso's position is reinforced by analysis of artefacts within the *Virtual Landscapes* project i.e. the meaning of the virtual spaces was different depending on aspects such as culture/heritage. This made the design of these spaces much more complex since as Crotty

(1998, p.8) states that "*different people may construct meaning in different ways, even in relation to the same phenomenon*".

Table 3: Philosophical Positions aligned to landscape design (Source: Calorusso (2002)

Philosophical Stance	Definition	Landscape Design Considerations
Subjectivism:	Meaning "is imposed on the object by the subject"	Designer's work can have little or no effect on the meanings users project onto their designs
Objectivism:	Objects have "intrinsic meaning" that exists "apart from the operation of any consciousness"	Design becomes "a matter of finding universally understood symbol[s] i.e the designer is merely a puzzle-solver
Constructivism:	Meaning is created through "our engagement with the realities in our world. . . . Meaning is not discovered, but constructed"	The role of Design is understand the nature of this interaction and encourage and shape it, given the goals and intentions of the project

Holding to a subjectivist view would mean the research and my position as a virtual environment designer would have little or no value as players would project their own meaning onto the virtual environments and as Calorusso (*ibid*. p.12) states "*…accepting such a stance as a landscape architect would negate a designer's potential to shape the meaning of a site*" as such the aims of the research cannot be met.

Holding to an objectivist view would mean the research and my position as a virtual environment designer is limited to finding these universal symbols and higher truths embedded in the natural environment. I am somewhat drawn to the idea of solving the puzzle of virtual environment design in order to find a higher truth, however the aspects of problem solving is only one aspect of the profession and I agree with Calorusso's (*ibid.* p.12) assentation that "*the potential of the profession should extend beyond this limited role into the realm of designing meaningful places"* as such the aims of the research can only partly be met.

Holding to a constructivist view would mean the research and my position as a virtual environment designer is at its most powerful - as such the aims of the research can be fully met and in fact support emergent design, however a downside is that the scope of design and the resulting experience is extremely wide, thereby conflicting with the nature of a

coherent and limited study. This further complicates creating a universal virtual environment design system or framework since as Crotty (1998, p.8) states that "*different people may construct meaning in different ways, even in relation to the same phenomenon"*.

3.2 **Art & Design Research**

There have been numerous attempts to define the configurations and range of art & design research from Bauhaus in the 1920's, Dreyfuss in the 1950's (Laurel, 2003) to Robinson in the 1970's to Frayling's work at the Royal college of Art in the 1990's. Sir Christopher Frayling, and eminent academic and expert in the field of art and design research, former RCA first professor of culture history in 1979, and current chairman of the Arts Council provides perhaps one of the earliest frameworks for categorising art & design as research. His framework, adapted from Herbert Reads' earlier work in *Education Through Art* (1958) is amongst the most cited for those entering practice as research. Frayling's (1993) framework compromises of three configurations of how research connects to art and design: research i*nto* art & design, research *through* art & design and research *for* art & design.

The first category, 'research i*nto* art & design', is the most straightforward since "*there are countless models and archives from which it derives its rules and procedures*" (*ibid*. 1993, p.5) and concerns historical, aesthetic, perceptual or research from a variety of theoretical perspectives. Frayling's second category, 'research *through* art & design', is less straightforward but includes materials research, development work and action research. Frayling's final category, 'research *for* art & design', is the most problematic. Frayling cites an example of Picasso's work, L*es Demoiselles D'avignon (The Young Ladies of Avignon),* a large oil painting depicting five women from Carrer d'Avinyó in Barcelona. Frayling discusses how Picasso used reference material in the creation of the work, but despite having the "spirit of research in him" it was not an objective - this was to produce a finished painting, hence the term 'research *for* art'. As Frayling states: "*research where the end product is an artefact – where the thinking is, so to speak, embodied in the artefact, where the goal is not primarily communicable knowledge in the sense of verbal communication, but in the sense of visual or iconic or imagistic communication*".

Friedman (2008, p.156) also states "*While we learn the art and craft of research by practising research, we do not undertake research simply by practising the art or craft to which the research field is linked."*

3.3 **Practice as Research**

Research as an integral aspect of practice, however it is only in the last few decades that creative practice has diversified (and in fact is some areas emerged) in both disciplines (i.e. computer games and animation programmes within higher education have only existed for the last decade and now number in over 250) and grown in importance. The result of this phenomenon has meant an increased number of creative practitioners entering Higher Education and subsequently research.

Practice based research, specifically practised based PhDs are relatively new phenomena having only emerged in the 1980's in Australia (Candy, 2006) in comparison to the traditional PhD which has been around since the early 1800's (Turner, 1971). However as Krauth (2011) notes, the University of Wollongong innovation was chiefly due to the work of Professor Edward Cowie, an exceptional British academic and a trans-disciplinarian (having both a doctorate in music and a PhD in applied physics) who innovated the idea "*of a doctorate was that it could at once contain the creative product and also exegetical writing about it*" (*ibid*. p.2). Cowie had a truly unique perspective of what he referred to as 'fusion arts research' and successfully argued that an artist who theorises about their work and is able to submit a practical submission and a thesis contributed to the language of scholarship must be a viable pathway in gaining the award of a (higher) degree. Shortly after he wrote this, the world first practice based PhD was awarded in the area of creative writing to Peter Shepard in 1987 (Krauth, 2011).

Over the last three decades since Edward Cowie's innovation, the relationship between research and creative practice has matured, and diversified to include a range of areas across the arts, although still widely debated practice coupled with research has grown to become increasingly accepted across the world. Although practice-based research is a relatively new phenomenon, as I aim to define the research strategy and methodology and the use of '*practice as research*', it is critical to define exactly what is meant by research, practice and practitioner. Niedderer (2007) uses a variety of different terms to label the varying approaches to combining research and practice, and as a relatively new area (~30 years old) clear established guidelines do not yet exist.

Niedderer (*ibid*. p.1) defines these four key aspects as following:

- **Research**: used to denote the systematic inquiry to the end of gaining new knowledge
- **Researcher:** used to denote a person who pursues research (e.g. in art and design)
- **Practice:** refers to professional practice or to processes usually used in professional and creative practice to produce work for any purpose other than the (deliberate) acquisition of knowledge.
- **Practitioner**: used to denote anyone who pursues professional/creative practice

Practice based research in many ways on first inspection appears to be the 'holy grail'; for a practitioner entering higher education the pressure of undertaking research is very present, and over the last decade has become from a desirable qualification to an essential qualification an academic must hold. As a practitioner on a practice based programme, and one that is in its embryonic stages, more so within the framework of education, I, like many other practitioners, feel a strong desire to retain and express the desire to engage with practice as a system to both increase the quality of our teaching practice and to continue most often a personal passion.

Candy (2006) comments that is critical to separate this personal artistic practice from the concept of practice-based research as "*searching for new understandings and seeking out new techniques for realising ideas is a substantial part of everyday practice. However, this kind of research is, for the most part, directed towards the individual's particular goals of the time rather than seeking to add to our shared store of knowledge in a more general sense*". Candy reiterates the importance of contributing to the wider "*shared store of knowledge*" rather than one's own goals as an artist/designer.

Rust et al (2007, p.66) offers a significant overview of the state of practice as research in the AHRC Research review *Practice-Led Research in Art, Design and Architecture*. In the review they argue that even in 2007 the state of practise research was still newly emerging, and had the review being conducted a few years earlier "*the picture would have been would have been far less clear and confident*", however at the time of the review, doctoral practice research was growing, demonstrating a new confidence, illustrating it's importance within Art, Design and Architecture higher education

Rust et al (ibid p.66) also point out in their conclusions that practice research has a huge potential to extend its reach since there was a growing relationship between innovation funded by the private sector and practice based research, citing several examples that illustrated "*the role of practice-led research in influencing domains beyond our immediate disciplines*". The conclusions also indicate a capacity issue; the 'production of practice research Phd's is slower than in most disciplines in addition to being compounded by the limited number of appropriately experienced supervisors, and there is no easy formulae in tackling this complex issue.

To conclude, research that focuses on creative is most often carried out by designers, artists, musicians and those in the field of art, design and creative media. This type of research when linked to creative practice falls into two categories: practice-*based* research and practice-*led* research, which will be briefly discussed below.

3.3.1 Practice Based Research

Practice based research follows the conventions of a traditional research project in that it is an original investigation used to gain and contribute knowledge to the discipline. Creative output is critical since it acts as the main body of work in the claim of the original contribution to knowledge. The creative output may include physical or digital artefacts such films, models, sculptures or creative works such as a performance. A practice based PhD is also accompanied by a written contextualisation of the work often referred to the exegesis (Anderson & Tobin, 2012); which describes its significance and how the artefact(s) (and or processes used in their construction) contribute new knowledge. This normally includes a range of documentation that captures the process, analysis and critical reflection on the artefacts, and is required to be rigorous, transparent and methodical in order to be accessible and reviewed by peers.

3.3.2 Practice Led Research

Practice led research (PLR) has been presented as somewhat different to practice based research, in that it is focused on the practice, but is not required to produce practice/artefact as part of the original contribution to knowledge.

Rust et al (2007, p.11) define PLR as "*Research in which the professional and/or creative practices of art, design or architecture play an instrumental part in an inquiry*"

The PLR project is primarily concerned with advancing knowledge in the field of practice and may focus on improving process or systems for the creation of artefacts but the final submission does not require the creation of any creative outcomes as part of the argument in how the work advances knowledge.

Amongst one of the positive aspects of practice led research Rust et al (2007, p.68) state "*Practice-led research is frequently interdisciplinary and this has been a great strength, especially as it contributes a new dimension to the disciplines that get involved*." Given the growing importance of inter-disciplinary work in contemporary research, this highlights a key benefit PBR offers in moving beyond traditional constraints.

3.4 **Reflective Practice**

Both Schon (1983) and Scrivener (2002) discuss the importance and value of the 'reflecting practitioner'. One of the key purposes of reflective practice as Scrivener (2004, p.5) states is that it: "*equips practitioners to induct novices into that practice*". One of the key objectives of this PhD research is to inspire and incite debate amongst virtual environment users and designers, as well as those not familiar with video games; engagement through practice is a possible method one can use to trigger and stimulate this discourse. Smith & Dean (2009, p.22) note one of the core benefits of reflective practice: "*Reflective practice therefore attempts to unite research and practice, thought and action into a framework for inquiry which involves practice, and which acknowledges the particular and special knowledge of the practitioner*".

Aarseth (2005) provides the only substantial methodology for analysing games as artefacts; however the approach lacks a user-centric design ethos which I have tried to embed into the artefact analysis that forms part of this study. However to fully take advantage of the reflection on games as artefacts one must move beyond simple evaluation (i.e. reflection) and attempt an analytical approach since this is more likely to draw out useable research data. Douglas, Scopa and Gray (2000) discuss the differences between evaluation and analysis: "*Processes of 'analysis' are distinct from that of 'evaluation', where the practitioner critically reflects on their experiences of practice. In comparison, 'analysis' is a more*

distinctive and time-consuming process of exploring research data in order to 'uncover' and 'interpret' imbedded patterns and information" (p.11).

The Reflective Process is further outlined as three discreet phases by Boud, Keogh & Walker (1985) as:

1) **Returning to the experience:** Recalling salient events.
2) **Attending/Connecting with feelings:** there are two elements within this - sing helpful feelings and removing (or containing) obstructive ones.
3) **Evaluating the experience:** Re-examining the experience using the original intent and existing knowledge; this involves integrating new knowledge into your own framework.

Scrivener's model (2002) of structuring practice-based research provides the basis for answering the research questions, since it proposes a structured approach which ties in all the essential elements (practice, reflection, theory) with cycles of artefact creation. Scrivener's model (2002) is refined further by the addition of an 'artefact review' as part of the review of relevant knowledge. Table 4 illustrates the structure of how the research intends to link reflection theory and creative practice into a structure.

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Table 4: Scriveners model of Creation Production (Source: Scrivener 2002)

1	Pre-project reflection on practice, including identification of issues, concerns and interests to be worked with in the project
2	Review of theory, knowledge and information relevant to identified issues, concerns and interests
3	Reframing of issues, concerns and interests in response to material found in the review
4	Cycles of production of work reflection on productive phase in terms of action and practice possible revision of issues, concerns and interests possible search for theory, knowledge and information relevant to modified issues, concerns and interests
5	Post project reflection on action and practice (*i.e.*, on the project as a whole)
6	Reflection on reflection on action and practice (*i.e.*, critical reflection on one's reflecting)

3.5 **Action Research**

Action research (AR) can be defined as any type of research that is concerned with practice with a focus on changing the practice. AR is a particularly useful framework for practitioners since it is directly concerned with action and research with a direct connection to one's practice.

Lewin (1946, p.34) defines AR as "*a comparative research on the conditions and effects of various forms of social action and research leading to social action*" that uses "*a spiral of steps, each of which is composed of a circle of planning, action, and fact-finding about the result of the action*".

This is further elaborated by Frayling (1993, p.5) who defines AR as "*where a research diary tells, in a step-by-step way, of a practical experiment in the studios, and the resulting report aims to contextualise it, Both the diary and the report are there to communicate the results, which is what separates research from the gathering of reference materials*."

Ferrance (2001, p.2) detailed how AR was different to traditional research in that it is: "*…a reflective process that allows for inquiry and discussions components of the research*." This differs from standard scientific research paradigms where reflective discussion and inquiry is not considered to be a subjectively tarnished tool and should be avoided. This difference is one that adds difficulty to those who engage in the process for the first time. According to the Action Research Institute[7]: "*…using a cyclic or spiral process which alternates between action and critical reflection and....is thus an emergent process which takes shape as understanding increases; it is an iterative process which converges towards a better understanding of what happens*".

This definition is a little easier to digest given the alternate nature of action and reflection, meaning in theory it should be difficult to 'go down the wrong road' on an issue, however given past experience and working habits this is something to be war off as a practitioner doing too much on a first cycle because of the initial similarities between AR and pure scientific research methods. McTaggart (1989) also pointed to the idea that AR should focus on small manageable changes.

[7] http://www.scu.edu.au/schools/gcm/ar/arhome.html

3.6 **Role Duality Insider Vs. Outsider**

Managing the dual roles of artist and researcher is a core challenge and a conflict that many undertaking a practice-based research will face. As an artist/designer I am concerned with only the creation of an artefact and/or the process that enabled its creation -this can be completely internalised i.e. bear no relation to the outside world's search for truth or knowledge, it does not require a purpose or needs to adhere to an external definition to be valid. Engels-Schwarzpaul (2008, p.5) states: "*the engagement in creative practice research does require an outward-looking disposition, beyond the experiments of the project itself*". As a researcher, I am required to focus on process rather than output, since research is an activity that is largely definable and falls within a specific framework, and is concerned with a contribution to a body of knowledge held externally to the individual.

There is little doubt that practice and research are different entities but they are not wholly incompatible; in order to ensure that practice-based research delivers both, the ability to use practice in order to explore (and answer) a research question their needs must both be managed. The practitioner must not become so absorbed in practice that research becomes a secondary consideration and is not articulated without an appropriate exegesis; however the contrary also applies - that practice is not subservient to research (Scrivener, 2001).

Dirkx (2008, p.266) argues that the development of a body of knowledge in an established discipline, the works of the great scholars in this area are "*… grounded in the careful observation, reflection, and analysis of their practices, case by case*". Dirkx (*ibid*. p.66) refers to this as 'insider research' as "*it arises within and is mediated by the practice context*." However there are disadvantages to 'insider research'. Robson (1993) discusses the disadvantages and advantages of the practitioner-researcher which is also commented upon by Smith & Dean (2009, p23) who define one of the main problems of an 'insider' as "*….the difficulty in adopting an open-minded approach and not allowing preconceptions to cloud the issues. Given that absolute objectivity is impossible, this is a challenge for all researchers*". Roth et al (2007) echo the pitfalls with being an insider researcher is because "*…the researcher is too close to the data and might not be able to objectively evaluate it*".

Adopting an open minded, objective approach and avoiding preconceptions can be extremely challenging and can become a critical flaw in the research depending on how

'embedded' the researcher is within their practice. As an avid games player I have played games for over thirty years and was often referred to as a 'hardcore gamer'. Bosser & Nakatsu (2006, p.1) define a 'hardcore gamer' as an individual who "*dedicates most of his leisure time and sometimes even more to his favourite virtual world"* as opposed to a 'casual gamer' who play games infrequently and limited to smaller duration. As a developer (both in professional practice and within an academic context) I have spent over a decade immersed in the creation of 3D environments; subsequently both these roles have deeply embedded me within the field of 3D environment design - so are researchers able to negate the negative aspects of an 'insider' experience? Smith & Dean (2009) propose a possible solution in that "*It can be addressed to some extent by always exposing ideas and practices to other professionals for feedback, support and advice. In seeking the views of others, which will inevitably be subjective, we can develop inter-subjective views, which are less likely to be one-sided*"(p.23).

However being an 'insider' does have distinct advantages as Smith & Dean (2009, p.23) state "*…the advantages of the practitioner-researcher role are compelling: your 'insider' knowledge, experience and status usually lends your research credibility and trustworthiness in the eyes of your peers, that is, you are not an 'external' researcher*." This insider knowledge is particularly critical in a field such as video game design where both game developers and users (players) are heavily critical of what they often perceive to be 'outsiders' analysing and/or critiquing their practice/domain of interest without any 'real' knowledge of actual games development or the experience of playing games. These two groups can be considered to be amongst the most valuable 'peers' that a practice-based researcher in video games design would seek for eventual evaluation and review of the research outcomes, subsequently increasing "*research credibility and trustworthiness*" is such an embryonic area I would argue outweighs the risk of preconceptions clouding the integrity or direction of the research goals. As an outsider it would be easier to gain a more objective view of the problem and develop a possible solution, but at the risk of lacking the critical insider knowledge which can significantly influence the impact and credibility of the research outcomes.

Added to the careful balancing of the insider/outsider researcher is the role of artist/researcher and the demands of both roles. Biggs (2001) argues that one day there will come a point where a creative artefact is able to answer a research question entirely without

additional exegesis. However until then as the AHRC state[8] there is still a requirement and expectation to provide some form of documentation for doctoral study.

Creative practice, especially games design and production, is near impossible to complete without documentation. As a practitioner, my academic background means I am also predisposed to writing and planning before engaging with practice; this documentation often takes the form of reflective diaries, creative journals sketchpads, etc. The intention is that this 'data' will be used to interrogate the practice and to provide a sense of objectivity by providing various possibly conflicting sources that will negate any sense of subjective introspection. The dual roles of artist and researcher, whilst capable of conflict, if correctly managed, can be a powerful dualism position to hold in practice research.

So is one able to navigate the potential pitfalls and benefits of insider research? The following are possible strategies once the insider researcher should consider:

1) **Insider Knowledge:** The insider should actively seek out and take advantage of insider knowledge rather than avoiding it, as it can be invaluable in helping in locating and identifying earlier in the research critical areas the research should address and avoid, as opposed to finding these out much later where the research may have become too rigid and lost the ability to be flexible due to time/resource constraints.

2) **Preconceptions & Assumptions:** It is critical for the researcher to state and expand upon any preconceptions & assumptions underlying the research, as Robson (1993) indicates this is to help the researcher identify possible areas that may cloud objectivity, the goal is not to be completely objective (thereby removing the benefit of subjective insider knowledge) but to develop an awareness of how preconceptions may influence and drive the research down particular paths., and ultimately limit it. This can take the form of a formal section within the research stating assumptions & expectations.

[8] http://www.ahrc.ac.uk/funding/research/researchfundingguide/definitionofresearch/

3) **External input into Practise**: Whether this be formal (via supervision) or informal (disseminated into appropriate practise forums), the researcher should share and gain critical feedback on the developing practise and how this relates to the research agenda, as often as is feasible. This is to avoid the research becoming one sided and too subjective in allowing the practise to become isolated from external guidance and become detached from the research aims and objectives.

4) **Critical Reflection:** The researcher should document and track all the research process, in particular the practice in order to provide a foundation for reflection, this is critically important in providing a multiple fixed tangible perspectives (i.e. reflection *in*, *on* and *for* action) that the research can interrogate and analyse in order to identify and develop a body of suitable knowledge, this reflective practise should take the form of notes, audio and video recordings etc..

3.7 **Research Strategy**

The overarching research strategy combines both a qualitative and quantitative approach in collecting, analysing and categorising data through the creation of, and reflection on several artefacts. The research approach will be focused on a synergy of four aspects (P.A.R.T):

- **Practice** (wider industry and individual - both foundation and emerging practice)
- **Analysis** (study of examples of virtual landscape design & interaction)
- **Reflection** (both as an individual practitioner and as part of a collective)
- **Theory** (study of relevant literature)

The research consists of two key stages:

1. **<u>Stage 1</u>**

- Explorative research phase - historical analysis of virtual environmental design.
- Identification of key issues (through existing practice & reflection on practice, literature review)

- Qualitative research on natural environment design, using (visual) grounded theory since this method is appropriate to identifying emergent themes and concepts without first establishing a hypothesis. (Konecki, 2011, p.133)

2. <u>Stage 2</u>

- Cycles of Artefact creation

The identified research objectives were addressed by creating appropriate artefacts. The artefacts were a mix of pure practice (artistic) and problem solving (scientific). Artefacts within the research were instrumental in advancing the research by providing a focal point to embed the research arguments and provide a vehicle for inciting critical debate and discussion, which will be reflected upon. The artefacts were created and followed a cyclical process, akin to AR where the end of the artefact's creation (i.e. reflections on practice informs the next artefact's initial stage.)

The method selected is based on Knudsen's (2008) approach in the creation of '*Heart of Gold'*, and is divided into four distinct stages:

1. Research Phase
2. Analysis & Interpretation by the practitioner
3. Creation of Artefact (building on the outcomes of the analysis)
4. Reflections on the discussion of dissemination of the artefact

The research is primarily practice based, focusing on my role as a researcher acting as a participant/observer as the 'reflective practitioner'. The general methodological approach has elements of a naturalistic enquiry. My approach was to break the research problem into several smaller areas of study and attempt to use multiple methods (a methodological bricolage) in order to explore each sub-problem. This in some cases led to the generation of an artefact in order to fully engage with the problem. I then critically reflected on the artefacts as a vehicle to discover new knowledge.

Each artefact was the result of a process of contextual review/inquiry/design/ implementation and reflection and was created using a variety of research methods. Ultimately the artefacts formed a portfolio of practice leading to the final submission which presents and illustrates the answer to the research problem. The 'original contribution' of the thesis using this model is contained in the nexus between the written text and artefacts.

3.8 **Research Methodology**

Defining ones methodology and methods in the emerging area of game design, and within a practice-based research context is difficult in itself, and was further compounded by how interchangeably the terms are used across research literature, however I have taken Norton's (1999) position in the distinction of the two, as he defines the 'methodology' as providing the "*…guiding principles that help to inform decisions about procedure and research strategy*" whereas research methods "*…tends to refer to specific techniques of data collection and analysis available to the researcher*" (1999, p.32).

Malins & Gray (1995) go further and describe four practiced-based PhDs from which they attempt to suggest that research methodologies (primarily aimed at craft-based practice research i.e. ceramics, jewellery) should be developed with the following guidelines in mind (Table 5).

Despite the methodology being primarily based on craft-based research practice (ceramics, jewellery) I believe the guidelines laid out by Malins & Gray (1995) as illustrated in **Table 5**, coupled with a literature review, to be appropriate as a basis to form an initial framework from which the final methodology was defined.

1. The methodology did not follow one approach but was tailored in response to practice, and the researcher's expertise. This was done by understanding and learning about the range of research strategies available to me and which ones (if any) aligned with my creative practice best in order to answer the research problem.
2. Reinforcement of positioning oneself from a *Reflective practitioner's* standpoint (Schon, 1983). This used reflection in/on and for action to provide various points from which a more objective analysis could be drawn.
3. An emergent (as opposed to a static/fixed) methodology was sought and encouraged using a continuous iterative design process; this is further supported by Rolling's position (2010): "*Arts-based research methodologies are characteristically emergent, imagined, and derivative from an artist/researcher's practice or arts praxis inquiry models; they are capable of yielding outcomes taking researchers in directions the Sciences cannot go*".
4. The development of a contextual review (i.e. not just a literature review) in order to situate oneself, with a view to generate critical debate. This took the form on an

artefact review (foundation practice and industry practice) as well as a visual review of existing virtual game landscapes.

5. Consideration of an interdisciplinary approach (multimethod) and of a triangulation approach in order to better serve a practice-based inquiry.

With this in mind the research was guided by the following methodology (adapted from Gray & Malins, 2004, p.73):

- **Practitioner/Researcher as instrument:** The design research is at the heart of the research process. My reflection in/on and for my practice work is the central location from which I approached the research question/problem. I am in essence the primary tool for collating and generating data (i.e. a human instrument) as a reflective practitioner.

Table 5: PBR Research guidelines (Source: Malins & Gray, 1995)

Initially to consider a range of research strategies (from all disciplines);
Individually 'tailor' the research project in response to the nature of practice, the specific research project and the researcher's expertise as a Craftsperson;
Carry out the research from the informed perspective of the reflective practitioner, as 'participant observer';
Continually define and refine the research question in an iterative process, and allow methodologies to emerge;
Acknowledge accessibility, discipline, rigour, transparency, transferability as the characteristics which distinguish research from day-to-day practice in the visual arts;
Be aware of the critical context of practice and research, and to use the contextual review to situate the researcher and to help generate and raise the level of critical debate;
Consider an interdisciplinary / multidisciplinary approach to research, using a 'multimethod' or 'triangulated' approach, acknowledging the complex nature of practice-based inquiry in a transient cultural and contextual framework.

- **Natural Setting*:*** Similar to Bunnel's interpretation (1998) of a 'natural setting', I consider the virtual spaces/physical natural spaces to be my 'workshop' environments from which I explored and created artefacts in order to answer the research problem.

- **Tacit Knowledge:** A contrast to explicit or propositional knowledge, this intuitive/felt level of knowledge, acquired through reflection is a critical and vital aspect of landscape design and a complimentary addition to other types of knowledge generated by the research. As a designer/creator, this level of knowledge is critical in practice and if positioned correctly can be extremely useful in navigating an uncertain terrain (research process).

- **Emergent Methodology:** Bunnel (1998) defines this as "*...possible strategies for problem solving emerge through immersion in the research problem and become more focused through action. Reflection in and on action and structured improvisation are valuable to the evolving research strategy*". Given the complex nature of the analysis of the artefacts that exemplify industry practice (there are no obvious routes of design analysis or no documentation/process is available) there was a need to build an initial conceptual framework on the areas of study (using visual grounded theory). The design of the research unravelled organically as issues were explored and ideas progressed.

3.9 **Triangulation/Mixed Methods**

Triangulation, a method first proposed by Campbell & Fiske (1959) as a means of confirming research findings by using a variety of intendant sources draws on a metaphor taken from trigonometry and geometry where a fixed location in space can be determined from the convergence of measurements taken from two other distinct points. Given the range of courses to be used in research following a list of specific methods to be employed in order to find/create new knowledge needed to answer the research question. Multiple methods are employed not only to 'triangulate' the data but to help "*... a more meaningful and balanced understanding of a research issue by the use of two or more research methods"* (Gray & Mallins, 2004, p.121) but also "*its value in using and integrating different kinds of media to provide different kinds of sensory information*" (*ibid*. p.121).

The idea of using multiple viewpoints in order to test an alternative theory/practise is further supported by Engels-Schwarzpaul (2008, p.5) who states creative practice PhD submissions "*…must, of necessity, incorporate multiple viewpoints to test and elaborate alternatives*" as such utilizing different 'senses' of the researcher/practitioner reflects the general

methodological approach as the researcher/practitioner as an instrument for data generation, different methods will require the use of alternate senses, subsequently collating the data through these 'sensory lenses' will allow for an internal triangulation of the information, and therefore should allow for a more accurate insight when analysing the collated data.

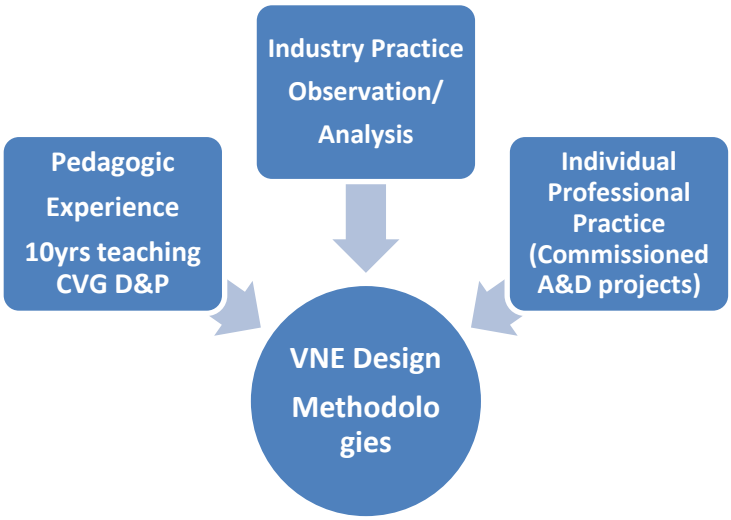

Figure 16: Triangulating 'the gap'

Identifying the gap in the body of knowledge within a discipline is a key requirement of doctoral level research. In reality, establishing the gap is not a straightforward task, and is compounded by the fact that the area of study ; video games design is embryonic and underdeveloped If we consider the truth to be spread out across these areas, then studying each area from a different perspective is more likely to reveal the truth.

Each perspective (i.e. as a lecturer, a consumer and as an artist/practitioner) offered an opportunity to study the phenomena at the heart of the research and offered unique insights. By triangulating and critically analysing and reflecting on these sometimes contradictory and competing perspectives, is it perhaps more likely that if we are able to establish truth (and knowledge) in different forms and therefore we are more likely as a result to find and establish a critical gap in the current body of knowledge that exists. As such, the research attempted to identify this gap based on three perspectives (**Figure 16**).

- As a teacher (through teaching & learning design and delivery)
- As a consumer (through observation and experience of commercial/industry artefacts)
- As a practitioner (through individual professional practice)

3.9.1 Pedagogic Practice

I have worked as an academic over the last twelve years, in a variety of roles ranging from part-time lecturer in media, moving to the role of programme leader for the BSc(Hons) Computer & Video Games (CVG) (a shared programme of the School of Arts & Media at the University of Salford) for over seven years to Director of Creative Media. Within my role as an academic at the University of Salford I have proposed, written and delivered modules as well as academic programmes in the field of animation, computer games and creative media. My external roles have included acting as a consultant for accrediting bodies and as an external examiner/validator for higher education degree programmes centred on game digital media, animation and computer games across the UK, Ireland and worldwide (see Appendix A: CV).

The specific context of the research related to my experiences of teaching games design and production on the BSc CVG programme for over twelve years, with a specific focus on the final year major project in which students work on the pre-production, production and testing of a wide variety of game prototypes over a year long period. This experience has provided valuable insight into the reality and often disconnect between professional games industry practices, my own professional practice, and the experience and perceptions of teaching and learning in computer and video games, and its evolution of the course over a decade, which ordinarily is not a significant period of time in higher education, but within the context of computer and video games represents nearly the entire span of games as a subject in Higher Education.

As a practising academic, reflection on teaching practice forms an integral part of an academic's 'toolkit', whether formally undertaken as a part of a teaching qualification (i.e. PGCHEPR) or through quality assurance mechanisms embedded in teaching and learning (post-module evaluation or periodic reviews). As one 'lens' available to me, an intention to reflect and use observations from my teaching practice has been made to include this as one aspect of triangulating of seeking knowledge and truth. Refsum (2002, p.2) outlines a personal account of her journey through academia as a case study in order to "*illustrate the situation of the field of visual arts in relation to other fields*".

Reflection and observation of teaching practice is not a one way process; the research did not simply funnel information into a research study intended to serve commercial or

industry interests, but it developed and enhanced research informed teaching; a critical aspect of the higher education experience.

3.9.2 Industry Practice

My experience as a consumer and analyst of the games medium over the last three decades was also used as one of the perspectives. A combination of qualitative analysis of user opinion (through user forums) and as a consumer (through observation and experience of commercial/industry artefacts) was used to provide a deeper and less subjective insight into the array of issues and observations.

3.9.3 Professional Practice

Professional practice examples are presented in Chapter 4 of this thesis (Foundation Practice Case Study Analysis & Reflection).

3.10 Case Study Model

The aim of the thesis was to conduct three practice-based studies. The structure of each study was based around a 'mini-thesis'. The justification for which is that the scope of the work covered areas as diverse as game design, geology, psychology, landscape architecture and interface design. Therefore:

1) Each study was led by a series of questions that have arisen as a result of the artefact/literature and foundation practice review
2) A brief background is provided for each study *in situ* to retain a sense of coherence in the chapters that present each study.
3) A relevant literature/artefact review was carried out again within the chapter to retain a sense of coherence and to ensure the reader is able make sense of the work and to keep sight of specific aims of the research.
4) The particular process and methodology specific to the study is explained in each study chapter.
5) The results of the practice-based studies are presented in a series of different forms, ranging from creative artefacts, development journals, theoretical frameworks, etc..

6) All outputs from the practice-based studies were analysed; this was based on reflecting on the intention behind using practice as a method and the resulting realisation, in addition to how successfully the research objectives have been met.
7) After the analysis, a critical reflection on-action provides insight into distinctions between the processes of *evaluation* and *analysis* highlighting this difference; developing appropriate methods of analysis has provided the most challenging element of this research. Processes of *analysis* are distinct from that of *evaluation*, where the practitioner critically reflects on their experiences of practice. In comparison, *analysis* is a more distinctive and time-consuming process of exploring research data in order to 'uncover' and 'interpret' imbedded patterns and information.
8) A set of next steps and further questions is then discussed providing the foundation for the subsequent study. James (2003) proposed a working model for PBR across the creative arts and recommends that: "*Students must be able to recognize achievements, mistakes, alternative pathways with the benefit of hindsight, as well as new questions that have arisen. The open door of research needs to be celebrated and embraced.*" (p.22).

3.11 **Specific Methods**

Within the 'emergent methodology' I will utilise two specific methods: Action research & grounded theory as well as several others (contextual review, case studies, experimental practice, documentation, exhibitions, photography and field trips)

1. Action Research

Using the mind-set of Schon's 'reflective practitioner', cycles of action research and reflection in/on and for action was used to inform practice and drive the work towards a resolution. Outcomes from the creation of each artefact formed a place from which to *reflect on action* feeding into an eventual *reflection for action* in a second cycle.

2. Grounded Theory

The research is complicated since the area of focus (environmental design methodologies in video game) does not have a body of readily accessible data or existing theoretical frameworks from which alternatives can be derived and tested, however the design data/methodology was 'contained' within these game artefacts, but was not readily 'accessible' or in a form that

was suited for analysis. In order to provide data to be used in an informed approach in generating an alternative design methodology, grounded theory (GT) was used in the first cycle of action research. Friedman (2008, p.154) defines GT as: "*an inductive theory emerging or rising from the ground of direct, empirical experience*" and as Glaser (1992, p.16) defines it as "*a general methodology of analysis linked with data collection that uses a systematically applied set of methods to generate an inductive theory about a substantive area*".

This is a notion of extracting theory (i.e. a design framework) from practice (i.e. game artefacts) in design/arts research is supported by Friedman (2008) as: "*…many designers confuse practice with research. Rather than developing theory from practice through articulation and inductive inquiry, some designers mistakenly argue that practice is research.*" (p. 154).

GT, as a quantitative research method can also be adapted to suit a variety of data types since the 'entry point' chosen from which to view the artefacts was visual (through photography), therefore it is appropriate to use a variant of GT: visual grounded theory (VGT) - a relatively new and emergent application of GT with extensive visual data (Konecki, 2011).

Konecki (2011, p.133) elaborates on the usefulness of VGT as it: "*…allow[s] researchers to incorporate visual data while designing their research projects within the framework of grounded theory*" and therefore VGT which "*…relies on visual data for constructing categories, describing properties and generating/constructing theoretical hypotheses, which account for the visual phenomena…".* Konecki develops his discussion further in citing the work of Charles Suchar, who provides one of the few examples of VGT. Suchar's research strategy in using VGT "*…..follows the interrogatory principle: a researcher attempts to answer research questions by photographing particular objects…. and by analyzing these photographic data in order to find patterns and start conceptualizing*". Konecki's analysis of Suchar's work reveals a critical benefit of using VGT as a research strategy: the linking of practice and research. Suchar is able to engage with his practice (photography) in a manner that directly serves to answering research questions by analysing the visual data from which patterns and an eventual theory can be conceptualised, thereby reshaping the pure practice of photography to a practice-based research. Suchar's approach was modified and used to guide the first artefact.

3. Contextual Review

Including published literature and contextual information such as an analysis of visual exemplars from both personal and professional practice, to both identify the gap in design practice and to justify why it should be researched and explored. Gray & Malins (2004, p.49) discuss the purpose of the contextual review, amongst of which is *"….to identify a 'gap' in existing knowledge, thus providing a rationale for the new research and a context for its original contribution to knowledge"*.

4. Experimental Practice

The *design, making and testing* of two specific game artefacts as a method to explore design theory and practice. This also included the creation of tools to realise the production of the artefact. In addition to the practice I reflect and analyse these artefacts where possible through play.

5. Case Study

The term 'case study' in this context refers to the in-depth, context-specific description, analysis and documentation of the artwork, including the feedback from collaborators/professionals and the public. This covers personal (commissioned and non-commissioned) works and industry practice. This was used to further identify and prove a gap in the knowledgebase and the need/requirement for it to be filled.

6. Documentation

Extensively illustrated *documentation* of artefacts from design to testing/evaluation, utilizing mind/concept maps, flowcharts and diagrams.

7. Computer Aided Design

A wide variety of *computer software* was used for data extraction/generation and the visualisation of non-conventional data sets.

8. Exhibitions

This is in both a traditional (physical) space and in the Virtual domain (as part of the PhD submission) and includes an element of dissemination and feedback in order to inform additional cycles of research.

9. Field Trip

This includes the standard definition of the term field trip (an observational method employed to gather data in a 'live' physical setting) but within this study I am including the virtual domain within this term (visiting a virtual space to observe and collect data for later analysis and reflection).

10. Photography

This method was chosen since it allows instant access to a place (virtual or physical space) in order provide a visual context to an otherwise difficult concept to describe) as a form of non-verbal communication, one that acts as entry point, to aid reflection and analysis, and as a method that allow the research to be transformed into more accessible (one that does not require lengthy time to absorb and digest) and appealing outcome; one that is more readily evolved into exhibit, ready to elicit response and incite critical discussion.

3.12 Artefacts/Methods/Justification Matrix

Artefact/Project	Research Methods Employed	Justification/Notes
Virtual Landscapes: A Visual Analysis of the historical progression of natural environment design in games.	1. Visual Contextual Review (historical) 2. Computer Aided Design 3. Photography 4. Exhibition 5. Reflective Practice 6. Experimental Design 7. Field Trip(Virtual)	• Photography since it functions as an entry point into the space and aids reflection and can produce outcomes ready for exhibition (incite debate) • Field trip allows the collection of virtual spatial/tactile data 'in-situ'
Preliminary Case Study: Design Analysis	1. Case Study (industry practice) 2. Case Study (foundation work) 3. Reflective Practice	• To identify and establish a gap in professional practice, & current design knowledgebase
ShadowMoss Island	1. Action Research 2. Computer Aided Design 3. Field Trip 4. Experimental 3D Design 5. Illustrated visual documentation of design process 6. Reflective Practice	• Allows the collection of physical spatial/tactile data • Allows the exploration and presentation of spatial and tactile data • Allows direct experimentation with concepts that have yet to be explored in commercial practice (Matias & Stern, 2005)
MindFlow Tool	1. Experimental Design 2. Computer Aided Design 3. Action Research 4. Reflective Practice	• Allows direct experimentation with concepts that have yet to be explored in commercial practice (Matias & Stern, 2005)

3.13 Research Problem/Chapter Matrix

Research Problem	**Artefact(s)** illustrating exploration and presentation of new knowledge	**Chapter**
How can one employ a practical approach to natural environment design which goes beyond the dominant paradigm exemplified by narrative/visual driven design?	**ShadowMoss Island**	Chapter 4: Reflection on Foundation practice Chapter 6: ShadowMoss Island
How and why has virtual natural environment design evolved in CVG over the last 30 years and what has been the dominant design paradigm?	**Virtual Landscapes**	Chapter 5: Virtual Landscapes
How can one create a framework for virtual natural environment design that incorporates complex elements such as psychology, geology and aesthetics but remain connected to the realities of games production?	**VNED Template**	Chapter 5: Virtual Landscapes & Chapter 6: ShadowMoss Island
How can one go beyond the current paradigm in the use of reference material used in the construction of environments on a purely visual level?	**MindFlow**	Chapter 7 MindFlow
Can the intangible essence of natural landscapes be distilled into a structural production based framework for virtual landscape design?	**VNED Template**	Chapter 6: ShadowMoss Island
How can one present and illustrate findings in a manner which goes beyond a fixed static form to allow for rich visual datasets to be interacted with beyond traditional viewing methods?	**MindFlow Tool** **Virtual Landscapes: Interactive Database**	Chapter 7: MindFlow & Chapter 5: Virtual Landscapes

3.14 Ethical Considerations

The investigation also considered ethical issues. These included:

a. Informed Consent via third-party publishers

Informed consent was gained through feedback gained through the apple iBook's and Google play reviews site which are independently verified. Consent is gained directly from the customers through a prior agreement, which includes the right of the author (in the case of this investigation the researcher) to use the reviews in any manner in which they see fit.

b. Informed Consent via Website

In addition, the website (www.virtualandscapes.co.uk) includes the following statement to make all users aware of the purpose and potential use of the feedback provided:

"Please note that the feedback below maybe used in research project on Virtual Landscapes attached to this project and by providing feedback you are consenting to your details and feedback to be used in the final report, which when completed will be made available here in due course".

c. Informed Consent via testing sessions

Anonymous consent was gained in the testing sessions ran in person for the *Virtual Landscape* PivotViewer app, *ShadowMoss Island* level and the *MindFlow* tool. These included the followed statement given to all participants to be signed.

"Dear Participant, my name is Umran Ali, and I am undertaking a PhD in virtual environment design. Part of this process is to receive feedback on the artefacts created as part of the research. You are about to undertake a test for the purposes of my research investigation. The research is specifically focused on virtual environment design, and this test is directly related to this study alone. This test will not collect any personal information, only comments that you are free to leave if you wish on the forms - all comments will remain anonymous. These comments may or may not be included in the final thesis/report which will be available for public use in due course".

d. **Intellectual Property Rights**

The research utilises existing intellectual property of many digital videogames. On consultation with a legal expert in order to balance intellectual property laws with academic fair use. It was decided that any existing intellectual work uses in the course of this study work would be clearly signposted in acknowledging the originating authors, developers, and publishers. The statement below was inserted into the Virtual Landscapes books clearly stating the research is "*unofficial and unauthorized*" in order not to mislead readers, and to ensure the copyright holders would not be negatively financially impacted in any way. A legal entity (Zayn Creative) was setup to act as the official legal publisher.

DISCLAIMER: This book is unofficial and unauthorized. It is not authorized, approved, licensed, or endorsed by any developer, publisher, designer, writer, artist, distributor, or licensor. Any use of the trademarks and game names are strictly for the purpose of analysis, criticism, teaching, and academic research. All material related to the analysis is © to the respective owners. Zayn Creative Limited has made every effort to determine the information contained in this book is accurate. However the publisher makes no warranty, either expressed or implied, as to the accuracy, effectiveness or completeness of the material in this book; nor does the publisher assume liability for damages, either incidental or consequential, that may result from using the information in this book.

The research acts as a vehicle which promotes and celebrates the works of many authors and in fact may lead to positive financial benefit by encouraging readers to legally purchase original works.

The research also relies of the fair dealing exception in the Copyright, Designs and Patents Act 1988. The research relies on exceptions to copyright law that allow limited use of copyright works without the permission of the copyright owner. Sections 29 & 30 allows copyright infringement under three scenarios; two of which are pertinent to this study 1) as long the work is for the purposes of research 2) for criticism or review. In addition any use must ensure it does not financially impact the copyright holder and the reproduced work is supported by a sufficient acknowledgment[9]. Any copyright infringement in this study adheres to the legal and moral requirements set out above.

[9] https://www.gov.uk/guidance/exceptions-to-copyright

Chapter 4: Reflection on Foundation Practice

4.1 Introduction

This chapter on foundation practice review analyses the past artefacts I have created over the last decade as a 3D Artist and Designer. These projects all share a common theme: design focusing on the virtual natural environments. The artefacts include:

1. Lorian - Quake 3 Game map (section 4.4)
2. Eternal Knight (game modification) (section 4.5)
3. Religious Fossils - M.A Final project Artefact (section 4.6)
4. PlastiCity - Urban Planning Game (section 4.7)
5. Virtually Factitious - DarkHorse Project (section 4.8)

4.2 Justification of Chapter

Creativity and Cognition Studios (CCS) is an internationally recognised multi-disciplinary environment for the advancement and understanding of practice in digital media and the arts. The CCS produced a report in 2006 containing a guide to practice-based research. Within the report CCS recommended that the structure of a practice-based research project should include a chapter specifically focused on *foundation work*, the intention of which they state is:

> *"….optional, chapter is a chance to describe earlier work done by the author/candidate (possibly with others) that provides a foundation or significant background. It may be helpful to revisit and reassess earlier work in the light of the research focus of the PhD"* (CCS, 2006, p7)

The purpose of revisiting and reassessing earlier work is twofold: one to act as an initial cycle of practice in an action research framework and second to provide a body of work where comparisons can be drawn against future practice. Dirkx (2008) discusses the use of multiple sources within a practice-based research context:

> *"…in practice-based research, we don't rely on the inquiry of a single case or even the work of a single scholar across multiple cases…we study our own practices and we use multiple cases from*

multiple sources to further and deepen our understanding of the question we are seeking to address" (p.268).

This chapter on foundation practice review analyses the past artefacts I created over the last decade as a 3D artist and designer.

4.3 **Structure & Methodology**

4.3.1 Rationale for Artefact Selection

The artefacts selected are a mix of both creative production and problem solving projects, and are concerned with natural environment landscape design in some form. They are all projects that as a practitioner I was directly involved in, and cover personal, commissioned projects across individual and team-based approaches.

Table 6 provides an overview of the range of research methods employed and the justification, in this chapter.

Artefact/Project	Research Methods Employed	Justification/Notes
Preliminary Case Study: Design Analysis	4. Case Study (industry practice) 5. Case Study (foundation work) 6. Reflective Practice	• To identify and establish a gap in professional practice, & current design knowledgebase

Table 6: Research Methods Overview

4.3.2 Analysis method

The reflection on foundation practice uses a combined analysis and evaluation of the artefacts to derive insight into how the artefacts were constructed and what worked as it was critical to undertake both an evaluation and analysis of the work since it relates to this PhD research. Douglas, Scopa & Gray (2000) argue:

"Distinctions between the processes of evaluation and analysis highlight this difference, since developing appropriate methods of analysis has provided the most challenging element of this research. Processes of "analysis" are distinct from that of "evaluation", where the practitioner critically reflects on their experiences of practice. In comparison, "analysis" is a more distinctive

and time-consuming process of exploring research data in order to "uncover" and "interpret" imbedded patterns and information" (p.11).

4.3.3 Artefact Review Process

Table 7 provides a summary of how the Artefact Evaluation & Analysis Framework is constructed.

Table 7: Summary of Artefact Evaluation & Analysis Framework

Name of Project
Background
Process of Development
1. Sources of Inspiration
2. Development Processes
Review
1. Form & Function
2. Usability/Feedback
3. Project Outcomes
Reflection
1. Intention versus Realisation
2. Artefact Successes & Failures
3. Effect on personal practice
Further Questions

4.4 Artefact 1 Lorian: Quake 3 Level

4.4.1 Background

'Lorian' started as a University project on the BSc Computer Video Games programme in practice-based games design module, and was my first real foray into openworld games development (small scale map). The goal of the project was to create a playable Quake3 level (map), a popular games engine at the time. The project was more of a creative production challenge than 'problem solving'.

4.4.2 Process of Development

1. Sources of Inspiration

- The project was grounded by *King's Bounty* (a game on the Sega Megadrive) and the experience I had after playing the game extensively, after which the notion of linking gameplay to how the environment looked and was experienced for the first time.
- The project was focused on creating 'believability' in the gameworld rather than realism, as experience and reflection led me to believe that it was emerging as a strong factor in immersive games.
- Environmental archetypes ← psychological factors linking narrative to environment.
- Inferred narrative of environmental archetypes.

2. Development Processes

Lorian was unique in that an attempt was made to develop a landscape design process; this involved:

- Codifying Environmental Archetypes
- Developed system for expanding on Environmental Archetypes into region features
- Aligning environmental design with gameplay through environmental gameflow and thematic design

Technical design processes included:

- Heightmap creation from game flow diagram
- 2D environment heightmap to 3D environment format
- Terrain texture generation through digital photographs
- Integration and balancing of other assets (sound, music, models) into the environment

4.4.3 Review

1. Form & Function

The project created a functional Quest 3 map (**Figure 17**); this was a functional multiplayer map and performed well in basic test runs with a small number of players. Ultimately *Lorian* was essentially a prototype to test the process of design and VNE design in particular whilst the technology was rudimentary by today's (2015) standards.

2. Usability/Feedback

The game looked impressive and different i.e. novel. However, feedback from users included the following comments:

- a boring map (not much to do)
- the environment design supersedes the game's design thus gameplay is compromised
- the world is small scale as such the environment is quickly traversed
- The virtual world looks empty

Figure 17: Screenshots of Lorian: Quake 3 Level

3. Project Outcomes

Table 8 offers the list of outcomes for the project and the location of supporting materials.

Table 8: Lorian Project Outcomes

Outcome	Section/Location
Lorian Design Document	Appendix B: Lorian design
Lorian Video 1	Digital media drive
Lorian Video 2	Digital media drive

4.4.4 Reflection

1. Intention versus Realisation

The original intention was to create a rich environment; however the actual implementation differed due to technological constraints and a lack of design knowledge and experience. Added to this was the realisation that the design solely rested on aesthetic considerations of how the environment looked, but what was needed went beyond traditional artistic demands, and involved a process of deeper landscape design; that did not seem apparent when the project commenced. A surprise was the design stage was enjoyable and very productive, and established a design process that was effective at managing feature creep and the creative brainstorming stage. In addition the design stage started to address the equilibrium between inspiration, reference and emotional narrative. A final realisation was made in those flaws down at the technical stage of balancing gameplay with environmental design (which is one aspect of the overall games design).

2. Artefact Successes & Failures

Successes:

- Aesthetically impressive for the period and comparative to other environments in the user community.
- Design stage included natural environment 'archetypes'.
- The design process developed was unique (archetypes to features to thematic flow to 2d heightmap to 3d env map).
- The creation of a logical, reusable and documented design process (concept of shared knowledge, this could be used as reference point for other to jump off and to learn, from private knowing to shared reusable knowledge).

Failures:

- Failed to balance/align environment design with gameflow design
- Limited natural landscape references used to reinforce believability and hence immersion
- Limited use of photograph to texture conversion
- The art process and design process were inseparable

- Codifying Environmental Archetypes were not based on reference or any other foundation such as narrative, mythology or research.

Limitations of Technology: The software/game engine was limited in the ability to convey real world, the variety of manifestations of landscape features such as water (rain versus waterfall versus stream) and complex lighting (specular, diffuse), limited capability of engine to handle complex assets ('ambient assets').

3. Effect on personal practice

The effects on personal practice included a realisation and recognition that environmental design was a fascinating extension of previous interests such as mythology and writing. As a practitioner, I developed both technical proficiency and artistic skill in landscape design due to the project, and documenting the process was invaluable in creating a reusable process (i.e. distilling/extracting knowledge from the artefact). The initial inquiry started to provoke questions about the relationship between technology, art and design in creation of an artefact i.e. design is a manufactured solution to the problem, which is delivered through technology, manifested as art into an artefact.

4.4.5 Further Questions

1. What is the relationship between technology and design? In particular games hardware/software and design.
2. What are the existing methodologies in environmental/landscape/terrain design?

4.5 Artefact 2: Eternal Knight: Morrowind Modification

4.5.1 Background

Eternal Knight was a 3rd year undergraduate project, game modification. The focus of the design was to create a unique mix of narrative and aesthetic influences in creating a unique virtual environment with a particular landscape.

4.5.2 Process of Development:

1. Sources of Inspiration

The project was based on the experience of creating the *Lorian* project, only this time on a larger and better scale i.e. second cycle, larger and team based. The project also used *Lord of the Rings* as a heavy influence specifically the traditional fantasy narrative and how the landscape formed an important part of reinforcing the narrative. The project also used extensive game reference of specific visual style (consistency) in order to develop the notion of believability to encompass the narrative and natural environment design.

2. Development Process

Eternal Knight built on the lessons learned during the *Lorian* project however one significant difference was that the design process now moved from individual-based design to a team design process. The project made use of a large amount of photographic natural landscape reference i.e. real locations such as Alderney edge were used for both feature and archetype design as well as art production stage assets.

- World overview methodology used for landscape design
- The idea that narrative and landscape were inseparable drove the project from the start aiming to embed an emotional context to virtual landscape
- Extensive texture sets developed for various landscapes (emotion→moods→ keywords→aesthetics→archetypal landscape)
- Extensive landscape design documentation
- Landscape design process involved the following steps:
    - World map development (based on LOTR)
    - Narrative developed around virtual landscape geography (world map)
    - Key archetypes drawings/concepts, based on aesthetical reference as well as emotional reference
    - Further Codifying Environmental Archetypes based on traditional narrative/ mythology
        - System for expanding on Environmental Archetypes into region types, used to provide a context additional source of inspiration for sound & music
- Aligning environmental design with narrative through gameplay via environmental gameflow and thematic design

The technical design processes included:

- Narrative to world map to 2D heightmap for entire 'world'
- Heightmap creation from game flow diagram
- 2D environment heightmap to 3D environment format
- Advanced Terrain texture generation through digital photographs reference
- Integration and balancing of other assets (sound, music, models) into the environment

4.5.3 Review

1. Form & function

The final project was a personal triumph, both on a technical level and on a creative front. The game was playable and managed to capture the original design ideas of creating rich narrative expressed in a unique gameworld, full of unique areas/landscapes (see Fig. 19 & Fig. 20).

2. Usability/Feedback

The final game looked and played well and was impressive compared to the original mod and different i.e. novel.

Feedback: again aesthetics stand out as refreshing but environment design supersedes the game's design and hence gameplay is compromised. *Eternal Knight* in comparison to *Lorian* had the opposite issue in that the environment was considered to be too large in scale i.e. it was tiresome to travel and/or easy to get lost in the game. Feedback again included comments on the gameworld looking 'empty', missing ambient foliage and landscape clutter. Players also fed back that the limited interaction with environment created a static world which broke the immersion somewhat.

3. Project Outcomes

Table 9 lists the project outcomes for Eternal Knight, whilst **Figure 18** & **Figure 19** illustrate the in-game environment.

Table 9: EternalKnight Project Outcomes

Outcome	Section/Location
EK Images, Design Document, Screenshots, Video's, Game	See Foundation Practice Folder on media drive

Figure 18: EternalKnight Screenshot 1

Figure 19: EternalKnight Screenshot 2

4.5.4 Reflection

1. Intention versus Realisation

The original intention was to create a rich environment that married narrative, using elements of rich landscape design, which would reinforce the other elements hence increasing believability and therefore immersion. The actual building of the game was relatively in line with the paper design, however technological constraints, lack of design knowledge and experience still impacted the final artefact and time taken to source, analyse and implement natural environment archetypes to include in a narrative was very time consuming.

Similar to *Lorian* there was a strong realisation after and during the project that the design of the of the environment required design thinking and knowledge that went beyond traditional art skills, and involved a specific process of design (design discipline specific), one that did not seem apparent when the project commenced. The paper and 3D design stage were highly enjoyable and very productive; landscape considerations, archetype conceptualisation, and development of a narrative as a core part of the design. The project helped to establish a design process that was effective at managing feature creep and the creative brainstorming stage.

2. Artefact Successes & Failures

Successes

- Created a rich world that managed to marry a strong narrative with landscape design well
- Aesthetically different to the original game
- Design stage incorporated advanced Environment archetypes both conceptually and inseparable from narrative
- Project advanced and developed the design process i.e. using a World landscape view as a basis of design:
  - → archetypes to features to 2D heightmap to 3D environment map
  - → Narrative/story/plot
- Strong use of photographic images to texture conversion (adding an extra layer of richness to the landscape)

- Research phase for design much broader and worked successfully from individual to team lead design approach
- The 2D texture design phase from keywords to location selection to digital photo conversion worked well
- The project advanced in creating a reusable documented design process (concept of shared knowledge, this could be used as reference point for others to jump off and to learn, from private knowing to shared reusable knowledge)

Failures

- Limited to no interaction allowed between user and the environment (landscape)
- Lack of waypoints or design to help the player navigate the large world; total reliance on an in-game map to navigate the world
- World space was too extensive and sparse

3. Effect on personal practise

One of the key effects was the appreciation of landscape design and environmental design. A full year on the project was not sufficient to explore even a small part of the design process; to truly justice this would have to be a sustained and deep investigation into natural environment design. In addition landscape was more than just the geography or the physical components i.e. to fully explore virtual natural landscape design, a more traditional and deeper approach needed to be applied i.e. art/philosophy and the human condition.

From a personal perspective I realised that environmental design was a fascinating extension of previous interests such as mythology and writing, and traditional concepting, and within the area of virtual natural environment design there were many interrelated aspects. The project allowed me to further develop both my technical proficiency and artistic skill in landscape design and concepting - design as an expression which artistic skill communicated.

The need for a clear design process that was transparent, logical and justified in order to have 'buy in' from team members, personal knowledge that transformed into shared knowledge was vital:

- A process for the designer (to verbalise and track design decisions)
- A process for Team (to implement and comprehend decisions)
- A process for external and wider use (i.e. to promote shared knowledge)

Documenting the process was invaluable in creating a reusable process (i.e. distilling/extracting knowledge from the artefact).

- Initial inquiry Realisation of the relationship between technology, art and design in creation of an artefact
- Design is a manufactured solution to the problem, which is delivered through technology, manifested as art into an artefact

With hindsight there was a realisation that a critical area of knowledge was not explored; the project did not use environmental psychology/behavioural psychology etc. to underpin/inform the research phase which relayed on human instinct in the context of natural spaces.

4.5.5 Further Questions

1. To find a more suitable technology for landscape design
2. To investigate if other disciplines can support the landscape design process
3. To explore aspects of the landscape design process - how the 'traditional' games design process needs changing
4. To investigate how landscape/environment design effects immersion and gameplay, what users want versus implemented design choices
5. To investigate how to develop a standard natural landscape design process that includes emotional/narrative context
6. To explore the landscape design process on a technical level - how to break up the process into a design and production pipeline of design and implementation (i.e. layer pipeline process)
7. To further refine the World view→ Research→terrain type→design process
   a) modelling/Design Phase: generic terrain modelling, archetype placement
   b) Texturing phase: generic terrain texturing, archetype texturing
   c) Ambient landscape clutter (flora and fauna, sound, lighting, etc.)
8. To explore how to further develop region treatment; any existing landscape design process exist that can be adapted into this process?

9. To explore how the design pipeline drives the art development through a cyclical method:

   Research→Reflection & Integration→Synthesis→Implementation→Testing

4.6 **Artefact 3: Religious Fossils**

4.6.1 Background

Religions Fossils was an exploration of the fine lines between art, Science and Religion and my major project submission for my M.A in Creative technology in 2005 (**Figure 20**).The project was grounded by the following two questions:

1. What would be the impact on society if the fossilised remains of an angel or demon were found?
2. What if religion's greatest adversary became its greatest advocate?

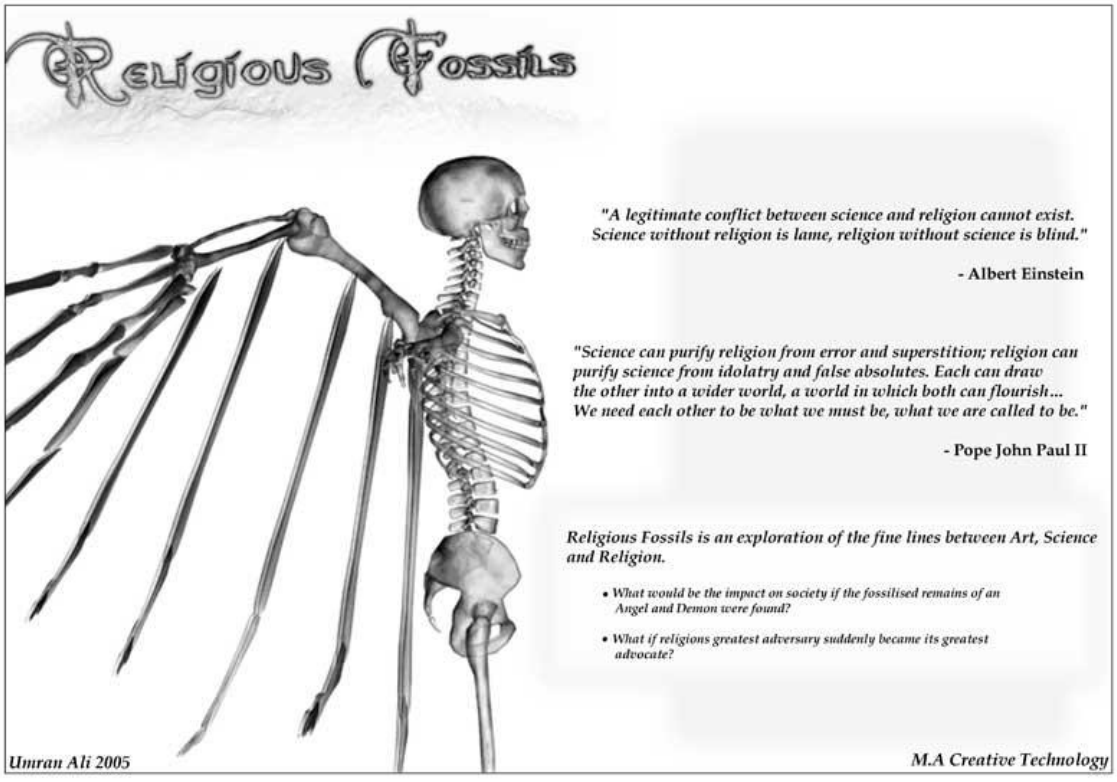

Figure 20: Religious Fossils Poster

4.6.2 Process of Development

1. Sources of Inspiration

The original inspiration behind the project was from *The Simpsons*, specifically the episode where one of the characters (Lisa Simpson) stumbled on the skeleton of an angel. The second main source was a particular real-life location (Alderley edge) I had visited for many years, and the idea of creating a new believable legend/inferred mythology for the region.

2. Processes undertaken/developed

The project undertook extensive on-site research in order to find a location that could contain fictional event The project attempted to combine 3D models with real life landscape into 'photorealistic evidence' This included the creation of false 'supporting documents', on and around excavation, geological dating, digs, etc. i.e. the development of a landscape interaction narrative to support the photographic evidence .The project combined local real mythology tied to local natural environment landscape to mythological event.

4.6.3 Review

1. Form & function

The final project consisted of a 3D printed demon skull; a folder of several fake x-rays, as well as several folders of 'fake' documentation. **Figure 21**, **Figure 22**, **Figure 23**, and **Figure 24** illustrate several of the outputs of the project. The component parts all acted as elements of a wider narrative - individual stories that helped create an illusion of a real cover up. The work was noted for its originality and its convincing nature.

2. Usability/Feedback

The feedback from the examiner and from an individual who attended a small exhibition were positive; many noted the collective piece was believable, authentic and highly convincing as a narrative, the use of a local landscape and mythology tied in well with final piece.

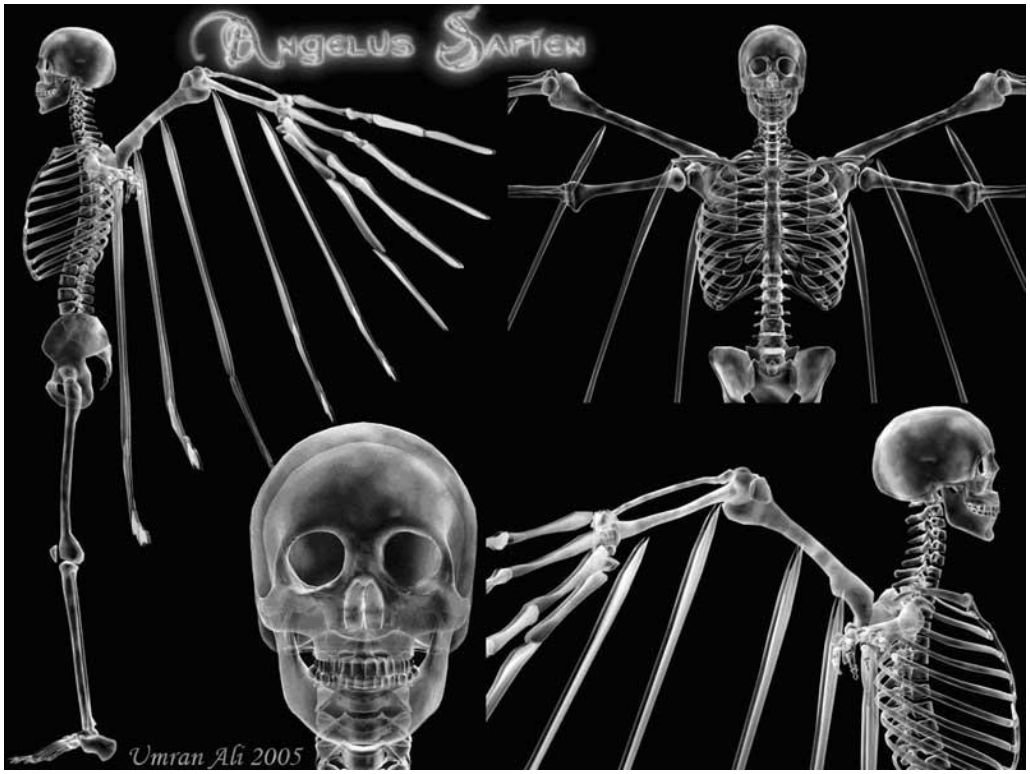

Figure 21: Religious Fossils Angel 'X-Ray'

Figure 22: Religious Fossils Demon 'X-Ray'

Figure 23: Religious Fossils Angel Photo/3D Composite

Figure 24: Religious Fossils Angel Photo/3D Composite

3. Project Outcomes

Table 10 summarises the list of outcomes for the project and includes the location of additional supporting materials.

Table 10: Religious Fossils Project Outcomes

Outcome	Section/Location
Religious Fossils Photographs	See Digital media drive
Alderley Edge Reference Images	See Digital media drive

4.6.4 Reflection

1. Intention versus Realisation

The original intention was to create a believable excavation site for a mythical creature, the final project was far more than the original intention as it grew to include a physical artefact (resin cast skull), and a full collection of documents, and a series of X-Rays.

2. Artefact Successes & Failures

Successes

- Creation of a fake x-ray material for the 3D models
- Creation of a convincing narrative to support the visual information
- Successful use of a real natural environment as a method of adding believability and authenticity to a fictional and highly controversial subject.
- Creation of a library of 'real' photographic evidence that combined 3D virtual models with actual landscape photographic imagery.

Failures

- The project did not delve deeply into religious perspectives or possible reaction to the work.

3. Effect on personal practise

- There was a definitive confirmation that local landscapes were an important and easy to access method of adding to the immersive (believable) quality of an artefact

- The belief that photorealism can add to immersive quality of the artefact was confirmed even further by the work.
- The notion that believability was a key part of immersion, which is not necessarily the same thing as realism (aesthetic or otherwise) was tested and largely confirmed based on initial assumptions, the work and resulting feedback.
- Landscape archetypes could be used to add inferred narrative to an artefact.

4.6.5 Further Questions

1. What is the relationship between realism, believability and immersion
2. Effect of photorealism on immersion
3. Effect of using inferred (landscape) narrative on immersive quality of an artefact

4.7 Artefact 4 PlastiCity: Urban Planning Game

4.7.1 Background

Plasticity was a computer game based on the British architect Will Alsop's vision of the future. The game was created in partnership with the following individuals in the following roles:

- Mathias Fuchs, University of Salford (Level Design, Art, Concept)
- Steve Manthorp, Bradford City Council (Concept, Gameplay)
- Vera Schlusmans (Unreal Script Programming, Concept, Gameplay)
- Umran Ali (Terrain Editing, Modelling)
- Kelvin Ward (Modelling, Digital Photos)

Bradford City centre was facing an urban reconstruction plan and Bradford City Council commissioned Alsop to redesign this new space; his final vision involved the removal of the magistrates Court/police station from the heart of the City Centre, and the creation of a 'lake', which at the time was controversial and in some instances derided by the press.

4.7.2 Process of Development:

1. Sources of Inspiration

According to Fuchs (2004):
"The genesis of PlastiCity was an investigation into the history of urban planning and a research project on the past, present and possible future of urban structures. The history of visions of cities of the future was also surveyed, as found in the work of: Boullée, Fourier, Malevitch, Tatlin, Le Corbusier, Fritz Lang, Arata Isozaki, Archigram and Will Alsop" (p.2).

Fuchs also commented on the unconventional nature of the cross disciplinary project:
"We set out to mix painterly and sculptural approaches with those originating from architecture and tried not to prejudge any of these approaches as being either naïve and silly or advanced and serious. While our interdisciplinary approach of cross-breeding games, film and architecture is certainly unconventional, we believe that it leads to much more interesting outcomes" (ibid, p.2).

Fuchs identified the grounding for the work:
"Led by Alsop's statement that "the absence of joy is the biggest threat to our society" we have attempted to emphasize the playful, joyful and ludic elements in urban planning and to question the more serious, technically 'sane' approaches" (ibid, p.2).

2. Development Processes

The project used extensive photographic reference that was collected by hand as well as the requirement of exploring real topographical and elevation data and photographs of the city. Several buildings were photographed in detail, from which a 3D model was modelled and textured (**Figure 25**).

The GIS Elevation data and aerial photography converted into 3D format (**Figure 26**) then converted this and imported it as a virtual 'terrain' inside the Unreal game engine, creating a simulacra of Bradford City Centre (**Figure 27**).

4.7.3 Review

1. Form & function

The final project offered the following:

- A detailed, misplayed 3D environment based on a real architecturally grounded city (Bradford)

- Created a prototype which was applicable to any planning activity across the UK (and wider) that involved an aspect of seeking participant (public) agreement
- Established a socially inclusive and democratic use of games technology used to encourage and facilitate a discussion on urban planning and architecture.
- Introduced a range of tools that could be used to demonstrate how architecture and built environment may be shaped.

Figure 25: Bradford Police Station 3D Model

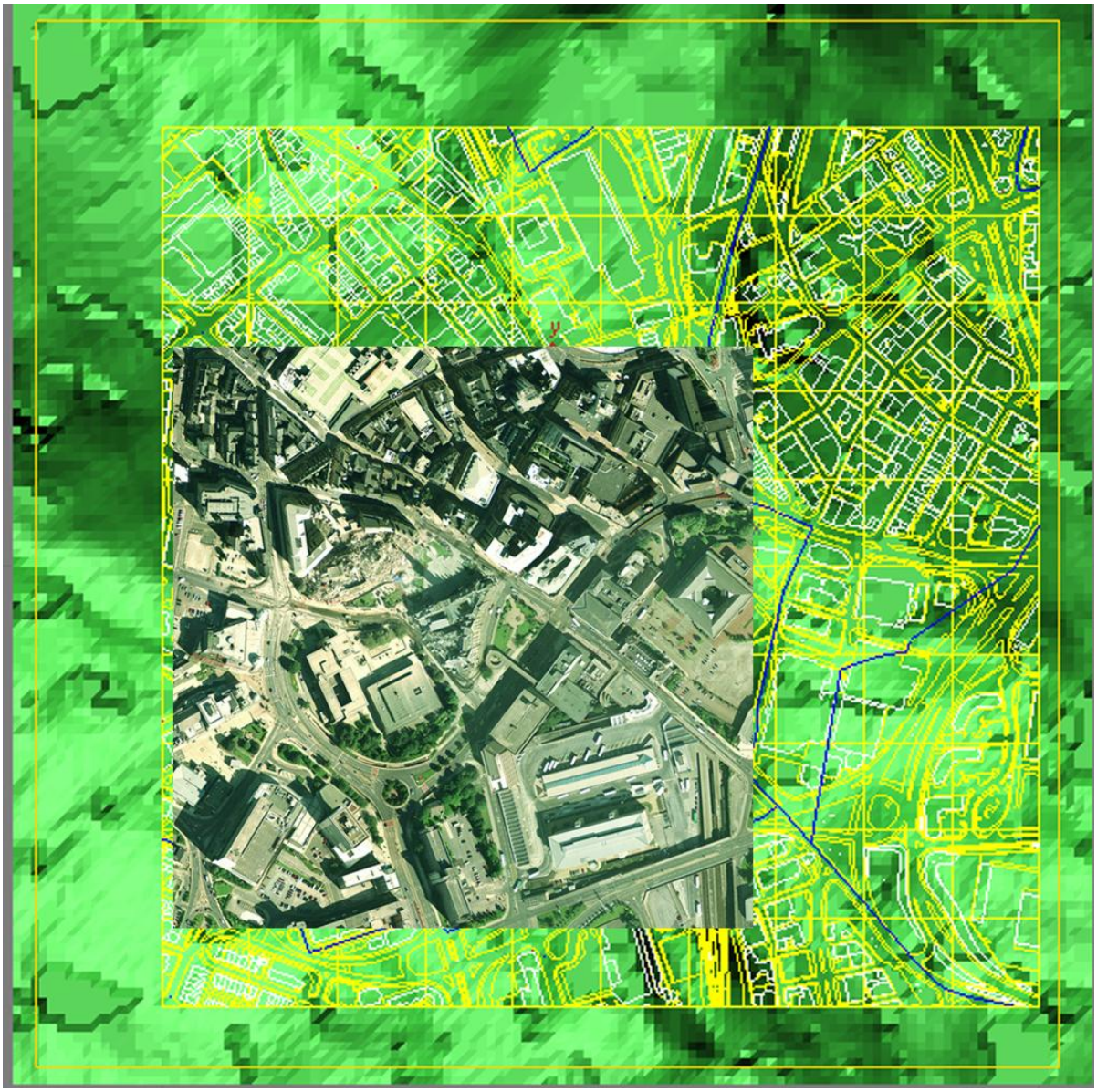

Figure 26: Bradford Topographic GIS Data/3D Model Overlay

2. Usability/Feedback

The game was showcased at the Game Developers Conference in 2006 and received feedback, and received praise and criticism. Fuchs states (2004, p.3): "*It is not surprising that user-feedback for the PlastiCity game has included complaints about a lack of serious real-life economics*". Fuchs also interestingly notes the issues around PlastiCity being work of art and the same time as not only impacting but facilitating a real world issue, stating (ibid, p.3) *"It is interesting to note that criticism of the PlastiCity project as being unrealistic because of its blind*

spot toward economic constraints, and its ambiguous role of having a say in real-world issues and being a work of game art at the same time".

Figure 27: PlastiCity In-Game Screenshot

3. Project Outcomes

Table 11 summarises the list of outcomes for the project and includes the location of additional supporting materials.

Table 11: PlastiCity Project Outcomes

Outcome	Section/Location
Plasticity Images	See FoundationPractice Folder on media drive

4.7.4 Reflection

1. Intention versus Realisation

The project intended to serve as a tool and the final result was a useable and engaging prototype which was applicable to creating a discourse on Alsop's vision for the city centre. The final game established a socially inclusive and democratic space for this discourse to take place in an engaging and creative manner.

2. Artefact Successes & Failures

Successes (listed under Form & Function on the previous page)

Failures

- Did not provide players with an in-game economic model of building/destroying the architecture.

3. Effect on personal practise

- Terrain deformation is a viable gameplay feature, opens up a range of scenarios to explore
- Realisations that over use of existing landscapes was potentially counter immersive, existing knowledge of a terrain would undermine efforts to promote immersion through believability
- Use of elevation data could add to immersion if subtle landscape forms exist and add what human terrain design misses
- Appeared to be unusual /expected behaviour in regards to territory in VE

4.7.5 Further Questions

1. What gameplay features or other contextual cues can be used for terrain deformation
2. The relationship between existing aesthetic and landscape data versus procedural
3. Subtle landscape forms; do they exist and what are the major theories underpinning environmental/landscape human behaviour (psychology)
4. Territoriality and Habitat selection in natural virtual environments

5. What are the environmental and behavioural psychological aspects of terrain deformation in virtual environments (i.e. games Harvest Moon)

4.8 Artefact 5: Virtually Factitious

4.8.1 Background

Virtually Facticious was a community cased interactive project. The project researched different concepts of 'memory' and its representation in an interactive virtual environment in 2004. The project was led by Mathias Fuchs (a noted games academic) and myself and others (Wibke Hott, Kelvin Ward). The project was a joint venture between the University of Salford, BT Exact and Liverpool based Dark Horse Venture.

The project used participants and partners to think about the way they visualise memory, how and who they shared their memories with; this was used to inform the creation of a virtual environment representing participants' memories. BT Exact, the supporting research technology partner, offered its in-house developed TARA rendering engine for the construction of the virtual environment containing over sixty years of participants' memories in and around Liverpool.

4.8.2 Process of Development

1. Sources of Inspiration

- The project used extensive interviews, images/photographs and information directly from the lives of several participants from the Dark Horse Venture.
- The project was focused on creating a gallery of memories in a 3D environment
- The project explored the relationships between memory and reality (romantic pseudo memory)
- There was a focus on cataloguing individual users' life experiences into tangible representations in a 3D space.

2. Processes undertaken/developed

- Abstracted virtual environment based on emotional memory
- Extracted key emotional events and seminal sounds/images into VE

- One core aspect was to translate children's paper drawings from 2D to pseudo 3D without the technology 'getting in the way'
- Developed pseudo 3D technique to reduce the impact of 3D modelling technology.

4.8.3 Review

1. Form & function

The project was a personal triumph, both on a technical level and on a creative front. The environment was well-received by participants, it was playable and managed to capture the original design ideas.

2. Usability/Feedback

The project was well-received by participants. There was a significant positive emotional impact on several of the users, one of which started to weep, as the project had successfully captured the spirit of some of the memories she had shared, they felt authentic and sincere

3. Project Outcomes

Table 12 summarises the list of outcomes for the project and includes the location of additional supporting materials.

Table 12: Virtually Factitious Project Outcomes

Outcome	Section/Location
Virtually Factitious Video	See Folder 'DarkHorse' on media drive
Virtually Factitious Presentation	See Folder 'DarkHorse' on media drive

4.8.4 Reflection

1. Intention versus Realisation

The project set out to capture the lives of several participants over 60 year period; key emotional memories were selected and then a 3D environment was created. On reflection the project's intention of creating a sincere and authentic, emotionally engaging virtual

space was faithfully realised in the final outcome, this was evidenced by the positive reaction it received from the participants and from the developers/partners.

2. Artefact Successes & Failures

Successes

- Achieved emotional impact/connection with a non-typical VE user
- Technology, both virtual and interface did at certain moments become transparent i.e. experience→user without the constraining tech barrier

Failures

- The 3D environment still constrained a user to a standard 'walk and look' type of interaction/ experience

3. Effect on personal practise

- Realisation that emotional connection/context added to a virtual environment increases immersiveness
- Realisation that memory concerning experiences pivots around a few core objects/ sounds/entities
- Landscape does not have to conform to set archetypes in the creation of a virtual space
- Believability is a key part of immersion, which is not necessarily the same thing as realism (aesthetic or otherwise)
- Aesthetics, as a Visual technology can sometimes interfere/detract (or become the unintended focus) from the experience→user path
- Research phase on gathering 'psychological profile' of users proved to be beneficial in helping them connect to the intended design experience.

4.8.5 Further Questions

1. Can emotional context/generic emotional responses be codified for certain archetypal landscapes or natural pattern forms?
2. To what extent can a natural landscape be abstracted and still remain a coherent space?

3. What sub factors form the constituent parts of believability in relation to immersion in a virtual environment?
4. To what extent does technology (visuals, interface, etc.) interfere /support the user experience?

4.9 Foundation Practice Summary & Conclusions

4.9.1 Overview

The practice review attempted to analyse past artefacts I have worked on/created over the last decade as a 3D artist and designer. They all share a common theme: virtual environment design focusing on the natural environments. **Table 13** lists brief summaries from the individual foundation artefact analysis.

Table 13: Summary of Individual foundation artefact analysis

Lorain, Quake 3 Game map
• Documenting the process was invaluable in creating a reusable process (i.e. distilling/extracting knowledge from the artefact) • Realisation of the relationship between technology, art and design in creation of an artefact can be problematic
Eternal Knight (game modification)
• To fully explore landscape design, non-traditional disciplines should needed to be explored i.e. art/philosophy and investigate the link between natural landscapes and human condition.
Religious Fossils: M.A Final project Artefact
• Believability is a key part of immersion: which is not necessarily the same thing as realism (aesthetic or otherwise) Landscape archetypes can be used to add inferred narrative to an artefact.
PlastiCity: Urban Planning Game
• Identified that over use of existing landscapes was potentially counter immersive, existing knowledge of a terrain would undermine efforts to promote immersion through believability.
Virtually Factitious: DarkHorse Project
• Virtual Natural landscapes do not have to conform to set archetypes when creating a rich immersive virtual space • Adding a research phase on gathering 'psychological profile' of users proved to be beneficial in helping them connect to the experience i.e. smaller gap between the intended design experience (IDE) and the actual user experience (AUE) • Identified that emotional connection/context (resonance) added to a virtual environment increases immersiveness.

4.9.2 Summary of Reflective Practice: Further Questions

1. What other disciplines can support and enrich the virtual natural landscape design process?
2. How can the landscape design process on a technical level be expanded into a design and production pipeline of design and implementation?
3. Do the concepts of territoriality and habitat selection occur within virtual natural environments? If so to what extent are these behaviours expressed?
4. Can emotional context/generic emotional responses be codified for certain archetypal landscapes or natural pattern forms?
5. To what extent can a natural landscape be abstracted and reduced and still remain a coherent space?
6. What sub factors form the constituent parts of believability in relation to immersion in a natural virtual environment?

Chapter 5: Study 1: Virtual Landscapes

5.1 Introduction

Natural landscapes have long been a focal point of human interest in the natural environment. It has been through these reflections either through art, literature or sculpture that we see a glimmer of immortality - one that granted a level of persistence to these landscapes in the minds of individuals and society over time; these landscapes were, in essence forever preserved, through art and literature even though the actual landscape, either through adverse natural or manmade change may have been lost centuries before.

The virtual domain is however different; the digital landscapes, are in a sense more vulnerable and prone to being lost than their physical counterparts. The virtual landscapes are in a sense, exposed to the ravages of time since they do not occupy a fixed physical space, and the virtual space that is occupied is limited to a fixed relatively short window of time dependant on factors such as the genre of the game and the platform (and its own lifespan). These factors have meant that many of these virtual landscapes now remain uninhabited, abandoned and largely forgotten. The *Virtual Landscapes* project in this respect functions as a digital preservation archive, one that attempts to visually record these unique environments and the landscapes contained within, and to present how, over time, they have evolved and developed into what we see, play and interact with today.

5.2 Overview

Games development has rapidly advanced over the medium's lifetime, which in comparison to traditional media (print, TV, cinema, etc.) is in its relative infancy (~30 years). This defining element of video games i.e. rapid technological advancement over such a short period of time proves to be both a major pitfall and success. Games development over the course of three decades has moved from the single 'bedroom coder' costing no more than a few hundred pounds over a several week production cycle to now employing multi-national

teams involving hundreds of individuals costing tens of millions of pounds, over the duration of several years.

5.2.1 Research Context

The literature review highlighted that open-world games, or games featuring more expansive and realistic natural environments and/or landscapes are growing, in terms of budget, scope, scale and development team sizes, and as such existing game development may not be sufficient to cope with the new demand, this is even more critical given that previous bottlenecks of technology limiting design have largely been overcome. Computer & video games are now a commercial super-weight compared to other media such as film or music, and as a result design practice is still largely contained, protected and not generally disseminated; however at the literature review revealed this is changing due to a demand, emerging across open/indie development, education and academic research, which is seeking to share, critique and evolve the embryonic game design & production theory and practice.

Games documentation and process is not standardised across the games industry and is often closely guarded and therefore inaccessible outside closed development studios. Games design as a skill is also increasingly been sought outside the games industry, this has been demonstrated by the recent rise of 'gamification' and the rise of games as an educational subject, evidenced by the explosion of computer & video programmes of study across the spectrum of education (e.g. in the UK alone over of the last 15 years there are now over 250 game related courses emerge). This increased demand illustrates the growing need for growing and advancing the knowledgebase in computer & video games design theory and practice, not just to service the current games and related industries with specialist game developers but also to develop and equip graduates with skills, knowledge and practice to better meet unknown future demands.

5.2.2 Issues identified by Foundation practice

The following issues were identified from reflection on foundation practice and were pertinent to this study:

1. Within the 'traditional' games design process, aspects of the landscape design process need changing given the complexity of the area and the lack of guidance (e.g. tutorials)
2. What other disciplines can support the landscape design process?
3. What is the impact of games technology on games design? And in particular games hardware/software on natural environment design?
4. How to further develop region treatment; any existing landscape design process exist that can be co-opted into this process? (turns out to be landscape character assessment maps).
5. How can one further develop 'region treatment' in VNE design; are there any existing landscape design processes that can be adapted and used into this process?

5.3 Questions & Problems

5.3.1 Main Research Question

Q: How have VNEs evolved in CVG over the last 30 years in both technological and design innovation and what has been (if any) the dominant design paradigm?

5.3.2 Research Problems

Problem 1: Given the rapid evolution of computer and video games in design and technology, how does one propose any improvements to the design process or technique or a new future framework for VNE design if a historical and chronological survey/analysis of existing VNEs has not been carried out? If one is to identify a gap in the knowledgebase/current state of design then this 'knowledgebase' needs to be identified and established.

Problem 2: How can one create a knowledgebase outcome that would be more than a simply static historical archive, in keeping with the immersive and interactive nature of computer and video games? How could one present any visual outcomes in a manner that would allow for collaborators (researchers, game developers, students) to search through the

historical repository in a personalised manner, in which they can identify elements that are specific to their interests/needs?

Problem 3: Given the complex nature of how these VNEs are integrated and embedded within computer and video games alongside aspects such as characters, narrative, etc. and given the heavily protected nature of games development (i.e. there is lack of appropriate freely accessible design material shared due to legal protection or simply lost due to the ad-hoc approach of early games design) how does one find the appropriate 'entry-point' into these virtual spaces in order to analyse the virtual environments?

Problem 4: Since there are multiple perspectives from which this problem can be approached, which one would enable the 'extraction' of meaningful primary data that would reveal the VNEs in a manner which would aid a level a deep level of reflection and follow-on analysis, with a view to separate strong/poor practice of successful/unsuccessful design positions/methods/techniques?

Problem 5: Despite the growth in popularity of the medium, computer and video games still remain a niche pastime and occupy an even smaller space in academic research. In order to truly develop VNE design as a discipline one must present these spaces in a way that could incite further discussion with audiences wider than simply gamers (users) and developers (product creators). How can one present any practice outcomes that will appeal to wider audiences in order to truly incite cross-disciplinary discussion and development?

5.3.3 Research Aim

To investigate and illustrate the history of VNEs in games over the last 30 years in order to support the creation of a new VNE design framework.

5.3.4 Research Objectives

1) To create a book archive which reveals, illustrates and exemplifies the findings of the practice-based work carried out and to publish the book in both physical and electronic forms.
2) To create an interactive historical archive of VNEs in games over the last 30 years.

3) To examine how the design of VNE has developed along specific design paradigms over the last 30 years.

4) To develop an initial VNE Design (VNED) framework as a basis for further investigation during the second action research cycle.

5) To identify practical ingredients which could form the basis for environmental design practitioners to further evolve non-empirical approaches to making natural environments in games.

6) To research possible alternatives to the narrative or aesthetic based approach employed by designers in the creation of natural environment games design

7) To create a design practice outcome, whose form and approach can shed new light on man's relationship to virtual natural landscapes.

8) To incite critical discussion and open debate on the state and function of natural environment design in virtual environments.

9) To provide gamers/users familiar with game environments a unique visual insight into game spaces that they may reveal them in a new light, and to provide non-gamers visually engaging and unique perspectives of 'games' treated in a serious and artistic manner.

5.4 Literature Review

5.4.1 Existing design process

The development of sub-roles within design has so far been a reactive approach, as games grow in complexity with an increasing demand for a larger and more complex array of digital assets; roles have been developed to cater for specific aspects of the design such as technical design, level design, so one can see this approach is problematic since it does nothing in addressing future demand but only addressing current developmental needs. The emergence of destructible environments (i.e. game with terrain deformation such as Fracture, 2009) within video games over the last few years begs the question of whether or not an environmental-interaction designer will eventually become a key role within game design.

5.4.2 Current research

Current research in VNED has focused in areas such as rules, player interactions, systems and communications. A problem with the current approach is that they diverge into two main paths: narrative (text) or ludo (play) approaches, and an issue arises due to the fact that existing analysis methods have been co-opted from other disciplines (e.g. textual from literature, communication from sociology). Research on VNED is essentially non-existent. Environmental storytelling briefly touched upon offering an insight into how immersiveness can be increased by using environmental archetypes but with brief recognition of the issue.

Relevant studies in the field of VNE or game environments are extremely limited. Current analysis is largely based around narrative versus play. Early videogame criticism often focused on one element or the other, with the 'ludologists' primarily interested in the systemic interactions of play (Aarseth, 1997; Frasca, 1999; Juul, 2006) while the 'narratologists' focused on the stories of play (Murray, 1997 and 2005; Jenkins, 2004). Although the play aspect within games is a useful focal point from which to analyse the impact on the user and resulting experience, the aesthetic component is not easily accessible and a powerful entry point from which to reflect and analyse design impact and experience (i.e. visual analysis is a useful research method).

5.4.3 Landscape Architecture & Environment Design

As discussed in the literature review current design methodologies around VNE design have tended to follow an aesthetic-driven approach rather than one centred on more traditional design methodologies or virtual architecture design in games. This illustrated that there is a need to use established design philosophy/processes such as Architecture to inform building the virtual environment. Within certain video game genres, entire virtual worlds can exist within these 'worlds'; entire unique environments exist (often separated by themes linked to the game's narrative) and these again can sometimes be separated by smaller sections crudely defined as landscapes. However, there is an important distinction between 'landscape' and 'environment'. As geographer, and landscape advocate, Jay Appleton (1975) states: "*Landscape does not mean the same as the word environment, it is the environment perceived, especially visually perceived*". This distinction is useful in providing a sense of the relationship between the two which will be discussed later and used as a basis to construct the new VNE framework.

A report[10] by the Water and Rivers commission (2000, p.1) further elaborates on the meaning of 'landscape': "*Unlike other aesthetic objects, such as buildings and paintings, landscape is not a discrete object. Landscape is more than physical features. It is the way a person interprets, interacts, and reacts to the natural and cultural elements of the environment*". A potential tool that could be used for this design process is found in traditional natural environment design disciplines such as landscape architecture and surveying. Landscape Character Assessment[11] (LCA) is step by step process/system used to codify and sort a range of landscapes and related features into discernible character types and areas. According to The Countryside Agency LCA guidance, LCA is a tool "...*used to help…understand, and articulate, the character of the landscape. It helps... identify the features that give a locality its 'sense of place' and pinpoints what makes it different from neighbouring areas.*"

Although LCAs used in traditional landscape planning on exiting physical landscapes, this framework could be adapted for VNED, as it relies on the process of defining the larger macro regional character areas (or even the larger bio-climatic zones) down to specific micro 'site features' so it could be proven to be very useful to a natural environment designer, if it were used as part of a systematic process to create more immersive, believable natural environments.

5.4.4 Beyond Textual Analysis

A text-based analysis of games can be useful as it provides a quick and easy entry point to analyse the design experience, yet was initially problematic since I was forced to describe complex virtual architecture either from memory or through a second hand perspective, and then attempting an analysis of this was problematic as the meaning and impact of the virtual spaces was filtered through additional 'lenses' i.e. would not have been primary data. Subsequently, research Problem 3 and Problem 4 were formulated (section 5.3.2 of this chapter).

[10] https://www.water.wa.gov.au/__data/assets/pdf_file/0015/3354/11419.pdf

[11] Landscape character assessment is the process of identifying and describing variation in character of the landscape. LCA documents identify and explain the unique combination of elements and features that make landscapes distinctive by mapping and describing character types and areas. They also show how the landscape is perceived, experienced and valued by people. [REF]

Figure 28: Typical Game Viewpoint (Source Gamereplay.com 2016)

Figure 28 illustrates the typical screen space (i.e. what a player would see) of a modern video game. The screen space is often comprised on a multitude of 'overlaid' sub-elements (**Figure 29**) onto the game world: the Head Up Display (HUD) and the character, and although not visually apparent the camera can also be considered an overlay since the field-of-view (FOV) can be altered to suit the gameplay and can radically effect how the player visualises the game world environments and landscapes (**Figure 30**).

However as defined by the scope of the research and on reflection, these overlaid components were not necessary and in fact a hindrance when collating the visual data for later reflection and analysis. After the initial textual analysis, a conscious decision was made to use practice (photography in particular) as a research method to help answer the problem. Gray & Malins (2004, p.108) note a particular concern when using photography *"…as a research method, needs to go beyond the 'happy snap'! Therefore, as an acquisition method (and to aid later analysis) annotation is essential"*.

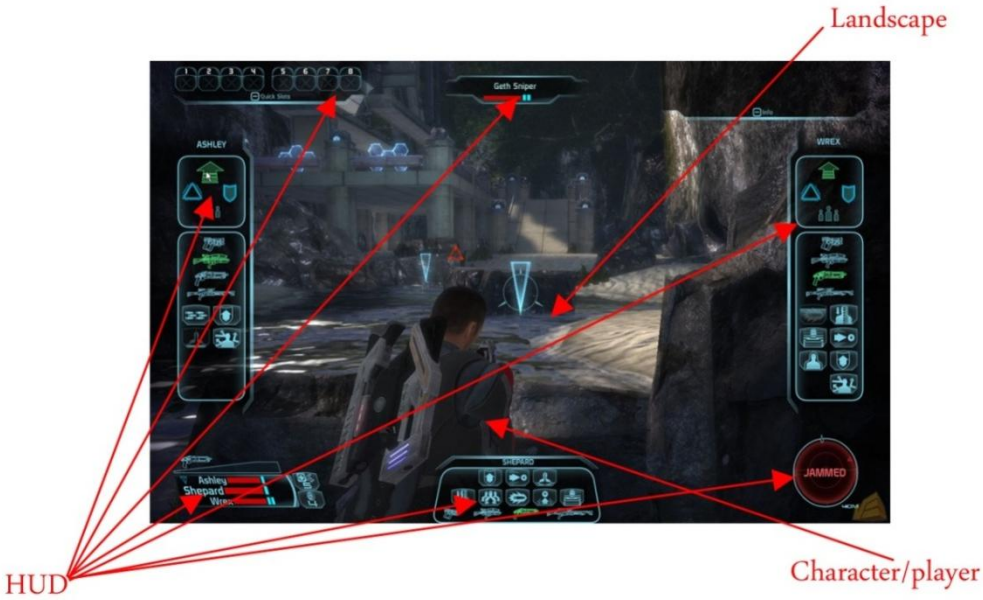

Figure 29: Visual components of a game

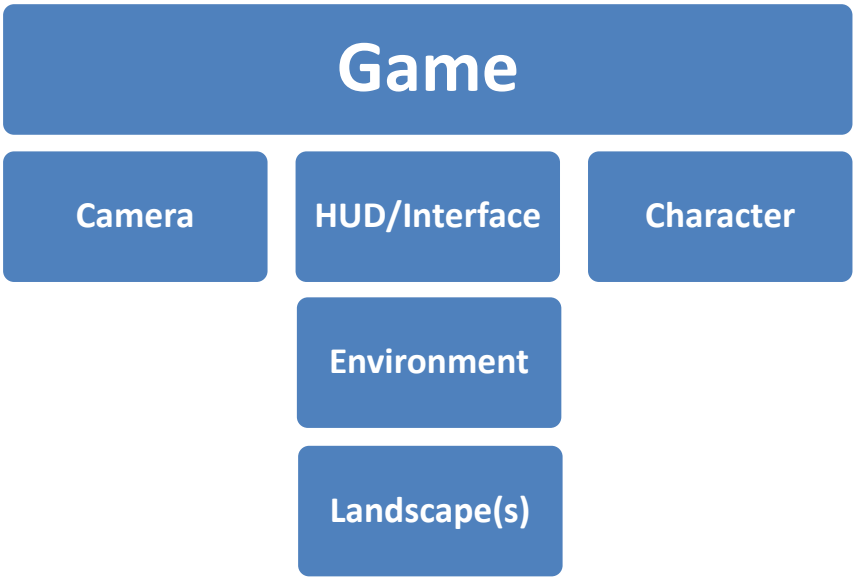

Figure 30: Hierarchy of Game Visual components

These *annotations* can fall into two categories:

- **Reflective Annotations:** Based on user experiences (personal or collective)
- **Analytical Annotations**: Using the reflection as a foundation one would attempt to analyse and 'extract' design knowledge, or establish any common trends or emerging patterns from the image.

Despite the use of photography in this research being 'virtual' as opposed to conventional physical photography, it was used as a qualitative research method in particular to:

- Determine the current legacy practice in games landscape design
- Understand the construction of virtual environments
- Provide an unhindered visual perspective of the constructed design
- Draw out difficult concepts related to VNED.
- Form of restoration - Environments lost long ago are extracted and distilled
- Photography as a method "*offers a reflective entrypoint into an exploration*" of the recording of the space (Gauntlett, 2005, p.1).

However the practice was still largely non-specific in focus and reasoning, until I reflected upon Jay Appleton's (1975) thoughts on the relationship between the wider environment and the more specific element contained within (i.e. landscapes); this proved to be a pivotal changing point in developing the emergent research process. Appleton defines the relationships between environment and landscape with succinctness: "*Landscape is not synonymous with environment, it is the environment perceived, especially visually perceived*".

An analysis of wider virtual environments could be extremely difficult and time consuming and would possibly fall far outside the scope of the intended investigation considering the size and scale and complexity of even relatively early virtual environments. However reflection and analysis of the distinct 'landscapes' within the large virtual spaces was a more manageable task given the time and resource constraints.

Another aspect that needed to be considered was how the outcome of the visual research would be presented. This led to the formulation of research Problem 5 (section 5.3.2). Through my personal interest in natural landscapes I had come across the *Landscape Photographer of the Year Awards.*

Landscape Photographer of the year, represented a possible manner in which the research outcomes could be presented in order to attract and incite wider discussion about virtual environment design by adopting an existing visual exhibition form. Rather than treating the games as narratives (and therefore using textual analysis to convey meaning and function) or from a ludic/play perspective, these spaces could be treated as real landscapes (albeit virtual) and reflect/analyse the ways in which gamers "*interpreted,*

interacted, and reacted to the natural elements of the environment..." Water and Rivers commission (2000, para.5).

Even within conventional landscape photography a wide range of techniques can be employed to capture the landscape, therefore, the aim of this study was to emulate the Landscape Photographer of the Year books to a degree and closely align to traditional landscape photography. However the format of how these images should be presented, raised another problem, and given the research objectives, it needed to be one that would facilitate the creation of unique visual perspectives that could be captured more readily and therefore help users perceive an entire landscape to reflect upon and analyse. A particular technique was chosen: 360 degree panorama photography.

5.4.5 Panoramic Framing

How does one chose a photographic framing technique to elicit deeper levels of engagement and reflection (which will hopefully provide a stronger foundation for later analysis) and frame these virtual spaces? Considering the broad range of techniques that have developed over the last several decades this initially presented a problem. However the question was somewhat partially focused as photography type and technique are often linked to the subject (i.e. photography→technique→subject). For example, insect photography often utilizes macro photography as a technique to capture miniature subject detail which conventional photography would struggle to capture. Since the subject of the creative practice investigation was landscape (virtual) one can narrow down the range of appropriate techniques further.

As Nausser (1993, p.15) argues the choice of framing can elicit different viewer responses: "*Different photographic framing choices can elicit different viewer responses to a landscape. Framing formats that create large images with broad horizontal ranges may be superior for simulating field experience*". In an ideal scenario one would be able to place the viewer directly into the virtual environment, however this is not currently possible given the technical constraints and wide variety of different tools and technologies used to create the virtual worlds; therefore consideration of the use of a 'surrogate' in representing the space was sought.

Panoramas are by nature wide-angle presentations of spaces, ones that often"…*create large images with broad horizontal ranges"* (Nausser (1993, p.15) therefore it was reasonable to

assume that by framing the landscapes as panoramas one could produce a visual 'surrogate' that is superior in "*simulating field experience*" (*ibid*. para.55) to other photographic framing techniques. An assumption that this still holds true in the virtual domain was made since the 'field experiences' that Nausser refers to are actual physical landscapes.

Panoramic photography is a popular technique in landscape photography; in fact the use of panoramic techniques in the presentation of landscape predates photography. Why is this the case? Apart from the increased dimensions, how do panoramas differ from other photographic techniques? The key in answering this question is considering how we visualise and perceive the space around us. A panorama is far more than simply a wide-angle photograph. A single-framed photograph is often referred to as a frozen moment or snapshot in time. Panoramas are conversely snapshots of many moments stitched together. As Bartscherer & Coover (2011, p.211) state: "*a conventional panorama is a collection of moments seamlessly combined; it is not one moment*". This sentiment which is also echoed by Rav-Acha & Pritch et al (2005, p.1) who discuss this dimension of the panorama in relation to our perception: "*…with the limited field of view of human vision, our perception of most scenes is built over time while our eyes are scanning the scene. In the case of static scenes this process can be modelled by panoramic mosaicking: stitching together images into a panoramic view*".

Whenever an individual observes through their limited field of view, they can only perceive no more than approximately one third (the horizontal field of view for humans is approx. 114 degrees out of a possible 360) of the entire visual field around them at any one point. Since panoramas are a visual snapshot of the entire field of view, it can be argued that they are more closely aligned with our perceptual view of how we would actually view a real landscape.

Bartscherer & Coover (2011) perspective on the nature of the panorama prompts to an incredibly powerful realisation, one that reflects not only on a greater range of information of the environment inherent in a panorama (i.e. you are capturing more of it) but also the wider perceptual process that occurs when one views a landscape; this is not limited to a single moment in time but a perception that is built up over many moments combined and stored as a memory. The combined thought and feeling that remains can be powerful but difficult to communicate if one lacks the appropriate language to articulate its impact, however panoramas offer this in an instant. In that combined instant the panorama offers the entire field of view, that would have taken time to survey due to constraints of our physiology, can

now be perceived in an instant on a single fixed plane; we are no longer bound by the limits of the physiology of our visual apparatus but free to now absorb, feel and reflect on those spaces.

Panoramic images offer the viewer more information which allows for the selection of multiple areas of stimuli simultaneously. The panorama has provided what Verhoeff (2012, p.37) calls *"the experience of the limitless visual perception"*. With this 'limitless visual perception' one can argue the viewer now has more freedom in choosing areas of stimuli, ones that would increase levels of engagement and reflection. Wherrett (1996) argues the amount of detail in a photographic frame offers users the ability to select stimuli: *"When a great deal of the landscape is included in the photographic frame, the viewer may scan the photograph much as she/he might scan the landscape, selecting from a range of stimuli those that are important."*

Figure 31 illustrates the relationship between environment, landscape and panoramic framing i.e. the panoramic framing as a method in which the landscapes are an entity in which the environment can be visually perceived.

Given the research objectives the use of panoramic photography was twofold:

1) To provide gamers/users familiar with the game environments a unique visual insight into a space that they may reveal them in a new light
2) To provide non-gamers visually appealing and unique perspectives of 'games' treated in a serious/artistic manner which may for the virtual landscapes do what Landscape Photographer of the Year Award did for real landscapes.

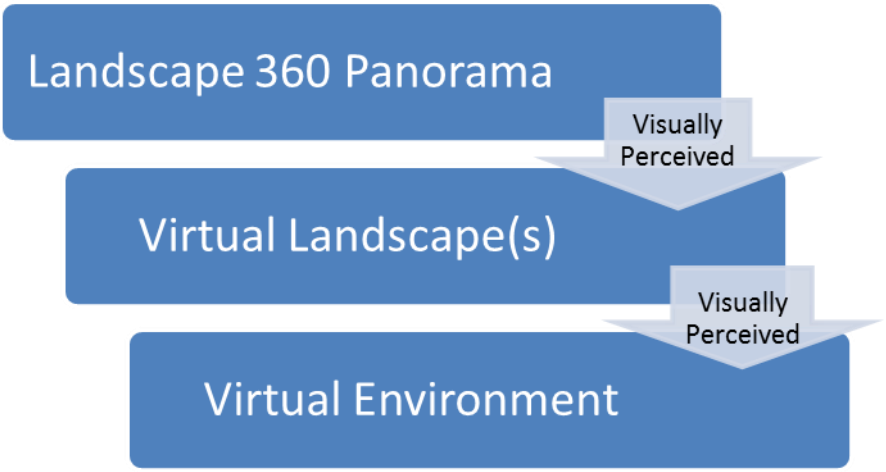

Figure 31: Relationship between environment, landscape and panoramic framing

5.5 Methodology

5.5.1 Research Strategy

The research strategy is focused on three key elements stages:

1. Initial Survey/Case Study (visual & textual - Emergent design)
2. Analysis & Reflection on primary and secondary data (in order to gain insight into practice with a view to create a VNE in a later second cycle)
3. Creation of practical outcomes (using traditional and interactive technologies) that can be disseminated in order to gain additional feedback and insight.

5.5.2 Research Methods

The research process was based on careful consideration and appropriate selection and use of a variety of research methods to explore each of the questions/problems outlined in section 5.3.1 and 5.3.2 of this Chapter.

Table 14 provides an overview of the range of research methods employed and the justification, in this chapter.

Artefact/Project	Research Methods Employed	Justification/Notes
Virtual Landscapes: A Visual Analysis of the historical progression of natural environment design in games.	8. Visual Contextual Review (historical) 9. Computer Aided Design 10. Photography 11. Exhibition 12. Reflective Practice 13. Experimental Design 14. Field Trip(Virtual)	• Photography since it functions as an entry point into the space and aids reflection and can produce outcomes ready for exhibition (incite debate) • Field trip allows the collection of virtual spatial/tactile data 'in-situ'

Table 14: Research Methods Overview

For research Problem 1 it became clear that a series of preliminary case studies was the most appropriate method of analysing professional practice in order to present the current state of practice which in turn led to an identification of potential gaps in knowledge (based on successes/failures).

5.5.3 Rationale for Preliminary textual analysis

The selection of games for preliminary analysis is not indicative of 'greatest' game virtual landscapes, but a combination of both iconic game landscapes that the gaming community generally hold in high regard and a personal selection based on landscapes I have encountered over the last three decades.

These case studies were based around a selection of seminal games which illustrated unique aspects of VNED; for the purpose of this study three elements were chosen:

1) Environment Interaction
2) Environmental Archetypes
3) Environmental Construction

The games chosen to form the basis of the artefact review are made up from:

- Seminal games in terms of VNE interaction and design. These games were selected after an extensive exploratory review of forums, articles, polls and general discussion and debate within the games industry.
- Personal experience of interacting with specific games. My reflections as a practitioner, as well as the specific aims of the research have led me to certain games that help form a complimentary addition to the list within the artefact review.

The following list (**Table 15**) is not meant to indicate a definitive list of seminal natural environment games, but a mix of both identified seminal games (e.g. Populous, Oblivion, Worms) and personal selection (e.g. King's Quest, Kings Bounty and Crysis).

Environmental Interaction (terrain)	Environmental Aesthetics (archetypes)	Environmental Construction (design planning & implementation)
DigDug Populous Worms	King's Quest 5 King's Bounty	Oblivion Crysis

Table 15: List of VNE Games selected for textual analysis.

Appendix K provides the full overview of the game artefact textual reviews, a summary of which can be found in the section on analysis (see section 5.7.1).

5.5.4 Summary of Textual to Visual Research Process

Since the research adopted an approach that was grounded in an emergent methodology, **Table 16** summarises how the emergent research process in the reflection/analysis of VNE games developed into using panoramic photography as a basis for the research outcomes.

Table 16: Summary of emergent research process

Research Step	Justification	Strengths/Weaknesses
Selection of appropriate artefacts to analyse	To provide a historical overview of development of Natural environments in video games.	Seminal games/artefacts were relatively easy to pick out at first, however this increasingly became more complex as it's was difficult to balance personal opinion (bias) with my interpretation of a wider collective opinion.
Textual analysis	As the easiest method for gaining insight into practice, gained via reviews (secondary data) and personal (primary) reflections.	Useful as it provides a quick and easy entry point to analyse the design experience, however problematic as you are forced to describe something from memory or through someone else's perspective, and conveying this is problematic as it is filtered through too many personal perspectives
Secondary Visual Data Analysis: Use of secondary visual material (images/Video)	Seeking secondary visual material in order to trigger a more meaningful response (internal and external where possible) that is not 'filtered/ contaminated' through on an external level	Limited access to screenshots and although they might not be 'contaminated' in the same sense of a review, they were still evidence of a different type of filtering & selection/bias i.e. • User contamination: who took the screenshot/video(developer vs. user) • Technical contamination (overlay of characters, HUD, interface) on the environments.
Primary Visual Analysis, Generation of primary visual material (images/video)	Generating primary visual material in order to trigger a more meaningful response (internal and external where possible) that is not 'filtered/ contaminated' by either an external user or on a technical level	• Ability to gain access to specific virtual environments • Difficult to locate the games (some had become 'abandonware') and innovate deciphering methods to access the environments without the aesthetic/ technical contamination. • Video proved to be too unwieldy, the sheer amount of data collated and collated would take too long to analyse and would become a technical distraction • Problems with camera FOV (field of View) not offering a true insight into the virtual space , as well as issues with quality (older digital games, offered very low resolution images which would not be sufficient to evoke reflection & analysis

Primary Visual Analysis: Photography (panoramic) as a method of inquiry	Generating primary visual material that went beyond *'a happy snap'*, a requirement to capture the essence of the environment (i.e. landscape)	Development of a virtual photography workflow to capture and distil the environments into rich visual spaces, utilizing 360 degree FOV to capture a snapshot of the environment and transform this into a picturesque/useful image. • Panoramic workflow: process to create Ultra high definition panorama's of the environments into distilled landscapes • High definition workflow: to transform the low-res imagery of older games to ones that 'restored' the landscapes to their original form

5.5.5 Visual Artefact Production Workflow

The workflows developed around the concept of undertaking a virtual 'field trip' utilising virtual photography. New tools and techniques in extracting rich unseen views of these spaces emerged during the creation of this work, which in many ways had parallels to traditional landscape photography.

1. **Upscaling Workflow: Conversion to image format/HD Upscale Workflow**
   a) Sourcing the game artefacts (i.e. finding a physical or electronic copy of the game), proved relatively easy for modern games, but for older games this proved to be extremely difficult, highlighting a serious issue of the lack of formal/recognised game archive/repositories.
   b) Analysis of file formats/game archives. This took extensive amount of time and utilized Xentax the game research forum (http://forum.xentax.com/index.php) in order to match proprietary file archive formats to the appropriate file decompressor/conversion tools.
   c) Sourcing of appropriate game archive decompressor/converters to convert proprietary file formats to .bmp/.jpg format.
   d) Conversion of all image data (which often included characters, menus, environment backgrounds) and removal of non-environment/landscape imagery.
   e) Up-scaling of image sets (which are often 320x240 resolution) with custom Photoshop actions to HD/print size.
   f) Compositing the images where possible into either isometric or linear panoramas.

2. Panoramic Workflow: SD to 16K (QUHD)

a) Sourcing the game (i.e. finding a physical or electronic copy of the game). Similar to what was mentioned above this proved relatively easy for modern games, but for older games this was extremely difficult.

b) Planning and researching the shot based on either personal experience of the game or broad searches online on particularly important in-game locations, and allocating time for the 'virtual shoot.'

c) Removing 'visual clutter' that could interfere with the shot (in the case of a virtual environment this would equate to a character, enemies or interface, etc.), this involved varying degrees of 'modding'[12]

d) Choosing an appropriate Field of View (FOV) angle (this would sometimes require an element of programming/modding the videogame's virtual camera). This would often involve a process of testing as focal length of the camera often varied in games, and only specific configurations would yield image sets that could be aligned and stitched correctly into panoramas by the stitching software.

e) Accessing the virtual location/landscape (which would either involve additional technical work in order to access content earlier than was originally allowed by the developers or manually playing through to the chosen destination in game).

f) Generating multiple 'raw' shots from multiple locations within a particular environment. This would often involve manually moving the 'virtual camera' in a set pattern (see **Figure 32**) and taking in-game screenshots using FRAPS software[13] often with an overlap of ~20% in order to capture enough visual data to generate the final panorama (approx. 20-26 images were needed at 90 degree FOV for a full 360 panorama). Overlap was required as the majority of panoramic software relied on reference points common to images in order to build the final piece.

g) Autopano Giga[14] was then used to stich the raw image set into the final panorama. In the instances that this failed to generate a panorama a tool from Microsoft research, Image Composite Editor (ICE)[15] was used. **Figure 33** provides a screenshot of the

[12] Modding is a process used to describe various activities such as modifying game asset files with custom configurations
[13] http://www.fraps.com/
[14] A specialist piece of software for panoramic image generation
http://www.kolor.com/autopano/autopano-features/
[15] http://research.microsoft.com/en-us/um/redmond/projects/ice/

program's interface and the typical process of converting multiple raw images into the final panorama

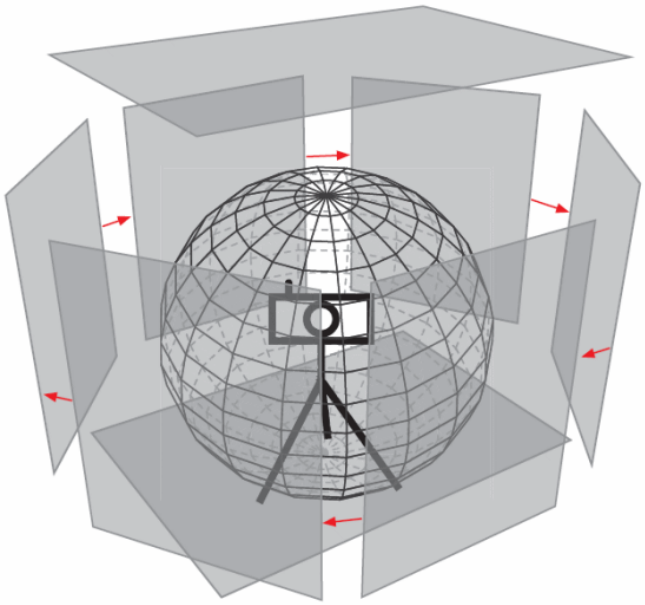

Figure 32: Visual illustration of required virtual camera positioning for panoramic output (Source: graphics.com)

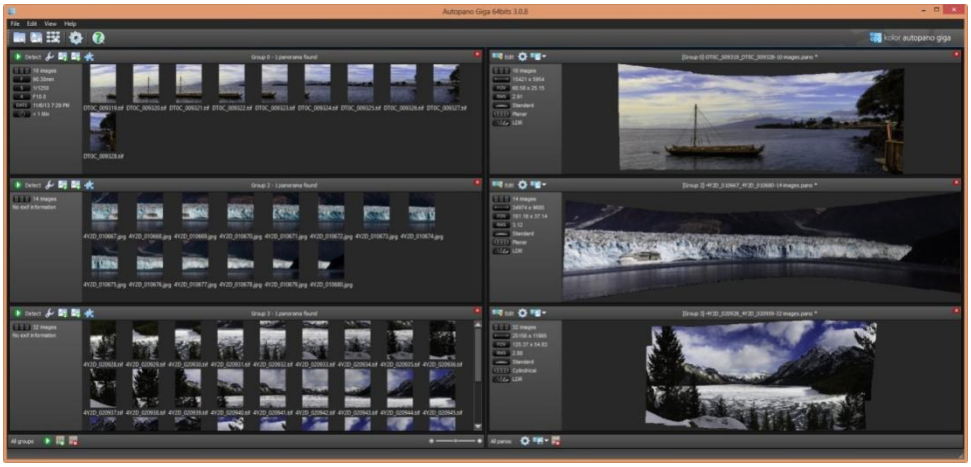

Figure 33: Autopano Giga Interface (Source Kolor.com)

h) **Figure 34** demonstrates how Adobe Photoshop was then used to produce the final panorama often this would involve straightening the horizon or to fixing distracting analogies (B), as well as standard image corrections in order to produce the finally compiled, edited and composited image (A).

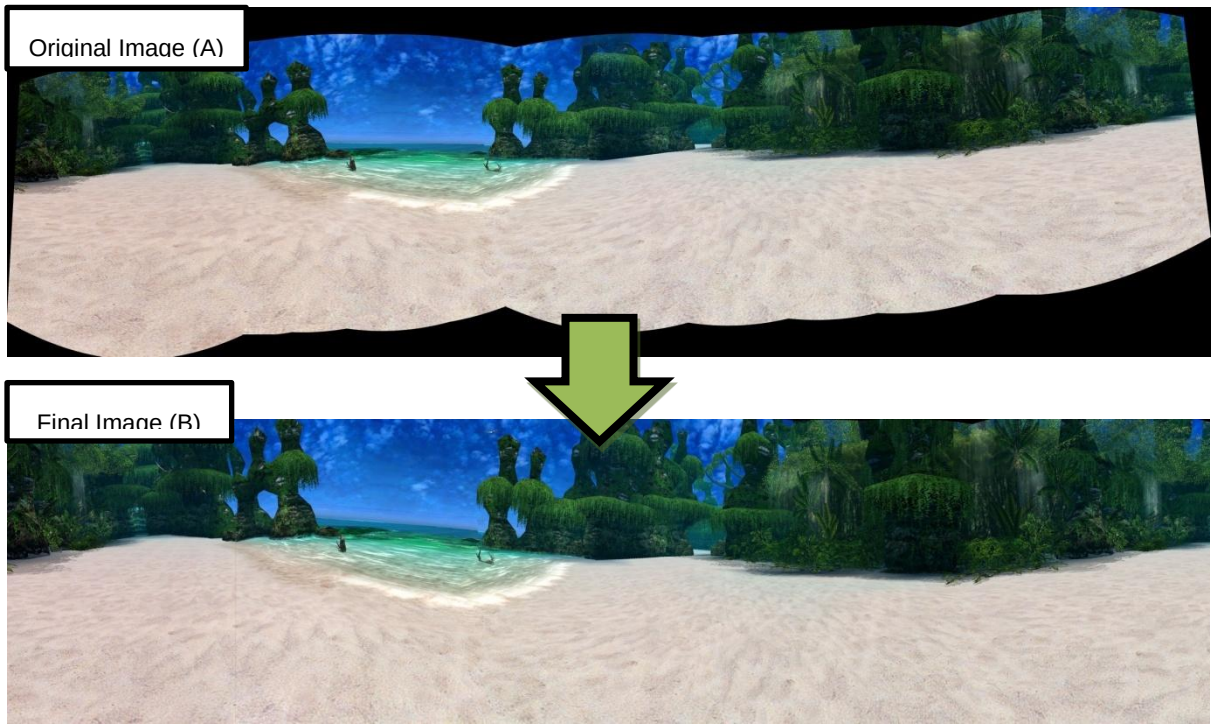

Figure 34: Phantasy Star Online; Before & After comparison of 'raw Vs final panorama

5.5.6 Visual Summary of Workflows & Process

1) Conversion to image format/HD Upscale Workflow

One of the problems encountered early on in the process of acquiring the visual imagery, was that many of the games from the embryonic era employed environments/landscapes that were in very low resolutions in comparison to games that emerged over the next decades. Once these VNEs and VNLs were 'extracted', a problem became apparent: they were of such low resolution (e.g. 320x240) that it presented a barrier to analysis and reflection since one was unable to perceive the environment/landscape without becoming distracted by the poor/low resolution. As a result a decision was made to 'upscale' the images to a high (print compatible) resolution in order to 'restore' the landscapes into a form where analysis/reflection was not limited by a technological constraint. **Figure 35** demonstrates the conversion process from 'raw' converted game asset (A) into the final print compatible version (B).

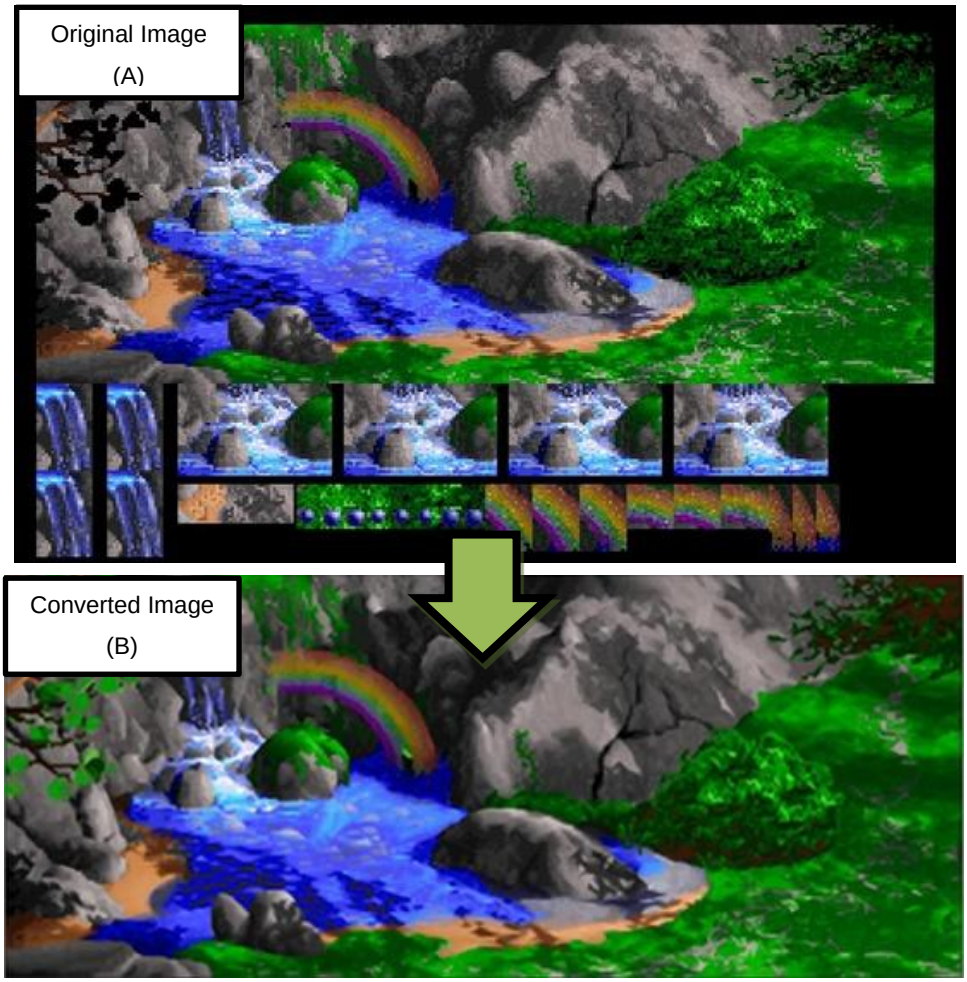

Figure 35: TES 3 Morrowind: 'Before/After' Workflow 1 Comparison

2) Panoramic Workflow: SD to 16K (QUHD)

Figure 36 and

Figure 37Figure 37 demonstrate how the panoramic workflow affected the visual view of the game and how the VNEs and VNLs images were generated and presented. The figures show the original perspective (A) that players would see when viewing the VNE in game and after the panoramic workflow was applied (B) the resulting visual output record of the VNE that was generated. **Figure 36** illustrates the process for Morrowind (2002) and **Figure 37** illustrates the process for Starfox Adventures (2002).

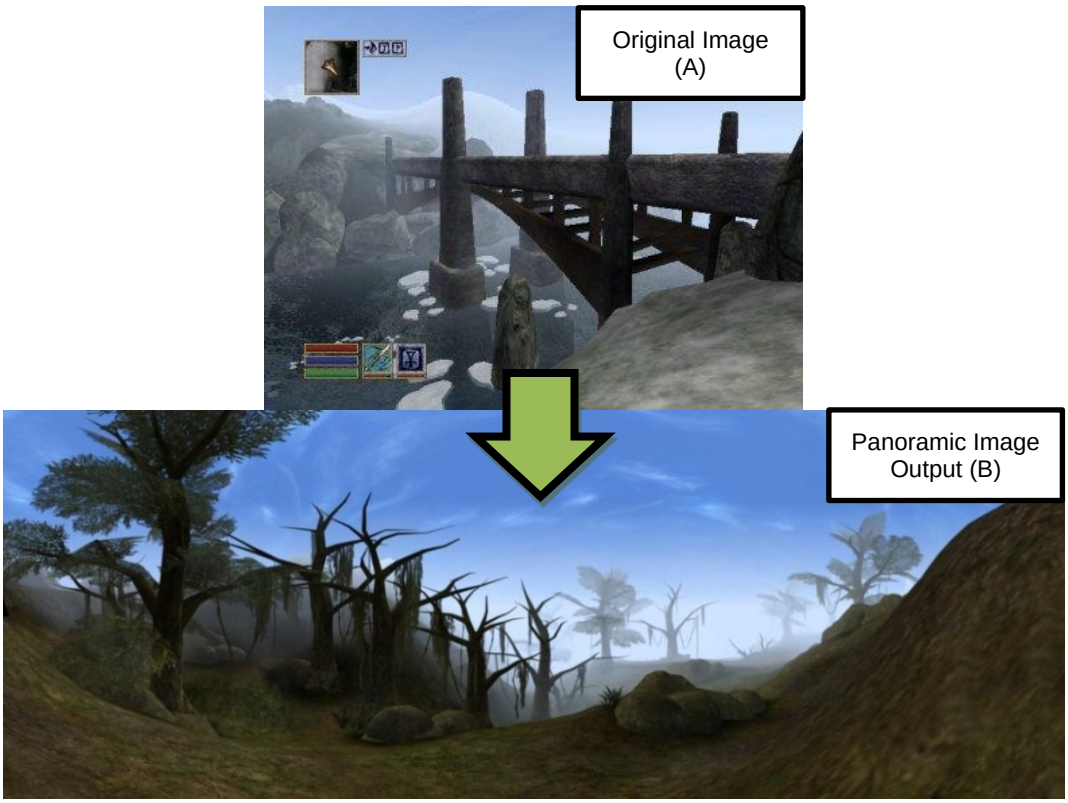

Figure 36: The Elder Scrolls 3: Morrowind – Before & After Comparison (Workflow 2)

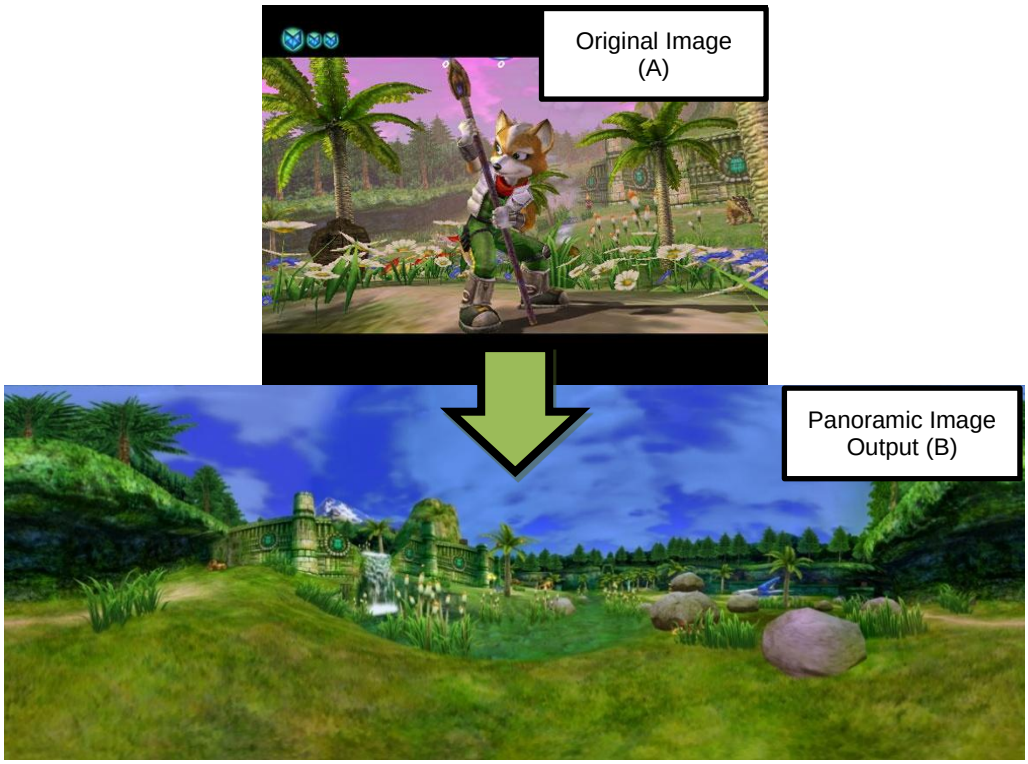

Figure 37: StarFox Adventures: Before & After Comparison (Workflow 2)

5.5.7 Reflective Analysis

After the generation of the unique 360 panoramic or high definition images, a reflective analysis was carried out across the range of the game artefacts studied. The reflective analysis was undertaken as a parallel process:

1) Initial reflections were captured detailing aspects of the VNE/VNLs in the game
2) The games (listed in section 5.5.3) were then played, either to a familiar point mentioned in step 1 or to areas that exemplified poor or strong VNE design
3) Once an area was 'selected' (the locations were found either from personal preference or derived from external indications, such as forums posts indicating an important are), the game would be played, and an initial reflection captured, and then raw image data would be collected and panoramas would then be generated.
4) Once the panoramas were generated, they would be analysed and reflected on; this final reflection and analysis is captured in the *Reflection: Comments* section in the reflection analysis document (see Appendix F).

The reflective analysis record was structured to aid critical reflection and analysis of the game landscapes as well as to identify technical breakthroughs/difficulties and the impact on the emerging workflow. The reflection included the following components for each game:

1) Reflection:

a) Keywords**:** Based on the initial VNED framework, used to add metadata to the reflective commentary to aid the visual data analysis.

b) Comments: Reflective commentary based on personal and other gamers' recollections and experiences of the game; this included observations and the emotional impact (if any) these landscapes had evoked.

2) Process:

a) Difficulties: Problems associated with extracting the landscapes either on a procurement or technical level.

b) Breakthroughs: Detail on methods used to finally overcome any difficulties

c) Process Adapted: Detail on how the emergent methodology was adapted and streamlined as my production workflow evolved.

Appendix F provides a full breakdown of each game whereas **Table 17** illustrates a typical entry record.

Table 17: Example Reflective Analysis Record Entry

Game: Quest for Glory		
Reflection	Keywords	**Aesthetics:** Visual, Colour, Pattern **Natural:** Geology, Landform, Environmental Conditions, Tree Cover, Flora & Fauna
	Comments	All three elements, colour and pattern of the flora & fauna, tree cover serve to direct the player to one focal point the tree, sense of mystery and intrigue as to what the tree holds
Process	Difficulties	Files were encrypted in proprietary format (i.e. non-standard image format bmp/jpg etc.)
	Breakthroughs	Game created with Adventure Game Interpreter, found AGI Studio (http://www.agidev.com/download/) to extract the files (Copyright © 2009 Nick Sonneveld)
	Process Adapted	AGI Studio 1.38, Pic files encrypted, exported to bmp, run Photoshop action(scale, clean-up), exported to HD size

5.5.8 Software Packages

The research used the following software:

1. **Emulators:** A range of game emulators were used in order to capture images directly on a PC for reconstruction into panoramic frame. Details can be found in Appendix F
2. **Photo Editing:** Adobe Photoshop, Microsoft Image Editor, Autopano Giga
3. **Game Utilities:** A range of game utilities were used, there is a significant number to list individually however they are mentioned in Appendix F.

5.5.9 Visual Analysis: List of Selected Games

Table 18, **Table 19** and **Table 20** list the games selected for visual analysis, listing the game title, platform, and year of publication.

Table 18: Selected Games-Embryonic Era (1980-1990)

Game Title	Platform	Year of Publication
Dig Dug	PC	1982
Forbidden Forest	C64	1983
King's Quest 1	PC	1984
King's Quest 2	PC	1985
Duck Hunt/	NES	1985
Robin of the wood	PC	1985
King's Quest 3	PC	1986

Alex Kidd in Miracle World	SMS	1986
Wonderboy/Dragon Quest 1	SMS/NES	1986
Phantasie	PC	1987
The Faery Tale Adventure	PC	1987
The Legend of Zelda	NES	1987
Phantasy Star 1	SMS	1987
King's Quest 4	PC	1988
Golvellius	SMS	1988
Quest for Glory	PC	1989
Populous	MD	1989
Psycho Fox	SMS	1989
Willow	NES	1989
Ghouls & Ghosts	MD	1989

Table 19: Selected Games - Transition Era: 1990-2000

Game Title	Platform	Year of Publication
King's Quest 5	PC	1990
Crystals Of Abor	PC	1990
Mickey Mouse: COI/	MD	1990
Maupiti Island	PC	1990
Kings Bounty	MD	1990
Conquests of Longbow	PC	1991
Super Ghouls & Ghosts/	SNES	1991
King's Quest 6	PC	1992
Ishar 1/QFG3	PC	1992
Kyrandia 1	PC	1992
Kyrandia 2	PC	1993
Betrayal at Krondor	PC	1993
Flinx	MD	1994
Kyrandia 3/QFG4	PC	1994
Arena	PC	1994
Donkey Kong	SNES	1994
Shannara/Albion	PC	1995
Tales of Phantasia SNES	SNES	1995
Daggerfall	PC	1996
Guardian Heroes	Saturn	1997
Goldeneye	N64	1997
Banjo Kazooie	N64	1998
Zelda Ocarina/	N64	1998
Tales of Phantasia	PS1	1998
Donkey Kong 64	N64	1999

Table 20: Selected Games - Modern Day Era: 2000-2010

Game Title	Platform	Year of Publication
Phantasy Star Online	PC/Xbox/PS2	2000
Wizardry 8	PC	2001
PSO v2	PC	2001
Morrowind	PC	2002
Zelda Wind Waker/	Gamecube	2003
Half Life 2	PC	2004
Fable 1: TLC	XBOX	2005
Oblivion	PC	2006
Call of Juarez 2	PC	2006
Half Life 2 ep2	PC	2007
Unreal Tournament 3	PC	2007
Crysis	PC	2007
Crysis Warhead	PC	2008
Fallout 3	PC	2008
Fable 3	PC	2010
Skyrim	PC	2011
Dear Esther	PC	2012

5.5.10 Summary of Visual Analysis Methodology

a. A list of games (where did they come from) - list gathered.
b. Sourcing of roms/games was undertaken (abandonware issues) - list reduced.
c. Functional extraction of landscapes (some did not work, loads of failures) - including new scripts/tools to mod files.
d. Realisation that the work would be too extensive and needed to be split into parts. Eras was the best way to break-up the work, so based on 30 years of gaming three decades (eras) were used namely *Embryonic Era 1980-1990*, *Transition Era 1990-2000* and *Modern Day Era 2000-2010*. However certain games were chosen after 2010, as they either indicated a continuing trend identified from earlier analysis (i.e *Oblivion*) or games that illustrated a unique or highly original aspect of VNE design (*Dear Esther*).
e. Selection of 'best games' or most revealing to include into the three eras
f. Selection of best panoramas/shots from each game based on aesthetic or functional considerations.
g. Reflection on each game/set of panoramas for each 'era'.
h. Initial categories of key elements (keywords) based on metadata from reflections.
i. Amendment of LCA metadata elements with VL metadata (See Appendix H).

5.5.11 Virtual Landscapes; Book Design

After the initial visual data set was generated, it became apparent that presenting approximately 12-15GB of image data across 800-1000 images (and in some instances with resolutions of 12.000x8.000 pixels) was difficult using conventional presentation and dissemination techniques. If the work was to elicit and encourage discussion it had to be readily accessible and be presented in a rich stylised format as opposed to only being accessible via DVD.

The first step was to collate the images into a coherent body of work, and with a view to publish them (in traditional print and eBook form). Several options for creating a digital eBook existed however *Blurb*[16] (www.blurb.com) was chosen since it provided:

a) **Template driven book design**: This reduced the time taken in composing individual pages since the volume of images was extensive. *Blurb* offered the Booksmart software (**Figure 38**) which allowed the rapid collation of work into books.
b) **Digital ebook creation (in both PDF and IOS compatible format):** This was a core requirement as accessibility to the material was key for gaining insight and feedback; digital publication platforms such as iTunes and Google Play were incredibility popular and removed the barrier of affordability (the print books were costly to print and as such could potentially limit the audience).
c) **Affordable, professional high quality book printing:** *Blurb* offered printing in large landscape format (13x11inches) and since most of the images were in wide panoramic format this was the most suitable format. In addition it was the same format used by Landscape Photographer of the Year. The total cost for all three books was under £300.

[16] Blurb is an online printing & publishing company that specialises in providing users with a range of software used to create books, magazines in a range of traditional print and digital ebooks.

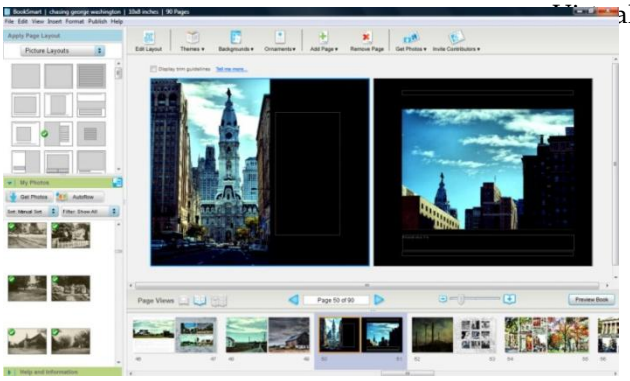

Figure 38: Blurb Booksmart Interface (Source Blurb.com 2016)

5.5.12 Digital & eBook Publication Process

The following steps were taken to publish the books digitally:

1. A company was setup in order to purchase ISBN numbers and apply for an iTunes developer account (US only). *'Zayn Creative'* was setup as the legal entity.
2. Purchased the domain names www.virtualandscapes.co.uk,www.zayncreative.com and www.zayncreative.co.uk for use in books and for website masking from www.godaddy.com
3. Purchased a block of 10 ISBN numbers from Nielsen (www.isbn.nielsenbook.co.uk/) required by iTunes at the time of publication (each print and digital book required a unique ISBN).
4. **iTunes:** Generated compatible .epub files using Apple iTunes Producer (including relevant metadata). This involved a small amount of work to fix the .epub to meet Apple requirements, and generated a sample chapter for each book. This then required a period of approval by Apple. The book was initially priced at £1.99 to cover costs for a period of three months and then made permanently available for free.
5. **Google Play:** Registered as a developer (https://play.google.com/publish) and uploaded the PDF versions of each book through Google Play developer site.
6. Registered to www.issuu.com[17] and uploaded the PDF books
7. Created a website using a website builder (www.wix.com) for www.umranali3.wix.com/virtuallandscapes as a placeholder for information on all print/ebooks versions of Virtual Landscapes.

[17] Issuu is a free digital publishing platform for magazines, catalogues and newspapers online.

5.5.13 Interactive Archive Process

The next challenge in the research was to create an outcome that would allow for collaborators (researchers, games, developers) to access this historical repository in rich interactive manner. The requirements were to:

1. Allow users to arrange the collection of the visual data according to a range of metadata, personalised to users' interests/needs
2. Be accessible online
3. Present the large amount of visual data in real-time and in full UHD resolution
4. Allow for additional online searches to be carried out on the title
5. Tentative: Not be too arduous to create and be easy to replicate for students

After a preliminary review of available software, *PivotViewer* (a technology based on Microsoft DeepZoom technology) was chosen (**Figure 39** illustrates the PivotViewer Interface). Microsoft provides an overview of the software:

> *PivotViewer makes it easier to interact with massive amounts of data on the web in ways that are powerful, informative and fun. By visualizing thousands of related items at once, users can see trends and patterns that would be hidden when looking at one item at a time. Because PivotViewer leverages DeepZoom, it displays full, high-resolution content without long load times, while the animations and natural transitions provide context and prevents users from feeling overwhelmed by large quantities of information".*

Figure 39: PivotViewer Interface (Source: Microsoft.com 2016

5.5.14 Study 1 Documentation Appendix

Area	Document/Reference
Times Education Higher Research Article	See Appendix C
Virtual Landscape feedback (books, website, exhibition)	See Appendix D
VNED Framework V3 - Design Guidelines	See Appendix E
Virtual Landscape Reflective Analysis	See Appendix F
LCA to VNED V1 Framework	See Appendix G
LCA to VNED V2 Framework	See Appendix H
List of Games Selected For Visual Analysis	See Appendix I

5.5.15 Natural Environment Design & Landscape Character Assessment

The LCA circle was used as a basis for the first prototype (see Appendix G: LCA to VNED V1 Framework). The VNED V1 grid was then modified with additional perceptual considerations (sensory, visual, physiological and sensory: agency) (See Appendix H: LCA to VNED Framework V2). A list of keywords was then derived from the *LCA to VNED V2 Framework* in order to classify and sort the analysis and reflective data from the visual analysis. Using specific game artefacts analysed in the *Virtual Environment Reflective Analysis* (see Appendix F) as references the *VNED Framework V2* was used to construct *NVE Design Guidelines into VNED Framework V3* (see Appendix E).

5.6 Research outcomes

This study presents two types of outcomes, practice and workflows (techniques supported by examples and documentation)

5.6.1 Practice-based Outcomes

The practice-based outcomes from the *Virtual Landscapes* study are as follows:

1) Virtual Landscapes print books: Three large landscape professionally printed books.

2) Creation of a publishing company (Zayn Creative), required for digital publication onto the Apple store (ibooks) including full book publishing (unique ISBN numbers)
3) The digital Virtual Landscape books were made freely available through platforms such as Apple iTunes and Google Play as well as digital book platform (issuu)
4) Virtual Landscapes website (www.virtuallandscapes.co.uk)
5) Emergent Landscapes blog (http://emergentlandscapes.wordpress.com/)
6) Virtual Landscapes Digital interactive database (PivotViewer) (see external drive)

5.6.2 Virtual Photography (Workflow)

The work has also led to the development of workflows around virtual field trip and virtual photography. New tools and techniques in extracting rich unseen views of these spaces emerged during the creation of this work, which in many ways had parallels to traditional landscape photography. A detailed description of the workflow is offered in section 5.5.5.

5.7 Analysis

5.7.1 Artefact Review Summary

If one is to look at natural environment interaction in games, one of the earliest exemplars of this was Namco's '*Dig Dug*' (1982). The simple technology of the game i.e. the 4-bit colour palette with a limited resolution did not limit the ingenious central gameplay feature which was based around terrain deformation (the player character that lived underground could 'dig', hence the name, around his environment to escape and kill his enemies). Namco's design idea of using the natural environment as a weapon/tool was taken several steps forward in Bullfrog's Populous (1989) game.

Populous was the first in a long line of 'god sim' games (player took on the role of a deity able to control/influence a representation of the world i.e. people and land) that gave the player the ability to alter that natural environment landscape in real-time and to observe the consequences. The game allowed an innovative 'cause and effect' mechanic where the player could cause an earthquake in an enemy's (or in fact his own) land and the resulting effect would be the partial or full destruction of local populous on an infrastructure level (i.e.

building) and/or a human level. The terrain altering mechanic was not purely based on a destructive effect (as is the case for LucasArts' latter day Fracture game), to win the player had to create a hospitable natural environment for his worshippers, as well as destroying the evil deities' land.

Populous marked the first real terrain interaction (through deformation) game that used the environment as a weapon, interestingly its landscape design appears to align with an unrelated geological planning tool: landscape character assessments since the physiographic/flora/settlement layers are evident in the aesthetic/visual representation of the natural landscape. The game also demonstrates a level of agency i.e. meaningful interaction. The player is not able to influence other aspects of the environment i.e. the water/weather/flora but only the terrain. One could argue that this approach provides a greater level of interaction by limiting the ability to influence the natural environment to just altering the terrain and observing the resulting effect.

Worms (1995) from Ocean Software again used terrain destruction as a gameplay mechanic. Players controlled a small group of 'worms' in a turn based strategy game of worm vs worm. Weapons had the ability to damage the 2D 'Ant farm' terrain in a variety of fashions. This mechanic allowed for emergent gameplay as players could use their weapons to tunnel to safety or destroy a bit of land underneath an enemy worm sending it to an early watery grave. However, the interaction with the environment was limited since boulders, trees, ground, and soil all had same resistance to explosions and acted in the same manner. This was probably a design choice due to technological constraints since introducing material types and resulting hardness would have introduced too many variables to test and hence led to possible buggy gameplay. However one can imagine that room exists for this to be very an effective gameplay addition, as blasting the ground beneath a fir tree to cause it to fall over would and push a rock over the edge and killing a worm below could potentially make for a more immersive experience. The environments were for the most part generated 'on the fly' procedurally and not designed in the classic sense.

Sierra's King's Quest series of games (1984-1992) were for the most part 'point & click adventures'. The player travelled across pre-drawn screens to interact with selected objects in a variety of ways. What marks the King's Quest series as distinct from latter day natural game environments is the carefully designed composition of each 2D pre-drawn natural environment. There is a sense of design reductionism evident in how the natural

environments are portrayed: each screen represents a fixed amount of the game world, the natural environments appear to be succinct archetypes (such as the lone magical tree, the precarious cliff edge) rather than the bland generalization we see today. It is a shame that these unique representations of the natural environment have been lost over time due to transition from 2D to 3D space which resulted in the loss of these archetypal compositions. Perhaps by revisiting and reflecting on these natural archetypes a process can be developed to inform the design of 3D natural environments.

Bethesda's Oblivion (2006) marks a major milestone in natural environment landscape design on many levels. The critically received game allowed users to freely explore a huge land known as *Cyrodill*, a land filled with forests. Oblivion's development demonstrated a non-traditional design process since the developers went as far as investigating geology to inform the rock formations within the game. However the design process was still reliant on the '30,000' image collection phase as aesthetic/design references, which I propose is un-scalable for future environment design. Oblivion also embodies another unexplored phenomenon within virtual environments: that of habitant selection and territoriality. Players can be seen to demonstrate behaviours normally associated to areas of study in environmental psychology:

- Online forums (such as Oblivion Real Estate) discussing and sharing the different 'homes' users have in game, demonstrating a shared emergent use of the game, not traditionally looked at as a feature/intended design experience.
- Players finding and creating homes based on typical affordance concepts such as water/shelter/storage/safety. Players justifying the need for habitant selection since they provided "*a place to get away from the outside world*" and a "*place to call their own*"

Crysis (2009) also illustrated remarkable jungle environments that were congested with a variety of different flora; players could literally lose their bearing in the dense, thick foliage, and the scale of the islands were also remarkable, these were not small stretches of limited confined space, but vast complete island spaces that could be explored in a variety of ways. Coupled with this, was the remarkable attention to detail in the landscapes, one could hear waves of the sea lapping gently on the rocky shores, birds chirping in the dense undergrowth, integrated with this, was a variety of rich weather patterns which cycled with in game time(day & night). All these qualities helped to both reinforce the immersiveness of the game's natural environment and mark *Crysis* as pivotal game in virtual natural design.

5.7.2 Virtual Landscapes: The Embryonic Era (1980-1990)

The representation of natural environments in the Embryonic Era begins with nothing more than simple shapes and forms. Colour, non-existent at first, meant environments were limited to black and white, with later developments allowed the use of several colours (albeit in a very limited range). Early in the era, natural environment design was largely limited to simulating entire environments rather than depicting a series of smaller landscapes. Later in games such as *King's Quest* the limited screen space illustrated the use of traditional composition techniques as larger game environments were broken down into smaller screen spaces i.e. traditional representations of landscapes, using the tools and techniques developed in other disciplines such as matte landscape painting were used within fragmented 2D space (i.e. hotspots) to simulate 3D environmental depth.

The Embryonic Era (1980-1990) can be defined:

1. The representation of natural environments begins at first with nothing more than simple shapes/forms, no colour, no lighting and in simple 2D space. Block forms were used to present key natural environment landscape features e.g. forbidden forest, green background solid colour represents a forest backdrop with vertical rectangles of brown representing trees.

2. The representation of 3D space is reduced, abstracted due to technological limitations to the 'Ant farm' view. This abstraction will have a profound impact on the recreation/representation of existing and fictional 3D space in all games including those attempting to recreate natural environments. There was very little in the way of landscapes rather than crude attempts at a complete environment.

3. The environments during this era were also static; dynamic movement was severely limited (i.e. trees did not sway, grass did not move) and for the most part players were unable to interact with any part of the environment. However, there were some early attempts at simulating a dynamic environment such as the day/night cycle (*Forbidden Forest*) and rockfalls/flowing water (*CaveLord*).

4. *Dig Dug*'s design despite using the 'Ant Farm' perspective illustrates an early attempt to marry the natural environment with gameplay through a unique designed mechanic. The natural environment becomes an integral part of the game by becoming embedded as a gameplay feature. The avatar moves through the ground

by digging through. Tunnelling through the terrain is reduced to the onscreen removal of pixels (a high level of abstraction is present since the digging results in the 'dug space' becoming a black void).

5. Early indicators of the use of the environment beyond a merely aesthetic consideration start to emerge. Bullfrog's *Populous* (1989) serves as a seminal example of the successful coupling of agency and natural environmental design, laying the foundations of how meaningful interaction (agency) could enrich immersion.
6. The limited screen space forced the use of traditional composition techniques; larger game environments were broken down into smaller screen spaces i.e. traditional representations of landscapes, using the same tools and techniques in the creation of these virtual spaces.

The use of idyllic and specific 'landscapes' was lost from the Embryonic Era (they were used mainly due to hardware and software technology constraints). Nevertheless during the transition era these constraints were removed and hence the design process changed, using more expansive environments as gamespace. The modern era has seen an evolution of this back to the recognising that landscapes as a vital feature within the environment.

5.7.3 Virtual Landscapes: The Transition Era (1990-2000)

The Transition Era (1990-2000) can be defined*:*

1. Technological advancements such as digital scanners and increased memory capacity allowed game environments to make the leap from the simple two-dimensional, block-pixel based forms to environments that utilized detailed digitally converted landscape paintings. Games such as *King's Quest 5* and *The Legend of Kyrandia* demonstrate the transformation of the visual quality of these virtual environments from crude simulations to rich detailed spaces.
2. The development of pseudo 3D attempts (e.g. isometric, pre-rendered 3D) leads to an inevitable decline in environmental design as designers learn to fully utilise the new toolsets.
3. Developments of new software technologies such as Mode 7, allow the creation of multi-layered 2D environments, platforms such as the Sega Megadrive and

Nintendo Super NES, herald an evolution of the 'Ant-farm' perspective with 2D layering allowing simulation of three-dimensional depth in creating detailed environments.

4. Simulations around environmental changes further evolved and started to become increasingly integrated with the visual elements in natural environments. In addition to technological developments in lighting (such as day and night cycles) crude weather cycles start to be incorporated into these virtual environments (*Daggerfall).*
5. The design process evolves with a realisation that natural environment design is more than just the geometrical representation of an environment but one that includes other elements and that related aspects (weather, climate, etc.) start to be increasingly added to the visual elements within an environment.
6. The 'Ant farm' perspective is reinterpreted into three dimensions. Natural environments on platforms such as Nintendo's N64 exemplify this with extruded block form geometry used to simulate hills and mountains on terrain. This approach is used as a system by designers to restrict access to the specific parts of the environment in order to align progression with the gameplay/narrative.
7. With the emergence of 3D there was a loss of design and traditional art disciplines (i.e. landscape painters) into pure spatial design.
8. The transition era also marks a deviation away from simply replicating the natural environment to one where the natural environment begins to cross over into fictional works.
9. Despite the emergence of 3D technologies, natural environments were essentially still limited to a flat horizontal plane. However, early indicators point to depth (i.e. Z axis) to be the next era key differentiator in virtual environment design.
10. Throughout the Transition Era, water simulation was also problematic, the result of which meant that natural environments for the most part lacked water. Rivers, waterfalls, lakes were essentially non-existent due to technological constraints of simulating water. Water bodies that were simulated were restricted to block

'volumes', carefully placed discrete sections of water that were often harshly separated from the terrain.

5.7.4 Virtual Landscapes: The Modern Day Era: 2000-2010

The Modern Day Era (2000-2010) can be defined:

1. The Modern Era heralded a leapfrogging in both the design and technologies surrounding virtual environments, resulting in revolution in complexity and richness of VNEs.
2. The early indicators during the transition era of height becoming the differentiator in modern 3D natural environments is realised; game environments are now fully simulated as detailed three dimensional spaces with players being able to move on all three axes. The size and scale of these natural spaces also increases exponentially.
3. The compartmentalization of the space within game environments that was apparent in the transition era reduces significantly as players are now able to traverse a greater variety of natural environments (spanning several virtual square miles in some cases). Players are able to traverse high mountains, dense forests, go to underwater caves/tunnels without the need to formally progress through structured 'levels'.
4. Early indicators of trans-disciplinary approaches towards natural environment design start to emerge. Bethesda's *Oblivion* illustrates this as the developers approached the University Of Maryland's Geology department to help inform the design of the environment (in this case natural erosion of rocks for *Oblivion*'s natural landscapes).
5. Complex environment systems further evolved, developing alongside the form (geometry) and aesthetic (graphics) elements of the natural environment. Weather systems now simulate a variety of complex weather and seasonal patterns. *Crysis* and *The Witcher* illustrated weather systems that included fog, dust, complex clouds simulations and unique weather phenomena (whirlwinds, tornados, etc.).
6. The concept of weather and seasons developed further and deeper into virtual natural environment design. The use of seasonal changes went beyond changes in

the environment aesthetics into design considerations i.e. a seasonal change provides both a chance for a designer to link an environmental change to gameplay and for players to explore an alternate environment. *Soul Reaver 2* illustrated this as players were able to experience gameplay differently in the same natural landscape but within different seasons (e.g. spring and winter).

7. Additional systems around environmental simulations such as dynamic flora (i.e. physics systems linked to flora in order to simulate movement linked to wind speed) are now integral parts of the natural environment simulations. Early indicators (such as the Dunia Engine) point to dynamic flora growth cycles being a future implementation within natural environments.

8. The Modern Era also marked a major milestone with water simulation no longer presenting a major technological constraint the result of which is now a wider, greater and richer use of water bodies in natural environments. Rivers, lakes and other water bodies have become more prevalent with the transition between water bodies and the terrain done much more subtly. Games such as *Zelda Wind Waker* highlighted both the technological developments and a design progression away from VNEs being solely based around a large central landmass as players navigated a natural environment that was based around a large ocean occupied by smaller archipelago type islands.

9. The cultural domination of western influenced representations of the natural environment also appears to be shifting games such as *Phantasy Star Universe* which demonstrated the growing popularity of home grown development coupled with a growing preference of players for culturally aligned content.

5.7.5 Landscape Character Assessment VNE Framework

The first pass in using landscape architecture through the landscape character assessment proved to be very interesting and was, with a little adaptation, ready as a basic framework from which to start sorting the variety of elements that constitute a natural environment, from which a design could be organised and planned. The 'base' landscape character assessment has four main areas, with each presenting unique challenges in trying to reconcile with the virtual world design:

- **Perceptual:** *Memories, Associates/Preferences:* The data from the visual analysis indicated this would be a critical part of proposing a new VNED framework. This was only just briefly touched upon in a few instances and is definitely something that raises further questions for the second cycle of the research.
- **Aesthetic:** *Sight, Sound, Smells, Touch:* The visual aspect was restively easily to reconcile with the data from which design guidelines could be proposed. Sound was recognised as an important aspect but fell outside the scope of the research. Touch was interpreted as interaction (agency) and again was noted as a future area to explore. Smell was also removed as current games technologies have not reached the state of using simulated smells in games.
- **Natural:** Geology, *Hydrology, Landform, Soils, Land Cover, Environmental Conditions:* This element was relatively easy to reconcile with the data from the visual analysis, and a number of design guidelines were produced.
- **Cultural & Social:** There were difficulties in identifying within the *Cultural* character under LCA specific examples of artefacts that could inform the VNED guidelines for land use and enclosure. This may have been due to the selection of games chosen for visual analysis or that these components of the LCA framework were not significant in VNE games. However time depth was one aspect that appeared to be aligned with evidence from the visual analysis.
- **Distinctive Features:** An extra character element using the Geomorphosites, was added to capture distinct elements of the landscape that did not fall into other categories.

5.8 Dissemination and Feedback

5.8.1 Dissemination Strategy

A critical part of the study in regards to achieving impact was the dissemination of the work to a wider audience. As a reflective practitioner this included an on-going dialogue via my blog/e-exhibitions and through my practice as an educator. By sharing the research with students and colleagues generated conversations about the meaning and context of the research and how it can be used on an individual/group basis.

The following concepts guided the dissemination strategy:

1. **Phased Dissemination:** The research has already been disseminated via the published *Virtual Landscape* books, the online Blog and various sites and presentations. The idea was to gradually spread awareness of the research, the various problems, research methods selected and the various artefacts created. .Rather than share the work at the end of the investigation, a phased approach allowed for a more readily digestion of the core principles of the work, the relating material and gradually incited a wider response from various audiences (practitioners, students, academics, researchers, etc.).
2. **Unrestricted access:** I believe that true dissemination should encompass unhindered free flowing of ideas and works, therefore all the books/guides/materials were made available (including documentation/working files) for free to students/researchers and to anyone engaged in the area in a non-commercial capacity, in the spirit of open research. In addition, the study's working files (project files from various programmes or my design work) can be used in any capacity without limitations as long as the original research is attributed and acknowledged. The practice of sharing all my 'working files' is relatively unique but one I believe will both help further the study and engage/induct new practitioners into the area in line with Scrivener's view (2002) in how "*reflective practice equips practitioners to induct novices into that practice*". In addition there has been a move towards open research where the raw data, methodologies, and work in progress is made openly and freely available to anyone wishing to expand, investigate on the original research.
3. **Inciting Discussion and Eliciting Dialogue:** Online and face-to-face dissemination of the work aimed to incite discussions and debate to facilitate dialogue between users (gamers) and designers (game developers).

Peer review is a critical aspect of academic dissemination, however within in practice based research it is problematic, as Smith & Dean (2009, p26) state: "*Processes for peer review are at are embryonic stage in the creative arts in many countries*". This is perhaps due to the nature of the artefacts and makes the identification of 'peers' difficult, so should I have selected practitioners, games industry developers, game academic, students, gamers in general? Each demographic has a valid set of opinions and represent what I would consider

to be 'peers'; however balancing the opinion of such a wide array of possible participants was felt to *out of scope* for this study at this time.

Does this mean the research outcome is severely limited by the expectation of peer review? I would argue given the artefacts are shared and disseminated in the public domain the requirement of an evaluation (through a peer review) can be met as long as the artefact and supporting material remain accessible. This position is also shared by Smith & Dean (2009, p26) *"Peer review is only the first stage in evaluation because as long as the artwork is retained in circulation, recorded or documented a re-evaluation can take place later".*

Virtual Landscapes has received a wide variety and range of feedback from the public demonstrating both engagement (number of downloads, comments, reviews) and appreciation (number of books that were purchased, positive reviews and attendance at exhibition). This appreciation and acceptance translates to impact and demonstrates the research achieved a positive impact as Smith & Dean (*ibid*. p26) state *"… public acceptance constitutes a major aspect of the 'impact' of artworks. Here we use impact to mean the degree to which the public engages with the artworks and appreciates them".*

5.8.2 Dissemination Methods

Virtual Landscapes has been disseminated in the following ways:

1) Academic Dissemination via Presentations at Conferences:

a. University of Salford - Pecha Kucha (2012)
   - YouTube video: http://www.youtube.com/watch?v=OdhmD2YTrE4
   - Slideshare: http://www.slideshare.net/unisalford/gaming-by-umran-ali-part-of-the-research-innovation-enterprise-exchange-powered-by-pechakucha

b. Ludotopia: http://creativegames.org.uk/LudotopiaII/(2010, University of Salford)

c. A&D Research forum: http://mmppgrhub.blogspot.co.uk/2012/05/art-and-design-pgr-presentations.html (2012, University of Salford)

2) Online:

a. Emergent landscape blog: http://emergentlandscapes.wordpress.com/

b. Virtual lands twitter account: https://twitter.com/VirtualLands (@VirtualLands)

c. Publishing company created to disseminate the work in a commercial manner. http://zayncreative.com/

d. ShadowMoss Island project page: http://www.crydev.net/project_db.php?action=project_profile&team_id=3043&project_id=2865

3) Exhibitions (digital and physical):

a. Physical Exhibition: This built on from the AnimGame Festival Exhibition (2012, MediaCity, UK) with various aspects of the work exhibited in relevant festival/exhibitions.

- http://www.salford.ac.uk/arts-media/about/arts-media-news/anigame-virtual-landscapes)
- http://manchestergazette.co.uk/university-celebrates-animation-and-gaming-at-mediacityuk/

b. Online: This involved the use of digital exhibition sites and competitions to increase the profile and awareness of the research: www.minus.com (December 2015). The strategy was to use the visual outcomes from the work to draw in individuals to the blog/books where the research is presented. So far this has included:

- Posts to Reddit (online news forum)
- Sharing of visual outcomes to minus.com (250,000 views up until December 2015 (http://umran.minus.com/)
- Imgur gallery (http://darkforce.imgur.com/)
- Posts to various specialized online forums (see **Table 21**)

Table 21: Selected sample of online forum postings

Site/Description	URL
The Witcher 2 Forum	http://en.thewitcher.com/forum/index.php?/topic/31589-the-witcher-1-ultra-hd-360-landscape-panorama-collection/
Zelda WindWakerForum	http://www.neoseeker.com/forums/1540/t1737994-zelda-wind-waker-ultra-hd-panorama-collection/
Phantasy Star Online Forums	http://www.pso-world.com/forums/showthread.php?t=198993

The Elder Scroll Forums	http://forums.bethsoft.com/topic/1367894-oblivion-landscape-panoramassuper-hd/#entry20651590 http://forums.bethsoft.com/topic/1366411-daggerfall-panoramas-hd/#entry20623400 http://forums.bethsoft.com/topic/1365467-morrowind-panoramas-super-hd/#entry20605235 http://forums.bethsoft.com/topic/1365346-skyrim-panorama-8k-resolution/#entry20603351

4) Teaching:

a. **Formal lectures:** A series of formal lectures based on the research, the research process and its outcomes were offered on multiple levels (undergraduate and postgraduates) to both cultivate future researchers and to provide information to current researchers. This has been undertaken on the following programmes: BA Visual Arts (2013), MA Creative Technology (2012), BSc Computer and Video Games (2011, 2012 and 2013). Two lectures were also delivered through the technology module and the Practice-Based dissertation module to students on the BSc Computer and Video Games programme.

b. **Peer-supported sessions:** Reflective based sessions with academic/technical staff discussing the strengths and shortfalls of the framework/guide.

5) Publications (either self or via a commissioned works):

This involved either self-publication (through the company setup through the *Virtual Landscapes* project) or through a recognised publisher (New Riders Games), this will in the future take the form of the academic training manual. **Table 22** lists where work has been published.

6) Online repositories:

The final databases were uploaded to a specialised server in order to act as a digital online repository. This included uploading to the Windows Azure platform (PivotViewer). There is already a 'test' repository online:[18]

https://dl.dropboxusercontent.com/u/75369284/shadowmoss/Test.html

[18] Not working due to issues so now offline version only

7) Offline repository:

A DVD and copies of the books will be provided to the University of Salford Library as a local repository of the portfolio of practice/theoretical work developed in course of the investigation.

Table 22: List of Virtual Landscape publishers

Publisher	Type	URL
Blurb e-store	Digital & print	http://store.blurb.com/ebooks/325349-virtual-landscapes-2 http://store.blurb.com/ebooks/325359-virtual-landscapes-1 http://store.blurb.com/ebooks/325325-virtual-landscapes-3
iTunes	Digital only (ebook)	https://itunes.apple.com/gb/book/virtual-landscapes/id574267842?mt=11 https://itunes.apple.com/gb/book/virtual-landscapes-transition/id574502404?mt=11 https://itunes.apple.com/gb/book/virtual-landscapes/id574267842?mt=11
Waterstones	Print	http://www.waterstones.com/waterstonesweb/products/umran+ali/virtual+landscapes/9447767/
Amazon	Digital (ebook)	http://www.amazon.co.uk/Virtual-Landscapes-Modern-2000-2012-ebook/dp/B00A3H4A88 http://www.amazon.co.uk/Virtual-Landscapes-Embryonic-1980-1989-ebook/dp/B00A3DDJNY/ref=tmm_kin_title_0 http://www.amazon.co.uk/Virtual-Landscapes-Transition-1990-1999-ebook/dp/B00A3GUFQK/ref=sr_1_2?s=digital-text&ie=UTF8&qid=1369487265&sr=1-2&keywords=virtual+landscapes
Zayn Creative	Ebook (PDF)	http://zayncreative.com/

5.8.3 Feedback

The following are reviews/comments gained through dissemination of the work. The study received a wide range of feedback from a variety of individuals from across the games industry, members of the public and those in professions that the research hoped to engage with. The feedback was gained through the *Virtual Landscapes* website, through publishing platforms such as iTunes and Google Play. The comments can be read in full in Appendix D.

Highlights included:

1) Feedback from Mark Jackson (Landscape Architect):

"I am a Landscape Architect practicing in Adelaide, South Australia. I am currently writing an article on the crossover between digital and physical play, and your Virtual Landscapes series of books have been an invaluable read. What a colossal piece of work it must have been. I will no doubt make reference to it as a gauge of how much the games industry has progressed in its portrayal of the landscape"

2) A book author (*Stephan Sabatier)* enquiring about the use of the virtual landscape images for the cover of his new book.

3) Student feedback: A range of positive feedback from students demonstrated the study; in particular the books had met its research object of being useful for students/novices entering the subject area.

4) The work was covered by The Times Education Higher (THE) in February 2016 and received national coverage. This was a fantastic personal achievement as it included references to terminology (golf course design) that originated from the study. (*See Appendix C*)

5) A research student who utilised the study's high definition panoramic images as 'raw data' in his AI/virtual world research, this is something I did not expect, but as time goes on the demand for ultra and QUHD images increases, and one of the research outputs clearly is meeting this need.

5.8.4 Statistics: Sales/Views

Virtual Landscapes Statistics/Sales as of 12 March 2016 are listed in **Table 23**

Table 23: Sales/Views of Virtual Landscape outcomes

Publisher/Host	Number of Views/Sales/Rating
iTunes Sales	871
Minus Gallery Views	249,423
Imgur Gallery Views	17,000
Google Play downloads	275
Google Play Reviews (VL Vol 1)	3.4 (39 Ratings)
Google Play Reviews (VL Vol 1)	3.5 (81 Ratings)
Google Play Reviews (VL Vol 1)	3.4 (155 Ratings)
Emergent Landscape Blog (Views)	38,250
Emergent Landscape Blog (Visitors)	15,024

5.9 Critical Reflection

The *Virtual Landscapes* study was originally undertaken due of a lack of relevant studies as revealed from the literature review. The study was also based on the belief that it would be easier to incite discussion and debate with game developers and gamers who would be more receptive to the research if the outcomes were directly related to, and celebrated the hidden beauty of virtual natural environments/landscapes in games.

The *Virtual Landscapes* books were not written to act as a substitute primary reference for VNED (in which there can be no substitute for the real thing) but to act as a complimentary reference in addition to primary landscape reference material. The books also function as a body of work that attempts to bring a rich visual chronology to a much underrated yet vital aspect of environments within computer and video games.

Virtual Landscapes attempts to preserve some of the unique and wonderful VNEs using modern day digital restoration tools and techniques, as such certain pieces throughout the

series have undergone restoration processes such as up-scaling, digital enhancement and digital cleaning. There has been a commitment throughout the work to present an authentic aesthetic view of the natural environments in computer and video games over a 30 year period (1980-2010) but *Virtual Landscapes* is not about absolute pixel by pixel authenticity and in many cases slight digital manipulation has been required to restore particular areas of the landscapes (where the menu/user interface/other anomalies have prevented capture of that particular section) in an attempt to bring the essence of that particular landscape to the audience.

It has been argued one should avoid the use of secondary sources in creating a new body of work since a process of reductionism is used in creating the artefact (i.e. one takes a large source of visual and other references to inform the production of an artefact) and by using this 'filtered interpretation', a risk is taken in restricting the richness and originality of the new body of work. However, it should be noted that *Virtual Landscapes* is the final result of a long, often meticulous, process of research, design and testing, one that involved the crafting of these spaces through a combination of selected visual references through cycles of research and iterative design and testing. Although the final result cannot be used purely as a substitute for the natural environment it can serve as a powerful complimentary reference aid in developing the next generation of virtual environments and landscapes, and represents one aspect of the research's contribution to knowledge.

The visual chronology of these landscapes over 30 years also goes beyond a pure aesthetic appreciation of these virtual spaces by considering aspects such as the environment design and construction process, and seminal occurrences as well as the significance and impact of culture on how the users respond to these virtual landscapes. In showcasing these spectacular landscapes, various elements that could potentially distract the viewer from the landscape have been stripped away, by a process of careful editing, cheats codes/debug menus, etc. to fully reveal the natural environments underneath without any distracting elements.

Virtual Landscapes developed through a combination of both a personal interest and observations I made over the years of the different communities that developed around particular games. What struck me over the decades was that particular aspects of videogames such as characters, player interactions and immersiveness started to increasingly become the centre of discussion and debate, evolving into academic discourse

and analysis. However within this there appeared to be a mismatch between one aspect that gamers were sharing and reflecting upon and what was the focal point that designers and academics were analysing: virtual natural environments. This was something that held my interest for nearly three decades and something that fellow gamers were sharing, discussing and reflecting upon. This was definitely something I felt needed to be discussed and shared with a wider audience.

The work has also led to the development of workflows around virtual photography. New tools and techniques in extracting rich unseen views of these spaces emerged during the creation of this work, which in many ways had parallels to traditional landscape photography (sourcing an environment, calculating the best angle, etc.) and I hope this work furthers these virtual spaces in becoming viewed as more than simply entertainment.

Virtual Landscapes perhaps serves as the first opening chapter of something I believe will grow and revolutionise how we see and experience the world around us and it is therefore critical for the minds of tomorrow to have access to what these virtual spaces looked like, how they were experienced and what their impact was. Ultimately I hope the work stands as a digital archive preserving these spaces for future generations in the form of a visual repository.

Virtual Landscapes has also strangely become a doorway for me into other disciplines such as photography and geology. Through the *Virtual Landscapes* study I discovered traditional photography; I was exposed to the works of John Ruskin, landscape artists such as Edwin Church, Turner and more. The work has also triggered an interest in environmental psychology, geology and how these disciplines can further develop virtual natural environment design. The work has also heightened a deeper appreciation of natural spaces, an appreciation of the tranquillity, beauty and sublime nature of natural landscapes.

The intention for this work is to engage gamers and non-gamers alike, to incite critical discussions about the design, impact and meaning of these virtual natural spaces, and ultimately to further celebrate the natural environment. For gamers, I hope this work captures some of the virtual spaces that have excited, enthralled and captivated their attentions for over three decades. For designers, I anticipate that this work will develop an appreciation of the impact of these spaces and further develop natural environment design

as a sub-discipline, one that future designers will evolve to giving rise to new possibilities in the medium.

In addition, it is hoped that the work will attract and engage non-gamers, who share an interest in the natural environment, to foster an appreciation of these new virtual natural spaces and to recognise the potential of videogames to connect a new generation to what typically maybe perceived as something relatively old-fashioned and out-dated.

5.10 Limitations of Study

The overall study on reflection was too unwieldy and with hindsight it should have been on a smaller scale, perhaps focusing on one 'era' instead of three. The study does not consider the –pre-era of video games (i.e. before 1980). This decision was made partly to limit the scope of the work and based on the assumption that technological changes (from 1960's to the 1970's) were not visually as significant as the changes from 1980 onwards. The study needed a more rigorous and systematic, independent selection of games selected for visual analysis; there was at times an over-bias towards personal favourites, however these were chosen with 'insider' knowledge of certain games exemplifying critical aspects of VNED, and therefore the study might not have had a significant bias introduced. The horizon in the panoramic images was higher than intended, due to the experimental process, yet it worked as the terrain held more useful data than sky. The reception for the books has been good, however greater dissemination and perhaps more focused feedback would have supported the study further.

5.11 Further Questions

1) This study primarily considered the physical elements of the natural environment yet what other aspects are as important in defining the impact and meaning of landscapes in the real or virtual world?
2) The process of linking VNED with the feeling and thoughts of being in a landscape. The virtual field trip has awakened thoughts and the possibility of undertaking a field trip to

a real natural environment in order to understand the meaning of impact and to capture observations of the nuances of the natural environment

3) Although the study made an initial new framework for VNED, a further question arises in how can this design framework produce a more authentic or engaging VNE when applied in practice?

4) How would one create a VNE that did not rely on maps for navigation i.e. was distinct and memorable?

5.12 Conclusions

In conclusion the *Virtual Landscapes* study was undertaken as a result of the lack of appropriate studies from which to securely draw more advanced research ideas/arguments on VNEs. This problem was incorporated into the study and as such was investigated using practice as a method.

The study has examined how the design of VNEs have developed along specific design paradigms over the last 30 years, revealing the move towards realism in VNED, as well as technology driving the evolution of VNED in games *(Objective 3)*.

The study provides gamers/users familiar with game environments a unique visual insight into a space that reveals them in a new light. In addition, the study attracted non-gamers to consider 'games' and virtual natural environments in a serious/artistic manner *(Objective 9)*. The study has produced a range of practice outcomes (books, a website, a blog) which were well-received by a spectrum of individual from across the games, education, artistic and technical professionals, and the general public, who described the work as an engaging, unique, original and enjoyable learning experience. The review also identified areas for investigation that may shed new light on man's relationship to natural landscapes and their virtual counterparts *(Objective 7)*.

The study did this in a number of ways:

- By presenting a book archive which reveals, illustrates and exemplifies the findings of the practice-based work carried out - this was in the form of published books in both physical and electronic forms *(Objective 1)*.

- By offering an interactive historical archive of VNEs in games over the last 30 years *(Objective 2)*.

Virtual Landscapes also identified practical ingredients which potentially can form the basis for environmental design practitioners to further evolve non-empirical approaches to making natural environments in games *(Objective 5)* by presenting a possible alternative to the narrative or aesthetic based approach employed by designers in the creation of natural environment games design *(Objective 6)* by developing an initial Virtual Natural Environment Design (VNED) framework, using Landscape Character assessment (LCA) as a basis for further investigation during the second action research cycle *(Objective 4)*. This framework and the tool was then analysed and reflected upon and a series of new recommendations and an improved design proposed for investigation for the second study.

Finally the study has incited critical discussion and open debate on the state and function of natural environment design in virtual environments. This was evidenced by comments and feedback received through a variety of dissemination techniques, by a range of individuals from a number of professions, including landscape architecture *(Objective 8)*. The study also suggested wider theoretical and practical areas which can be explored by future practitioners.

Chapter 6: Study 2: ShadowMoss Island

6.1 Introduction

> *"Go to Nature in all singleness of heart, and walk with her laboriously and trustingly, having no other thoughts but how best to penetrate her meaning, and remember her instructions; rejecting nothing, selecting nothing, and scorning nothing; believing all things to be right and good, and rejoicing always in the truth.'* John Ruskin

Driven by John Ruskin's '*Go to Nature*' dictum to the pre-Raphaelites and influenced by Edward Relph's notion of 'placeness', *ShadowMoss Island* is a practice-based exploration of how VNED can incorporate elements from environmental psychology, such as 'placeness', landscape architecture/ planning (i.e. landscape character assessments - LCA) and be enriched through observational analysis and qualitative reflection based on a field trip to Moel Siabod in Wales.

From sombre Cotton Oak/White Birch forests to the rich to the intriguing cotton cavern, *ShadowMoss Island* is a place like no other; the interconnected natural place is a wilderness play area that evokes memories and feelings, allowing players to construct a personalised narrative and experience.

6.1.1 Research Context

This is the second cycle of the action/design research. It is based on the game *Oblivion* which used geology to inform VNED. *Virtual Landscapes* (Study 1) also revealed that the game developers were in rare instances attempting to further enhance the virtual environments by enhancing the design process by going beyond internal development process by visiting for example the University of Maryland to study geological processes such as erosion, growth of plants and meteorology. Todd Howard executive producer for *Oblivion* summed this up: "*The team at Bethesda actually consulted the University of Maryland geological lab in order to generate accurate algorithms for producing realistic environments. This also means that the forests in Oblivion are randomly generated meaning no two areas will be alike*" (Howard, 2007).

This attempt marked a pivotal point in natural environment design with the developers actively seeking to improve environment design by combining a discipline such as Geology (one that is normally associated with video games) with the design of the game environments. Although this appears primarily to add aesthetic realism (based on a common assumption that increased realism leads to greater immersion) Bethesda's fourth game in the *Elder Scrolls* series was a pivotal example both that VNED could successfully be combined with disciplines such as geology.

6.1.2 Issues identified by Foundation practice

The following issues were identified from reflection on foundation practice and were pertinent to this study:

1. What are the existing dominant methodologies in environmental/landscape/terrain design and production?
2. What is an effective production process for landscape design and what range of tools and technologies is required?
3. What other disciplines can support the virtual landscape design process?
4. How to develop a standard natural landscape design process that includes emotional/narrative considerations?
5. The landscape design process on a technical level: how would one to break up the process into a discrete design and production pipeline of design and implementation
6. World view→Research→Terrain type
    a) modelling/Design Phase: generic terrain modelling, archetype placement
    b) Texturing phase: generic terrain texturing, archetype texturing
    c) Ambient landscape clutter (flora & fauna, sound, lighting, etc.)
7. How to further develop region treatment? Does any existing landscape design process exists that can be adapted into the design?
8. Subtle landscape forms: do they exist and what are the major theories underpinning environmental/landscape human behaviour (psychology)
9. To what extent can a natural landscape be abstracted into a series of metadata components and still remain a coherent engaging space when reassembled in the virtual domain?

6.1.3 Virtual Landscapes

The *Virtual landscapes* project revealed a range of different problems and areas to explore, the majority of which fell into the three areas discussed below.

6.1.3.1 Beyond the Physical Landscape

Virtual Landscapes revealed that one of the simplest ways in which the design of a VNE can be started was by observing and replicating the physical attributes of a landscape (i.e. terrain, tree cover, etc.), however it became clear throughout the work that the impact and meaning, and effective design of these virtual spaces went far beyond merely replicating physical attributes. There was something additional that certain VNEs possessed or evoked that others did not. Although finding this 'ethereal' quality could potentially add a significant tangent to the original research direction, I felt it was important and warranted to at least investigate this for the second cycle.

Discovering these additional qualities would be both time consuming and extremely difficult if using an analysis of virtual environments alone or through any theoretical work since I would be required to study the meaning of these virtual spaces first hand. I would need to replicate the experience that Bethesda has sought in making *Oblivion* but in a more '*authentic*' manner i.e. more than just observation and replication.

During the *Virtual landscapes* study I had investigated and adapted a well-known research method (field trip) for the virtual domain in order to extract visual data for later reflection and analysis, however it also led me to the realisation that utilizing an actual physical field trip to gather data was both an interesting and valuable method to explore. At this early stage the type of data to be collected was unknown, however a commitment to using a field trip in a manner which supported the research outcomes was made.

6.1.3.2 VNED Practice

My second consideration from the *Virtual Landscapes* project was reflecting on the theoretical VNED framework and how this would, in practice, impact the design, production and immersiveness of a VNE. Nevertheless, I was split between two opposing thoughts. Firstly, the framework on initial inspection inspired confidence; this was something I definitely would have used in the past and would have been useful in structuring the design of a VNE

in a non-aesthetic only driven approach. The second thought was based on design experience since it is one thing to create a theoretical design and it can be something entirely different to build it. My past practice (as discussed in Chapter 4) had taught me that given the state of many development tools (often not fully documented and tested) and the variety of production pipelines (one could use many 'bits' of software in a variety of ways to arrive at a similar final creative solution) sometimes even the most robust theoretical designs would need significant overhaul when applied in practice, often to the extent that little or nothing remained of the original design intention.

Game development has also moved on significantly in the last few years, game engines, such as a Unreal, Cryengine, Source and Unity to name a few, have evolved from relatively obscurity to extremely powerful middleware solutions, used extensively in games development and outside of it (serious games, simulations). Hence there was also the possibility that the issues I had encountered during my past practice had largely been solved or were no longer relevant so how would my theoretical design work match when applied to one of these new powerful engines such as Cryengine?

The benchmark in measuring success in this case is based on the authenticity and the level of engagement evoked by a VNE that was designed through the VNED framework. Therefore, I did not necessarily need to build a VNE without it to test the hypothesis (this had already been done with past practice) but I had to test and refine the VNED based on an actual production method.

6.1.3.3 Distinct and Memorable Places

One of the most important realisations from the *Virtual landscapes* project was the recollection of certain distinct and memorable landscapes within VNEs. Given the growth, size and scope of modern VNEs in games, a potential issue was designing spaces that were both distinct and memorable (landscapes and environments). Traditionally many VNEs would require the use of maps (both local and global) to help a player navigate the virtual world, however in a few instances certain games demonstrated environments where players were able to navigate complex areas with little or no navigation tools simply based on recollecting landmarks and navigating 'mental maps'. This is echoed in my own personal experience of navigating complex natural physical spaces; certain environments would be relatively easy to navigate with little or no map/navigation use, others were extremely

difficult without regular bearing checks. This would often come down to unique landmarks being present in the environment as well as presence of smaller sub-landscapes or regions that had some distinct characteristic.

These observations led me to the idea of whether it would be possible to create a VNE containing several distinct landscapes and features that would allow a player to navigate efficiently and with ease without the use of maps or directional aids. Motloch (2002, p.19) refers to this as: *"geographers developing cognitive mapping techniques"* when he discusses the phenomenological view of landscapes as place. I was particularly drawn to Motloch's view that *"adherents of this view believe that the person and the environment are inextricably bound in oneness"*(p.19) and that landscapes generated by this view tend to be *"visually coherent, exciting and sensually rewarding"*. This is precisely what I have felt when creating and experiencing physical and virtual landscapes - there is always a sense of coherence across the wider landscapes/environment, landscapes that excite and fill me with a sense of wonder and intrigue, and are sensually fulfilling. The view of landscapes as place also resonates with Wilson's (1984) Biophilia hypothesis (the oneness of man with the natural environment) which I will discuss later.

6.2 Questions & Problems

6.2.1 Main Research Question

How can one explore virtual natural environmental and landscape design theory and practice in order to propose and develop a new approach that is able to incorporate a range of subjects, such as geology, landscape architecture and planning, to enrich any developed practice through observational analysis and qualitative reflection?

6.2.2 Research Problems

Problem 1: What attributes define the meaning and impact of the term 'landscape'? Are these applicable to the virtual domain and can they be quantified or embedded into a design framework/philosophy?

Problem 2: How would a theoretical VNED framework work when applied in practice? Do the theoretical design principles hold up when applied to modern games production technologies?

Problem 3: What would the resulting production workflow/pipeline look like? Is it feasible or realistic for either indie or professional developers to add to an actual development cycle?

Problem 4: Given the rapid evolution of computer and video games in both design and technology, how does one propose any improvements to either process, technique or a new future framework for VNED?

Problem 5: Could it be possible to create a VNE containing several distinct landscapes and features that would allow a player to navigate without the use of maps or directional aids?

6.3 Aims & Objectives

6.3.1 Research Aim

To test and investigate the creation of a VNED framework, one that considers both the physical and physiological aspects in order to create a deep, immersive and memorable VNE in a contemporary games engine.

6.3.2 Research Objectives

1. To create practice-based work (a game) which reveals, illustrates and exemplifies the findings and whose form and approach can shed new light on the man's relationship to natural landscapes.
2. To further refine the VNED framework during a second action research cycle.
3. To explore the concept and components of landscape and to examine if these can be applied and embedded in a VNED framework philosophy.
4. To test the theoretical VNED framework by practice and to test if theoretical design principles hold up when tested in CryEngine 3.
5. To develop a range of production workflow/pipelines that are feasible and realistic for either indie or professional game developers to add to the development cycle of a VNE.

6. To propose any improvements to either process or technique or a new future framework for VNED.
7. To create a VNE containing several distinct landscapes and features in a manner that would enable a player to navigate without the use of maps or directional aids.

6.4 Literature Review

6.4.1 Existing Design Approaches

As discussed in the literature review (Chapter 2) the majority of existing approaches to natural environment design are purely aesthetic-driven rather than focused on the experience or grounded in real natural spaces. Aesthetics, whilst important in defining the visual aspect of landscapes, are just a single aspect of what defines a landscape. Landscapes are not simply an object but of equal importance is the way in which we perceive and experience them. In order to develop a proposal for VNED we must first review the importance and meaning of landscape in a wider context.

6.4.2 The Importance of Landscape

Landscapes since the dawn of man have been the subject of artistic interpretation, from the Roman and Greek landscapes to the early Dutch painters of the 1500's where landscape painting became popular. However, landscapes have not always been the focus of artistic interpretation and in fact one could argue the artistic and cultural space that landscape art now holds in the modern world was in fact a ninetieth century creation. Clark (1975) elaborates on this in his opening introduction to *'Landscape into Art'*:

> *"I chose the subject of landscape painting, because this, in an even fuller sense than Ruskin realised, was the chief artistic creation of the nineteenth century: and without a clear understanding of nineteenth-century art, no evaluation of contemporary painting is possible. People who have given the matter no thought are apt to assume that the appreciation of natural beauty and the painting of landscape is a normal and enduring part of our spiritual activity… By the time he reached the third volume of Modern Painters Ruskin realised this, and wrote a section entitled Of the Novelty of Landscape in which he claims that mankind has almost acquired a new sense"* (p.3).

Clark's position is interesting as he states: "*…the appreciation of natural beauty and the painting of landscape is a normal and enduring part of our spiritual activity*", and it is surprisingly to note that his assertion is partially supported by evidence, gathered early in the investigation. I was convinced that landscapes had been a subject for artistic endeavour since prehistoric/Neolithic times; however in reviewing available literature it became clear this notion was not supported or evidenced (i.e. no evidence of landscape art has been found dating back to Neolithic or prehistoric times). Clark comments on the strange occurrence that during periods of artistic and intellectual enlightenment: "*painting of landscape for its own sake did not exist and was unthinkable.*" This leads us to a critical point in the western world at which society and art became fascinated and preoccupied with landscapes and forever changed our perception of them, especially during the end of the eighteenth century, namely the Romantic period.

6.4.3 The 18th Century Enlightenment

The 18th Century Enlightenment, particularly the romantic period in landscape painting demonstrated a change in how art and society viewed landscapes. For the first time landscapes became the central focal point for artistic impression. Turner and Constable are both celebrated for their contribution to the romantic landscape era. Turner in particular winning praise from another celebrated art critic from the period, John Ruskin. Sir Charles Lyell first published his ground breaking and influential *Principles of Geology* in 1830-1833. This was a particularly important time for the sciences, in particularly the geosciences, which started to become more popular among the general public, and the boundaries between science and art started to blur. The popularity of the geosciences, particular geology had a huge impact on one such individual who took this to heart was the noted English artist/critic John Ruskin. Ballantyne (2015, p22) noted in his biography of Ruskin, that Ruskin's fascination with geology started at a young age and he was someone who was so fully immersed in the beauty of nature it consumed all his time and energy, search for truth through observation, fact over thought. At the young age of 12 he started to compile his own dictionary of mineralogy, an interest he held all his life, resulting in membership to the British Geological Society of London in 1840.

Later in his life, Ruskin produced the '*Modern Painters*' (1843-1860), a piece of work that would ultimately consist of five volumes, and occupy nearly two decades of his life, and

was hugely influential on artists, specifically landscape artists at the time, and as Darhos & Thompson (2012) state "*played a formative role in the Pre-Raphaelite movement*." Ruskin explained that the artist should pay great attention to elements of nature and science. Ruskin developed his approach in the overarching methodology offered in '*Modern Painters*' in creating landscapes: the induction observation of facts and the operation of imagination.

Smith (1994) stated Ruskin believed that "*great art began with the faithful conception of natural objects*" and that "*The artist's emotional and intellectual response to the landscape is of no value without this careful representation of visible nature*", contrary to what other artists practiced according to Ruskin who were drawing from imagination first and if and when required would then draw influence from observation. In other words Ruskin believed that the second layer (imagination) was useless without the foundation (observation/fact) to support it.

Wilcox & Newall (1992) note Ruskin's advice, later to be his recognised dictum, for those wishing to create great landscape art. Although this was primarily aimed at those practising landscape painting, it was aimed wider at all those who practiced landscape art in whatever form they chose, the dictum *The Duty and After Privileges of All Students* has been quoted at the very beginning of this Chapter.

There is an immense sense of direction, focus and passion in what Ruskin proposes: one must *go to nature.* This is not a case of observing from a distance or from the outside but to actively seek her, one must walk (literally as Ruskin did many a time) "*laboriously and trustingly*". Anyone who has undertaken even a short nature walk realises that even the most forgiving terrain requires patience and time, and how easy it is for the mind to wander, so keeping one's mind focused on the experience in situ, absorbing the layers of complexity beneath the calm landscape. Ruskin did not believe in simply taking from nature; there was no selection or rejection, there was no picking or choosing, no avoidance of things one would find challenging or uncomfortable, but simply to embrace nature in "*all singleness of heart*".

Ruskin criticised the old masters for inventing and not conveying natural landscapes and urged them to go back to nature in order to bring authenticity to their work. This linking of art to natural sciences (namely geology in this instance) to increase authenticity in an artistic representation of natural landscape was to be echoed over a century later with Bethesda's design process in the creation of the *Oblivion* game, where the developers sought to use geology to inform the design of rock formations within the virtual game.. Ruskin

believed that in order to create more meaningful landscapes one must study nature not on a surface (aesthetic) level but from a deeper (i.e. studying geological formations) approach, scientific in study leading to sublime experience.

I was particularly drawn to the idea of a 'Ruskin experience', to literally follow Ruskin's dictum 'go to nature', and to study and observe it first-hand. Ruskin himself undertook many field trips during his life in order to enrich his work, the study of *Gneiss Rock* being one particular example, and raised an important consideration: would the use of a Ruskin inspired field trip to a real physical landscape help to both elicit a deeper appreciation of the natural landscapes, and help to define and understand the intangible nature and meaning of landscape.

6.4.4 Towards a definition

The word landscape can conjure up so many different meanings that defining the word can become a task in itself. The etymology of the word originated from the Dutch word '*Landschapp*' used by Dutch painters at the time to refer to paintings depicting natural or rural scenery. At its most basic interpretation the word has traditionally involved a physical space, a natural physical part of the land, and often a smaller distinct part of the wider environment, one we are able to perceive. The meaning of the word however changes depending on the perspective from which it is viewed. The word landscape for a landscape architect is a definable quantifiable area of land that has certain characteristics that separates it from other 'landscapes', a landscape to an early pre-Raphaelite painter such as Turner or Constable however would inevitably be different to the definition above.

Perhaps an easier starting to point in coming to a definition for the term is to look at how the word 'Landscape' has been perceived; the meaning ranges from a visual, social or cultural construct:

> "*Landscape is a kind of backcloth to the whole stage of human activity*". (Appleton, 1975. p.2)
>
> "*A portion of a territory that the eye can comprehend in a single view, including mountains, rivers, lakes and whatever the land contains*" (Webster & Mckechnie, 1975, p.27)
>
> "*Landscape, as the term has been used since the 17th century, is a construct of the mind as well as a physical and measurable entity*". (Tuan, 1979, p.6)

"…..When we consider landscape, we are almost always concerned with a visual construct". (Porteous, 1990, p.4)

"Landscape is about the relationship between people and place…People's perceptions turn land into the concept of landscape. It is not just about visual perception…Landscape character is the pattern that arises from particular combinations of different components which provide a sense of place to our surroundings." (Landscape Character Assessment – Guidance for England and Scotland, Countryside Agency, 2002).

Johnson (2007, p.3) in '*Ideas of Landscape*' states that landscape involves at least two elements interestingly pointing out this is '*at least within Western traditions*' noting cultural differences. The two elements are:

1. The *'land'* itself, however defined: the humanly created features that exist 'objectively' across space, and their natural context.
2. How '*the land*' is viewed: how we, and people in the past, came to apprehend and understand the landscape, and what those systems of apprehension and understanding are (the cognitive systems and processes of perception).

Johnson's view raises questions about the notion of there being two distinct elements of landscape: the abiotic/biotic aspect (terrain, geology, tree cover, etc.) and secondly our response to it (i.e. our perception and interaction with it). At its most basic level we are dealing with a physical space and psychological reaction to it. A report by the Water and Rivers Commission (2000, p.1) further elaborates on the meaning of 'landscape' and reinforces Johnson's (2007) notion of the two aspects of landscape:

"Unlike other aesthetic objects, such as buildings and paintings, landscape is not a discrete object. Landscape is more than physical features. It is the way a person interprets, interacts, and reacts to the natural and cultural elements of the environment."

Again we see a clear distinction in separating the main elements of landscape between the physical component and the psychological (interpretation, interaction and reactions) of what the landscape contains/refers to. **Figure 40** illustrates the components of landscape in its most crude form. In order to again fully understand what landscape involves, both components will be discussed in the next section.

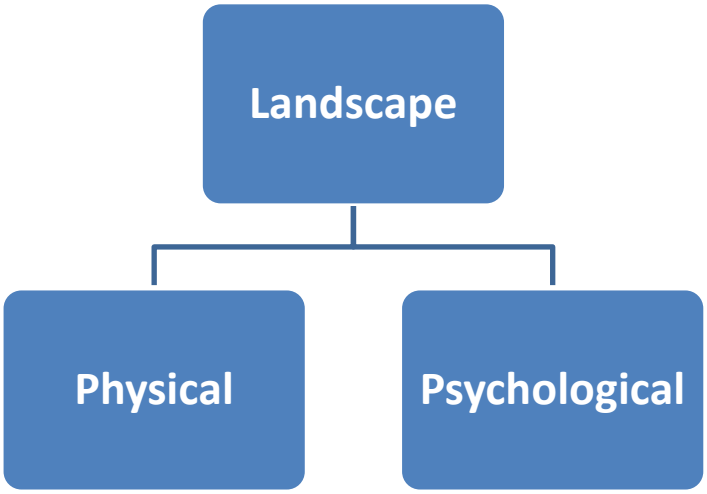

Figure 40: Components of Landscape

6.4.5 The Physical Landscape

The physical component of landscapes is perhaps the easier of the two components to define, as there is greater consensus on what attributes/elements are referred to in the term landscape (i.e. there are a number of frameworks for categorising and sorting the abiotic elements of a landscape, and the most significant of these is landscape architecture).

6.4.5.1 Landscape Architecture

Landscape architecture is a multi-disciplinary field as Waterman (2009, p.8) states: "*Landscape Architecture combines art & science to make places*". Motloch (2000) discusses the many ways that landscapes can be perceived and hence interpreted, and if we take one of Motloch's views of Landscape as a system, and planning as one aspect of creating/managing these systems, landscape character assessments presenting one such system for organising the abiotic elements of a landscape.

6.4.5.2 Landscape Character Assessments

Within landscape architecture and planning LCAs is a tool that is used for this design process found in traditional natural environment design disciplines such as landscape architecture and surveying. Tudor (2014, p.8) defines landscape character as "*a distinct and recognisable pattern of elements, or characteristics, in the landscape that make one landscape different from another, rather than better or worse.*"

According to The Countryside Agency LCA guidance (2002), LCAs are therefore a tool "*...used to help…understand, and articulate, the character of the landscape. It helps... identify the features that give a locality its 'sense of place' and pinpoints what makes it different from neighbouring areas*". The Scottish Natural Heritage defines Lands LCA as: "*a recognised analytical technique which identifies areas with a distinct composition of inter-related natural, physical, cultural and historical characteristics*[19]". The Countryside Agency's '*Making sense of Place*' defines it as: "*Landscape Character Assessment provides a framework for describing an area in a systematic way*"[20].

Although LCAs are used on exiting physical landscapes, the process of defining the larger macro regional character areas (or even the larger bio-climatic zones) down to specific micro 'site features', is particularly interesting as a potential systematic process for a natural environment designer to create more immersive, believable natural environments. LCAs are often presented as a diagrammatic wheel (i.e. a visual representation of the different components and sub-components of character). **Figure 41** illustrates the conventional manner in which these components of the landscape character are linked.

These components of landscape character are separated into two main categories *People & Place* and within these there are three sub-categories: *Natural, Perception & Aesthetics* and *Cultural/Social*. Each sub-character component is then broken down further into particular aspects:

- **Natural**: Geology, Landform, Hydrology, Air & Climate, Soils, Land Cover
- **Perception & Aesthetics:** Memories, Associates, Preferences, Sounds, Smell, Touch and Sight (Colour, Texture, Pattern, Form)
- **Cultural/Social:** Land Use, Settlement, Enclosure, Land ownership, Time depth

LCA is aimed as a tool for not only capturing the specific character of a particular landscape but also addresses larger spatial 'units' and/or 'levels' of ranging from the smallest (site feature) to Land Cover Parcels (LCPs) to Landscape Description Units (LDUs) to landscape types and regional character areas, to the largest finally bio-climatic zones (**Figure 42**).

[19] https://data.gov.uk/dataset/landscape-character-assessment-scotland
[20] http://www.snh.org.uk/wwo/sharinggoodpractice/cci/cci/guidance/Downloads/summary.pdf

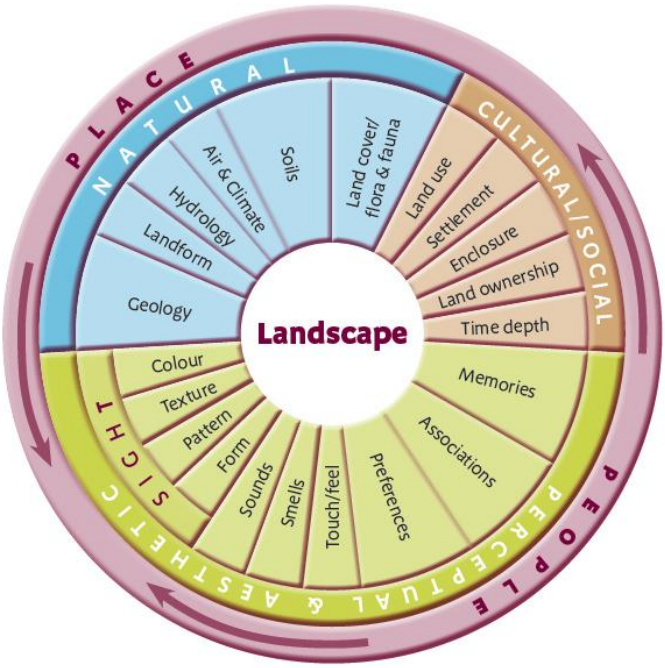

Figure 41: The landscape wheel from 'Landscape Character Assessment (adapted from Tudor, 2014)

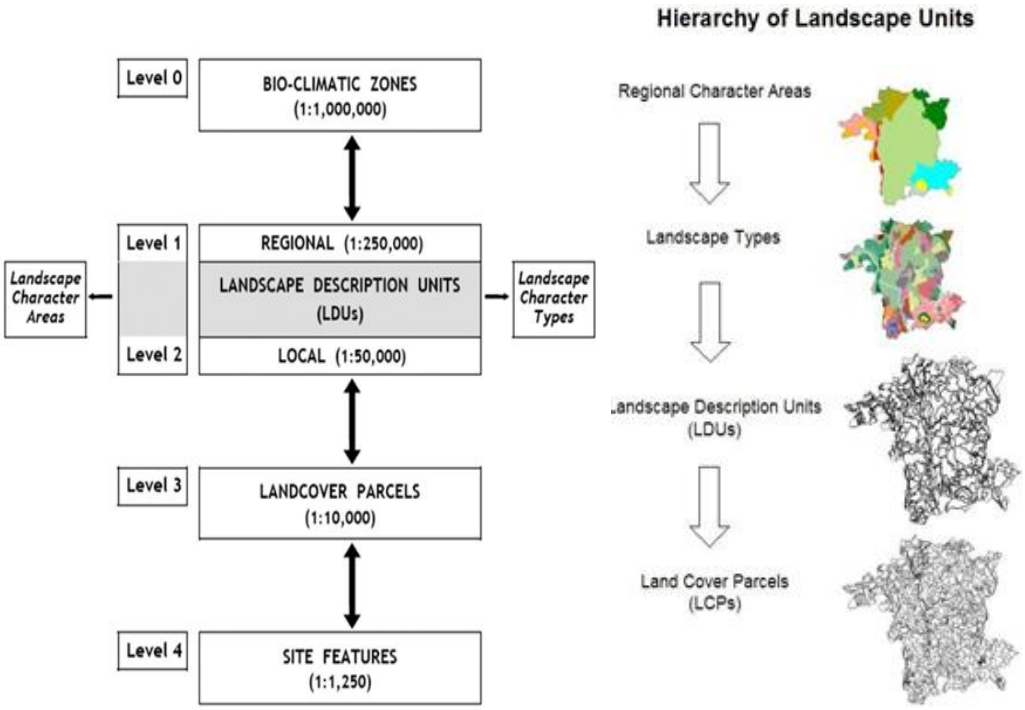

Figure 42: Landscape Character Assessment -Unit Hierarchy (Source: gov.uk)

6.4.6 Landscape Character Assessment & Games Design

During the design of *EternalKnight* (Chapter 4) the project experimented with creating a methodical system from which the fictional continent of Laconia could be broken up into different identifiable 'regions' each of which aligned to a particular aspect of the narrative, and had different character/traits, which at the time meant variety on tree cover and the physiographic nature of each region. Figure 44 illustrates the region map for the game.

Over a decade later, I began my investigation of exploring natural environment design in games design and production. What I found was minimal, ad-hoc and proprietary; there was a uniform, standardised approach to what I assumed to be a very uniform and standardised problem. There was nothing I could adapt or base my original design thinking on, until I went wider, outside the games design field, outside games entirely and looked at landscape architecture. The systematic and methodical process of breaking down a wider environment into distinct regions;, the colour coded maps and region descriptions all had a remarkable similarity, despite the fact I had never consciously studied landscape architecture or design in any capacity, my design process had unknowingly mirrored a common and powerful landscape planning and design tool within landscape architecture. **Figure 44** illustrates a regional character map that is colour coded to match the different character regions/types. The *Eternal Knight* Region Treatment (**Figure 43**) compared to landscape region descriptions (**Figure 44**).

So, what if the process used in LCA could be 'reversed' and applied to the creation of virtual natural landscapes as opposed to categorising them? (i.e. using the LCA tool that is used for categorisation of an environment for design & planning and environment). **Figure 45** illustrates how this 'reversed' planning to design process could be structured. Starting with the physical natural environment, this is categorised through the landscape character assessment process, producing landscape character assessments (i.e. types and areas), which are then subsequently a VNE process in order to produce a new virtual natural environment.

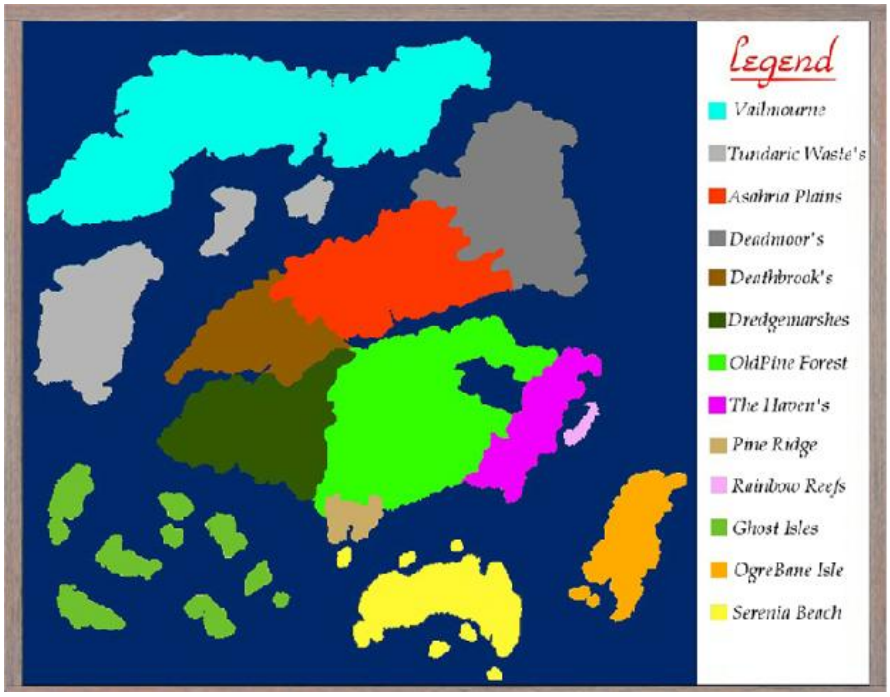

Figure 43: Eternal Knight Landscape Region Map

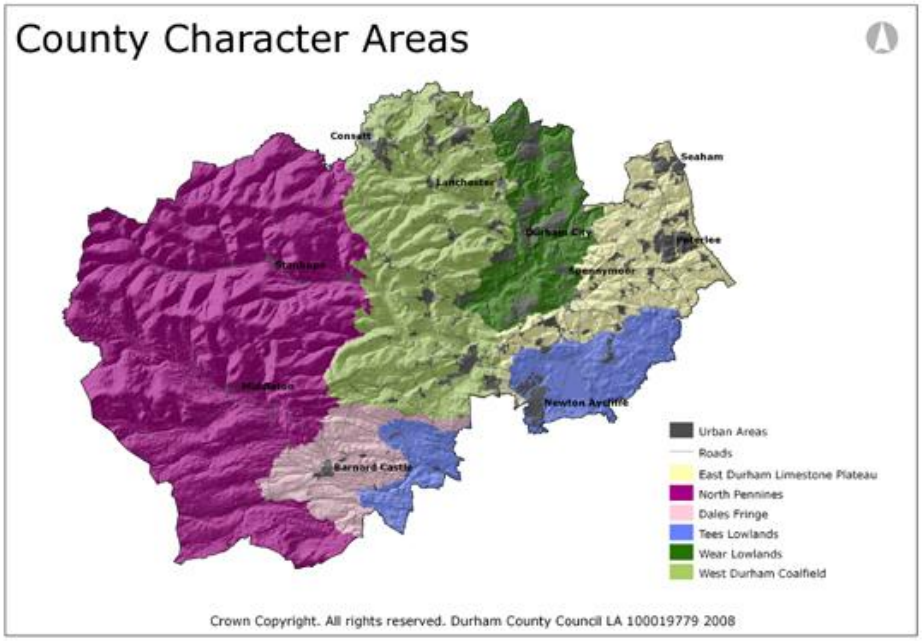

Figure 44: County Durham Regional Character Map (Source Durham.gov.uk)[21]

[21] http://content.durham.gov.uk/ImageRepository/CoDurhamCCA_Land.jpg

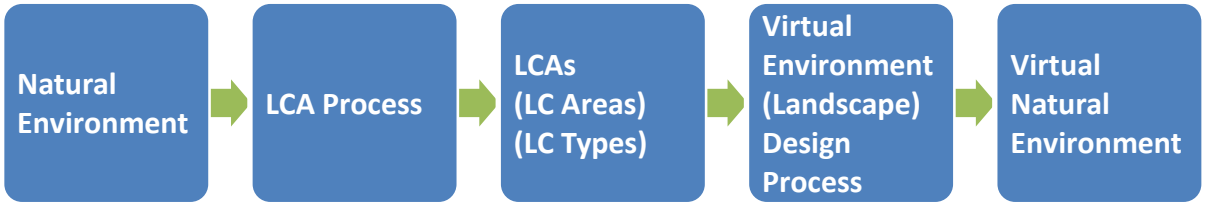

Figure 45: Proposed Virtual Landscape Design Framework

6.4.7 The Psychological Landscape

As was discussed previously the second component of 'landscape involves the physiological element (i.e. how landscapes are perceived and experienced). In order to examine the true impact of natural environments we need to take a step further into the psychological effects of the natural environment.

6.4.7.1 Environmental Psychology

Within psychology one particular branch aligns closely with landscape design. Environmental psychology is an area that deals with the psychological impact of environments and focuses on the relationship between environments and human behaviour. Gibson's (1979) '*The Theory of Affordances*' links closely to this in proposing humans may have developed a preference for certain environment that 'afforded' a better chance of survival by providing safety, food and shelter. Kaplan & Kaplan's (1977) model of environmental preference also supported the work by Gibson. Little work has been done however on whether these behaviours can be replicated into a virtual domain, and this was proposed as a future research question by Ulrich (1984).

The area of environment/landscape aesthetics also provides an insight into the significance of natural environments to humans. Dutton (2003) in '*Environmental Preference, Aesthetics and Evolutionary Psychology*', stated that preferences for specific environments such as the savannah extended into modern day art and design and it was not surprising to see *"these are the very elements we see repeated endlessly in both calendar art and in the design of public parks worldwide"* since *"The savannah environment is in fact a singularly food-rich environment"*.

6.4.7.2 Game Design informed Psychology

The use of psychology however to inform games design has only recently emerged (Bostan, 2009). The journal paper analyses the basics of goal-directed behaviour in computer games by *"investigating the actions provoked by the interactions between psychological needs and game situations; and to construct an integrated framework of player motivations"*. Isbister (2007) also marks a pivotal advancement in one area of games design: mainly character design. Isbister's approach is original in using a social-psychological approach to enhance the game play experience.

6.4.7.3 Biophilia Hypothesis & Biophilic Design

Wilson's (1984) *'Biophilia'* is another noted example of a theory linking the natural world (including the natural environment) to man's view and in particular his connection to it. Wilson proposed that man has an innate link and affinity to the natural environment so much so that our responses are triggered by behaviours that are learned evolutionary reactions to the environment. Founded on Wilson's *Biophilia* hypothesis, Browning et al. (2014) wrote '*14 Patterns of Biophilic Design*', which develops the concept of *Biophilia* as applied to landscape architecture and design as a design ethos. The work presents a practical framework with design considerations, examples and case studies for promoting and implementing Biophilic Design, and a useful framework for considering the nature-design relationship. Biophilic design (BPD) can be organised into three categories: *Nature in the Space, Natural Analogues and Nature of the Space* (**Figure 46**). Table 21 details the relevance of each area of BPD to the real and virtual domain.

Nature of the Space concerns the spatiality of nature, and includes both instinctual and learned desires regarding fascination with the dangerous or unknown. These experiences are best achieved when combined with the other two main elements of BPD. ***Nature of the Space*** involves four BPD patterns:

1. **Prospect:** A clear view of the surrounding for planning or surveillance purposes.
2. **Refuge**: A place to hide from the environment or any other activity, specifically offering cover behind and over the individual
3. **Mystery**: Sensory devices that are manipulated to entice an individual to explore the unexplored areas of the environment.
4. **Risk**: A threat coupled with safety

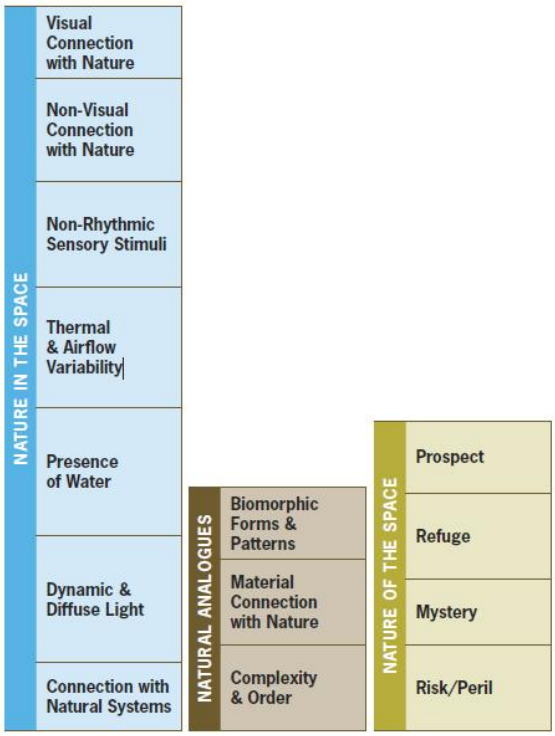

Figure 46: Categories of Biophillic Design (adapted from 2014, 14 Patterns of Biophilic Design)

Biophilic Design Category	Physical Domain	Virtual Domain
Nature in Space	Highly Applicable	Highly Applicable
Natural Analogues	Highly Applicable	Not Applicable
Nature of Space	Highly Applicable	Partially Applicable

Table 24: Biophillic Design Physical vs Virtual environment

What is striking is the BPD offers an ethos (*"Above all, biophilic design must nurture a love of place")* that embraces a honest and sincere approach in how a place is considered; it is not simply a product or a service to be sold but an emotional response - the *love* of the place that is to be nurtured and achieved through the design philosophy. In addition, it offers a practical structured approach to realising landscape design guide (albeit in the physical world) by underlying Biophilic ethos. BPD most certainly offers a design framework/philosophy that is underpinned with a rich and emotional ethos and supported by practical guidelines/ examples, however the answer is no, not quite. The main criticism is that the BPD central tenant is *"to create spaces that are inspirational, restorative, and healthy, as well as integrative with the functionality of the place and the (urban) ecosystem to which it is applied"*.

So how do virtual environments align with this design aim? Is the above fully or partially applicable? Let us consider each one of those aspects under the design aim separately in order to examine these two questions.

1. **Restorative:** might be a side benefit that is useful but not within the scope of this study
2. **Healthy:** This aspect is tied to restorative and although I would certainly agree based on personal anecdotal experience and through reflection on my own experiences of virtual landscapes, this is not the focus of traditional games/environment design.

Whilst the health benefits of using BPD in a physical domain may be paramount, within a virtual environment this might lead to an added benefit, but the main focus of games design (and virtual environment design) is on immersion i.e. to create more meaningful and immersive places. The most critical aspect of what BPD can offer VNED is in creating places that are inspirational. A place that inspires is one that engages an individual on a deeper and more emotional level, if one is able to trigger a positive emotional response then this could lead to a greater level of engagement and immersion.

Another difficulty with using the framework is that not all of the categories are applicable to virtual environments (see **Error! Reference source not found.**). Some categories and atterns are pertinent and align perfectly with initial assumptions and expectations, others do not. However, this will inevitably change in the future as games and entertainment technologies grow and allow for a greater sense of immersion through additional visual/audio/olfactory interfaces, meaning these additional areas within BPD will become relevant. On initial first inspection there appears to be a great deal of similarity between biophilic landscape design considerations and virtual landscape design hence it will be interesting to see if and how this is applied in practice.

6.4.8 The Romanticised Virtual Environment

The process of embedding meaning into a virtual environment i.e. the first initial point of contact the player experiences (what they see), that can be built upon, narrative and gameplay are often explicit and actively forced onto a player, game environments are often referred to as a vehicle to deliver narrative/gameplay, a subservient aspect of the game world, with little or no inherent value apart from *'defining boundaries' and 'providing a*

narrative context' (Smith & Worch, 2010).

However, what if do not accept this design thinking/practice? What if virtual environments (and the virtual landscapes they contain) are not just mere components within a game (or an aspect of gameplay)? For instance, what if we no longer assume the virtual environment as a subservient element in creating an immersive experience but an entity in itself capable of having its own value or meaning and impact?

This shift has in fact occurred before specifically in landscape art, and in particular landscape painting which during the romantic period experienced a surge in popularity when the shift occurred. Clark (1975, p.3) states: "*the painting of landscape for its own sake did not exist and was unthinkable…*". Clark also noted an assumption that many (including myself) without thinking made about the appreciation of natural world in art: "*People who have given the matter no thought are apt to assume that the appreciation of natural beauty and the painting of landscape is a normal and enduring part of our spiritual activity*".

After this paradigm shift, artists did not require a subject or another entity to justify painting a natural landscape (i.e. it meaning/context or value in itself). What was the backdrop now became of value and interest, worthy in its own right to be painted, displayed and cherished. What if this paradigm was applied to virtual natural landscapes? What if virtual natural landscapes were created to be enjoyed without any additional 'layers' such as a narrative context? Could they be enjoyed 'as is'? Actually could they be experienced since the word 'enjoy' implies a specific type of experience and my belief is that landscapes can elicit both a huge range of emotions, including but not limited to enjoyment, without the traditional added layers of narrative and goal driven gameplay?

What if you could embed evocative meaning into the virtual environment/landscapes, one that could be built upon with layers of additional gameplay and narrative later on? Theorists have argued that virtual space is not just a subservient foundation for other more 'meaningful' aspects such as gameplay (which is still largely contested) within which contains aspects of exploration, intrigue, enjoyment, discovery which do not require anything more than an environment to be present and a player to explore it. What if I could create an environment that would trigger happiness, sadness, reflection by embedding innate evocative meaningful places such as the lone cypress tree, where one could 'play' with the environment through exploration and discovery?

6.4.9 Place & Placelessness

The idea of place and placeness and meaning of place was first discussed by Edward Relph, a geographer, is his ground-breaking book '*Place and Placelessness*' published in 1976. Relph's work is often cited to be amongst the top geographical ideas that have changed the world (listed at no.10 in Hanson's (1997) 'Ten *Geographic Ideas That Changed the World*. Relph argued that places were either authentic and genuine or inauthentic and artificial, and that space has a more complex relationship to place than merely a '*container*' that holds space. Seamen & Sowers (2008) discuss one of the most unique and intriguing aspects of Relph's concept of place: insideness & outsideness:

> "*If a person feels inside a place, he or she is here rather than there, safe rather than threatened, enclosed rather than exposed, at ease rather than stressed. …. the more profoundly inside a place a person feels, the stronger will be his or her identity with that place*" (p.45).

The strongest sense of place Relph defines as 'existential insideness' and its counterpart 'existential outsideness'. All virtual game environments are unknown alien spaces (many literally simulating alien worlds), users will not have any familiarity with the space as often these are imaginary worlds with no relation to any physical counterpart; they are in essence (if we assume that Relph's concept of insideness and outsideness is applicable to the virtual domain) forced to experience the space and experience a sense of existential outsideness (i.e. "*….a sense of strangeness and alienation"*).

The goal of any designer is for a design to connect and deliver what is expected, yet I would argue the role of an environmental/landscape designer should be to evoke deep immersion/connection with a virtual space turning it into a place that has emotional resonance. There would be nothing more powerful and nothing greater as a measure of success as a designer to elicit Relph's existential insideness experience which Seaman & Sowers (2008, p.45) define as: *"….a situation of deep, unself-conscious immersion in place and the experience most people know when they are at home in their own community and region".*

I can imagine nothing more profound as a designer than being able to evoke a feeling of deep unconscious immersion in a game environment I had created, a sense of home and belonging. Relph's existential insideness echoes some of my experiences of playing/experiencing virtual landscapes over the last thirty years. One experience in particular was standing on the virtual cliff in Sega's *Phantasy Star Online* (**Figure 47**).

Figure 47: Cliff Landscape, Phantasy Star Online (2001)

Sega's *Phantasy Star Online* had several unique natural landscapes across a range of alien worlds, one of which triggered a very personal memory and associations; it was an unusual auditory/visual combination I encountered in the mountain region overseeing the cliffs, with the rich dusk sunset playing to a melancholic music track that seemed to trigger a sombre reflection on past real sunsets from my youth - moments of basking in the final rays of the setting summer sun playing with brothers and parents in the park came flooding back when I stood on the virtual cliff. The facsimile was clearly artificial, and one that I had no prior experience of (I have rarely visited landscapes that had a similar physiographic nature and as far as I am able to tell I have no conscious memories of any 'real' experience that was similar to the virtual cliffside) but the emotional response was certainly real and unusual, considering this was a 'mere' virtual representation.

I felt and still do feel an incredible unexplained connection to this space; I had a real, tangible emotional experience and response to this place, both at the time and on recollection, one of fondness and belonging, and I cannot think of a better description of that deep sense of place I had than that of Relph's e*xistential insideness.* My subconscious and deep response to a virtual place is something not individual to me. During my extensive time teaching students on the BSc Computer & Video games programme I have had many conversations with students who have revealed similar stories and deep emotional connections and experiences of virtual places including virtual natural landscapes and although anecdotal, my intuition and limited experience led me to believe Relph's idea of existential insideness is something that has manifested itself in the virtual world and is experienced by all gamers at some point in their gaming lives.

We inhabit many different spaces across our lives and my experience of space have leapt across both the physical and virtual worlds, and I have been fortunate enough to visit many spaces, but within these spaces there is only a selection that I am able to recall - places that are memorable or ones that I can recollect with fondness or with intrigue. Throughout our lives we travel to countless spaces, natural to artificial, physical to virtual, these two terms space and place, may appear to be interchangeable but in fact can be remarkably different. There is a distinction between space and place. Space is a measureable description applied to a quantifiable region (i.e. a volume or area defined by x, y, z - a 'container') however a place is something more - it holds additional qualities or is valued/perceived to be important for particular reasons.

An experience that describes this concept of 'place', and an experience that for me delineates the distinction between space and place were during a trip to California, USA, in 2004. The event was an extended road trip that involved a 2,500 mile route across the state visiting countless scenic locations. During the 17 mile drive (stretch of road in Pebble Beach) as I was nonchalantly peering out the window I asked the driver to stop the car suddenly as I had seen something rather unique and incredibly intriguing out the window. Jutting out into the sea was a small headland (a narrow piece of land that projects from a coastline into the sea), a mysterious lone tree sat alone in what appeared to be a small ancient manmade enclosure. There was something unusual, something inviting, something unique and alluring about this space that called me to a literal stop. The tree stood alone, almost like a guardian silently waiting for the return of an unknown friend or foe (see **Figure 48**).

A blurred succession of thoughts raced through my mind (was this tree of some cultural or historic value? Why someone would build an enclosure, given the precarious nature of the cliff - around the tree? Was there something of value buried underneath the tree? Did the tree bear some unknown or strange fruit or did its roots/bark have some rare medicinal quality to them?). All these questions raced through my mind in an instant, but one thing remained constant: the pull and a textbook '*call to adventure*' that Joseph Campbell discusses in his pivotal '*Hero of a Thousand Faces*' wondering if perhaps there was something hidden underneath the mystical tree most probably not but the idea had firmly entrenched itself upon me.

Figure 48: Lone Cypress Tree (Ali, 2004)

On my return to the UK, I found out the Lone Cypress Tree *(*as it is commonly referred to) perched on the granite hillside is actually one of the most recognised and photographed trees in the USA, so my encounter and reaction to the tree was not unique to me, but part of a much larger collective response. Even eleven years on, this 'place' evokes a very powerful emotional response; it was one of the defining moments of discovery and exploration in the entire trip (an impressive feat since over 50 unique locations were visited over the two week period). What was even more interesting was the lack of any other cues (information, signage) as this was not a region I was familiar with, and was culturally/geographically quite different; however the response was almost instinctual.

Motloch (2000) discusses how we process visual information in two distinct stages the pre-cognitive and the cognitive of the perceptual process when viewing the environment. The first phase is pre-cognitive where "*nearly instantaneous appraisal and action for survival"* (*ibid*, p.248) the users' need to understand what they are perceiving and assess any danger/safety/survival concerns. In this stage we perceive super signs/chunks (overall shapes/patterns). The second stage of the perceptual process (cognitive) where a *"need to sustain interest and discover more information"* (*ibid*, p.248) is when the above survival needs have been satisfied for the user and gives way to an individual's motivation to explore detail

and subtleties. Reflecting upon the Lone Cypress Tree experience using Motloch's pre-cognitive/cognitive model, I analysed the incident on a pre-cognitive and cognitive level.

- **Pre-Cognitive**: Capturing my visual attention amongst a plethora of other strong visual cues
- **Cognitive**: Drawing me to the immediate area and triggering a desire to explore/investigate the area.

This view in environmental psychology is closely linked with Appleton's (1975) theory of *Prospect and Refuge*, published in his book '*The Experience of Landscape'*. What is intriguing is the Lone Cypress tree incident acted as an exemplar of an ideal prospect (provided the capacity to observe) and refuge (without being seen) environment.

One of the pitfalls of games that utilise an open 3D gamespace is that directing a player's focus to a particular object/area can prove to be a difficult task; often this is done through explicit devices such as oral or written instruction delivered through narrative (quest dialogue, map markers) and often, if done incorrectly, can affect immersion and gameplay (i.e. getting lost, losing track of game goal). The ultimate goal of any game designer utilising a VNE quest-driven gameplay would be the ability to direct a player without the need to 'handhold' the player and explicitly direct them through narrative or other devices. There seemed to be a remarkable alignment with my experience with the lone cypress tree and the designers' ultimate hope of effective design in a game that utilizes a VNE.

6.4.10 Virtual World Placelessness

Over the course of my 30 years in gaming, I have observed that game VNEs can suffer from what I refer to as '*Golf course'* design (i.e. the natural wilderness and landscapes are reduced to undulating differentiated hills and troughs), with little to no tree cover making it hard to discern one area from the next (i.e. absence of memorable places) Surface cover e.g. grasses, shrubs) is minimal and appear ideal and uniform like perfectly repetitive patterns almost like a perfectly mowed lawn. **Figure 49** illustrates this *golf course* design as exemplified by a panoramic image taken from Sega's *Phantasy Star Universe* in comparison to a panoramic image of an actual golf course (**Figure 50**).

Figure 49: Typical Golf Course (Source mounttemplegolfclub.com)

Figure 50: Phantasy Star Universe: AOTI's Forest of Illusions exemplifying Golf Course Design

These game environments were virtual spaces but had a strong emptiness to them. In many ways, golf courses are a perfect analogy to games that suffer from *golf course design* as they are artificially created areas designed as spaces with play in mind - the only key difference is that one is a virtual space, and the other a physical space. Several of the critical considerations include:

- Evoking mental imagery
- Effecting changes in one's emotional state (physiological impact) over time
- Lacking *functional, cultural, aesthetic or associational meaning and convey a negative sense*
- Transformation of a setting *(forgettable)* to a place *(memorable)*

Motloch (2000) defines *placelessness* as: *"The inability of a setting to evoke a vivid mental images and to effect changes in one's emotional state over long periods of time, places characterized by placelessness lack functional, cultural, aesthetic or associational meaning and convey a negative sense"* (p.352). This view of placelessness aligns with my experiences in both the virtual and

physical worlds. During the Moel Siabod field trip in a few instances along the hike, the terrain was devoid of evoking mental imagery or emotions - the landscape was itself barren and repetitive apart from specific places that stood out. In the virtual domain, games such as Bethesda's *Morrowind* or Sega's *Phantasy Star: AOTI* demonstrated environments/ landscapes that were forgettable exhibiting the *golf course design* discussed above.

Motloch also defines 'placeness' as: "*The ability of a setting to evoke a vivid mental images and to effect changes in ones emotional state over long periods of time, …through cognition, individuals translate settings into place, and determine placeness*". This view of placeness aligns with my experiences with the Lone Cypress tree; this was most definitely a place I, and others, held with high regard, despite not being overly impressive or outstanding, it evoked mental imagery (i.e. imagining if something was hidden underneath), and it evoked and changed my emotional state (surprise, joy, curiosity). This setting had without a doubt became a place embedded in my memory that I recollected with fondness and joy.

6.4.11 Genius Loci

The concept of each particular place having a unique character is embodied in classical roman religion as the Latin phrase '*Genius Loci*', translated to mean "*genius of the place*". Traditionally applied to natural areas, a unique protective spirit/deity (often a mythical creature such as a centaur, fawn, nymph) would watch over the area as a protective guardian. White (1967) describes the *genius loci* and its importance in the ancient world in her essay '*The Historical Roots of Our Ecological Crisis*':

> "*In Antiquity every tree, every spring, every stream, every hill had its own genius loci, its guardian spirit…..Before one cut a tree, mined a mountain, or dammed a brook, it was important to placate the spirit in charge of that particular situation, and to keep it placated*" (para.21)

This further refinement of a concept of place, especially in a natural setting is incredibility powerful; the size of the area under protection was not large swathes of the natural environment but was often a much smaller area (i.e. particular landscapes) and in many instances specific objects/entities such as a single tree, a brook or a small hillside. Each one was afforded the protection of a personified spirit as these were meaningful spaces that one could not alter in any way without actively appeasing its protective guardian.

A contemporary usage of *genius loci* now refers to the spirit of the place - its unique character. This is not simply a set of values or variables to be quantified but the use of the word *'spirit'* implies an independent life energy, an entity, something living, dynamic with a unique and distinctive placeness, a concept that is more readily grasped. It is perhaps far easier to connect (and remember/recall) a location if it is entwined with a mythical spirit guardian (than one that is not) since it evokes a much deeper relationship between people and these distinct places.

Kroeber (1921) notes one particular myth about malevolent spirits that inhabited particular natural spaces in his discussion on the *Native Americans of Yosemite*, where he discusses the Miwok who believed waterfalls were inhabited by evil spirits (para.36).

I was strongly drawn to this vibrant and dynamic concept of the *genius loci*; my encounter with the Lone Cypress Tree in California echoes the sentiment held within the phrase that even a tree or a babbling brook is capable of evoking a strong reaction/emotion and is precious enough to warrant its own guardian, a natural entity having its own unique personality and mood, creating a unique atmosphere and bringing a vitality to an area, that otherwise cannot be quantified. I was intrigued by the concept (and practicality) of imbuing character, personality and spirit into the virtual natural landscape. So, could I assign moods/personality traits to otherwise inanimate objects/locales in order to bring a sense of placeness and connect users' feelings to the virtual natural spaces?

6.5 **Process/Methodology**

6.5.1 Overview/Research Strategy

As a gamer, the intended design experience can differ largely from the actual user experience, so I needed to see how the game actually plays, as it cannot be evaluated through for instance a statistical analysis, which although useful would be very tricky to assess an intangible quality such as gameplay and immersion. Since I am an 'instrument' in this process and as a gamer with over 30 years of experience, my initial assessment/experience of 'playing' this space is a valid reference point to build upon.

Table 25 provides an overview of the range of research methods employed and the justification, in this chapter.

Artefact/Project	Research Methods Employed	Justification/Notes
ShadowMoss Island	7. Action Research 8. Computer Aided Design 9. Field Trip 10. Experimental 3D Design 11. Illustrated visual documentation of design process 12. Reflective Practice	• Allows the collection of physical spatial/tactile data • Allows the exploration and presentation of spatial and tactile data • Allows direct experimentation with concepts that have yet to be explored in commercial practice (Matias & Stern, 2005)

Table 25: Research Methods Overview

6.5.2 Drivers in Methodology

The research was primarily practice-based, focusing on my role as researcher acting as a participant/observer and as a 'reflective practitioner'. The general methodological approach has elements of a naturalistic enquiry. My approach was to break the research problem into several smaller areas of study and attempt to use multiple methods in order to explore each sub-problem (summarised in **Table 26**). This led to the generation of an artefact in order to fully engage with the problem, and then I critically reflected on the artefacts as a vehicle to discover new knowledge. Each artefact was the result of a process of contextual review/inquiry/ design/implementation and reflection and they were created using a variety of research methods. Ultimately they formed a portfolio of practice leading to this final submission which presents and illustrates the answer to the research problem. Several characteristics drove the selection of methods for this study, namely *Practitioner/Researcher as instrument, Natural Setting, Tacit Knowledge and Emergent Methodology*. These are described in section 3.10 of the Methodology Chapter.

Table 26: Summary of Research Process

Steps
1. Issues/Concerns and areas addressed from VL project and Reflection on foundation practice
2. Lit review on above, reframing of ideas
3. Key vision concept: Chose image from Kyrandia 2(VL project) as it looked like a strong archetypal island: manageable small scale(big issues in natural landscape design is scale), rich(variety of smaller landscapes) and evocative as a space
4. Field trip to Mol Siabod to gain insight, documented reflection and analysis; based on observation and imagination(Ruskin) and place/placenesss (KEY M.S SUMMARY)
5. Initial design and concepting of VNED through software tech and VNED V1(Deep zoom) Region treatment through the use of environmental storytelling
6. Building of Shadowmoss Island in world machine, geocontrol/cryengine, documentation of whole process
7. Reflection and analysis of design process
8. Output of refined pipeline and VNED V2

6.5.3 Specific Methods

Given the above elements the following are a list of specific methods to be employed in order to find/create new knowledge needed to answer the research question:

1. ***Experimental Practice:*** The *design, making and testing* of two specific game artefacts as a method to explore design theory and practice.
2. ***Documentation:*** Extensively illustrated *documentation* of artworks from design to testing/evaluation, utilizing mind/concept maps, flowcharts and diagrams
3. ***Computer Aided Design***: A wide variety of *computer software* was used for data extraction/generation of the visualisation of non-conventional data sets.
4. ***Exhibitions***: This is in both a traditional (physical) space and in the Virtual domain and includes an element of dissemination.
5. ***Action Research*****:** Using the mind-set of Schon's 'reflective practitioner', cycles of action research and reflection in/on and for action was used to inform practice and drive the work towards a resolution. Outcomes from the creation of each artefact (case study, digital design, etc.) formed a place from which to *reflect on action* feeding into an eventual *reflection for action* in a second cycle.
6. ***Field Trip*****:** This includes the standard definition of the term field trip (an observational method employed to gather data in a 'live' physical setting) but within this study I am

including the virtual domain within this term (visiting a virtual space to observe and collect data for later analysis and reflection).

Table 27 lists the document and appendix reference.

Table 27: Study Document Appendix/Reference

Area	Document/Reference
1. Issues/Concerns and areas addressed from VL project and Reflection on foundation practice	See Section 6.13
2. Lit review on above, reframing of ideas	See Section 4
3. Key vision concept: Chose image from Kyrandia 2 (VL project) as it looked like a strong archetypal island: manageable small scale(big issues in natural landscape design is scale), rich(variety of smaller landscapes) and evocative as a space	See Figure 73
4. Field trip to Mol Siabod to gain insight, documented reflection and analysis; based on observation and imagination (Ruskin) and place/placenesss (KEY M.S SUMMARY)	See Appendix M
5. Initial design and concepting of VNED through software tech and VNED V1 (Deep zoom) Region treatment through the use of environmental storytelling	See Appendix H
6. Building of Shadowmoss Island in world machine, geocontrol / cryengine, documentation of whole process	See Appendix N
7. Reflection and analysis of design process	See Section 6.6 & 6.7
8. Output of refined pipeline and VNED V2	See Appendix H

Paper Design of *ShadowMoss Island* - key considerations:

1. Selection of virtual 'place' to act as a foundation for the design; high aesthetic concept
2. Landscape design element 1: Physical is driven by LCA process
3. Moel Siabod experience becomes source to process by observation
4. Virtual Landscape Project VNED Summary v1
5. Landscape design element 2: Psychological is driven by a combination of the following:

a. Ruskin's '*Go To nature*' dictum - Moel Siabod experience becomes source to process by imagination/feeling
b. Cognitive spatial mapping (based my Moel Siabod/reflection on games)
c. Relph's concept of *Place & Placenessness*
d. *Genius Loci* - Each place has a unique guiding spirit

Appendix R details the categories/sub categories of BPD against virtual landscape design including notes on whether it is applicable or not with considerations/design notes taken from the paper to be applied in practice to *ShadowMoss Island.*

6.6 Practice Based Outputs

Table 28 Illustrates the range, description and the reference to locating the output.

Table 28: Overview of study output

Output	Description	Reference
1. Moel Siabod Field Trip notes	Field notes including images from field trip	See Appendix M
2. Moel Siabod Field Gallery	Gallery of photo's from Field trip	https://goo.gl/photos/8Hs9VTzHcnwZ6vow5
3. ShadowMoss Island - Cryengine Level	Playable game level experiment of ShadowMoss Island	See Chapter 6-ShadowMoss Island folder on external media drive
4. ShadowMoss Island	Document providing visual and written descriptions of the unique places in ShadowMoss Island	See Appendix N
5. ShadowMoss Video Trailer	A trailer demonstrating the unique aspects of the game	See Chapter 6-ShadowMoss Island folder on external media drive
6. VNED v2 a) VNED Grid v2 b) VNE Design Production Guidelines	Production guidelines for creating a virtual natural environment (technology agnostic)	See Appendix P See Appendix H

6.7 Analysis

In order to measure the success of the creative cycle, each of the original research problems and objectives will be discussed based on the creative output and findings from the study.

6.7.1 The Elements of Landscape

Research Problem 1: *What attributes define the meaning and impact of the term 'landscape'? Are these applicable to the virtual domain and can they be quantified or embedded into a design framework/philosophy?*

The literature review revealed that the term 'landscape', most commonly includes the physical aspect (physiographic nature including the geology, surface cover etc.) and the psychological aspect (**Figure 51**). The physical aspect was easier to find consensus on and what has emerged (modified LCA grid).

As a result VNED can be broken down into several sub-areas. **Figure 52** illustrates how each of the explored components from the literature review fits into either the physical or psychological component of landscape (design), although there was overlap in some of the areas (i.e. BPD addressed both the physical and physiological aspects of landscape). The physical nature of landscape design was composed of two elements: LCA and BPD.

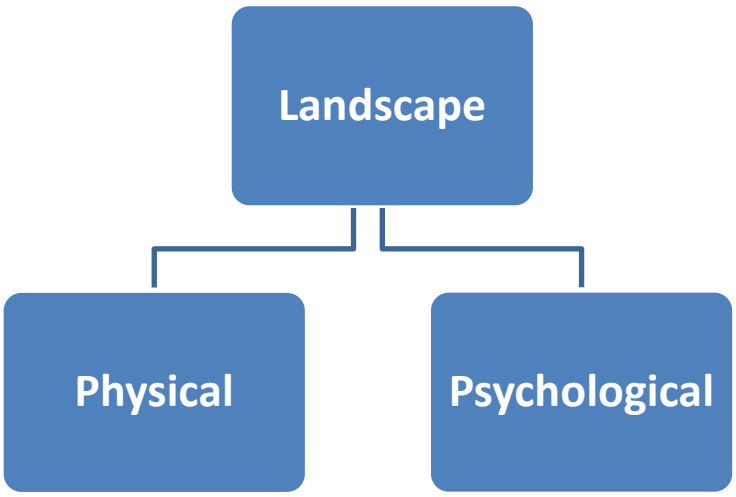

Figure 51: Components of Landscape

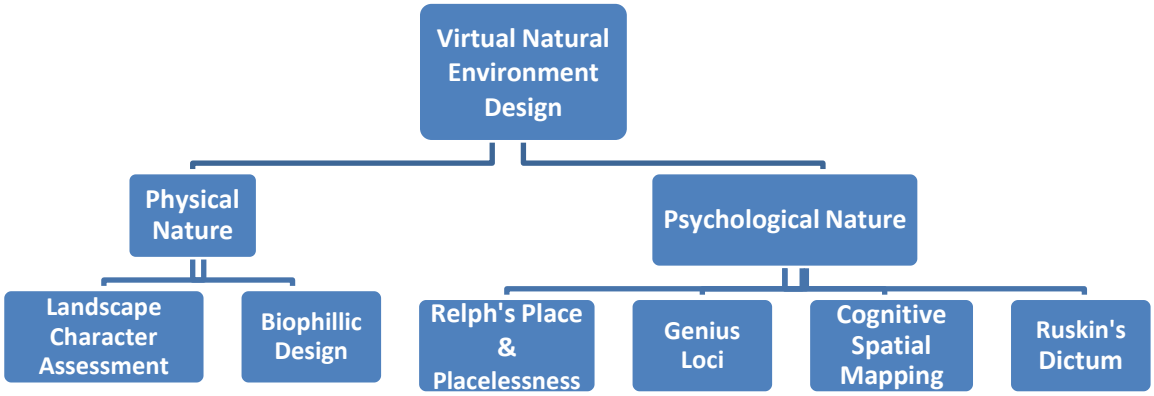

Figure 52: Refined Components of Landscape

BPD was a surprising revelation, there is a great wealth of insight, however due to time constraints, there was not an opportunity to explore these in a deeper and detailed manner. The psychological aspect of landscapes was far wider than originally anticipated, although disciplines such as environmental psychology do offer valuable insight into elements I had uncovered in the *Virtual Landscapes* study. The psychological nature of landscape design was composed of four elements:

1. Ruskin's '*Go To nature*' dictum - Using Ruskin's dictum the field trip to Moel Siabod was used to capture observations as well as reflections on the imagination/feeling the landscape evoked.
2. Cognitive spatial mapping (based on Moel Siabod/own reflection on games) - this was used to try and create a space that embedded navigational signs directly into the virtual space.
3. Relph's concept of *Place & Placelessness*: This was used to create a rich sense of place to each particular landscape within the larger environment.
4. *Genius Loci:* Each 'place' had a unique guiding spirit associated with it in order to develop and further the sense of place.

6.7.2 Virtual Landscape Design Practice

Research Problem 2: *How would a theoretical VNED framework work when applied in practice? Do the theoretical design principles hold up when applied to modern games production technologies?*

The original concerns about developing a practical artefact given the separation in reality sometimes between theoretical design and practical prototyping/ build/implementation were not entirely valid. The theoretical VNED design holds up. There was not a great deal of difference between the intended design experience and the actual user experience , When applied in practice the design principles were useful, feasible and helped in making the project come to life. The use of CryEngine (one of the most complex and powerful game engines available as of 2015) to test the theoretical design demonstrated the theoretical design was a viable and practical foundation from which to build a working, functional prototype. Even though some tweaks were needed, the VNED framework is extremely useful.

6.7.3 Virtual Landscape Design Workflows

Research Problem 3: *What would the resulting production workflow/pipeline look like? Is it feasible or realistic for either indie or professional developers to add to an actual development cycle?*

The paper design did not account for some additional workflows that developed only after applying the design theory in practice. The Research and Reference phase used to bring a sense of individuality to various landscapes and a sense of coherence to the wider virtual environment, was a significant step and one that traditionally only included visual reference. Nevertheless, the literature review led to additional contextual information that proved difficult to bring together with the visual reference material in a coherent manner. It was extremely difficult to 'paper design' a terrain that involves height where restrictions are not in place (i.e. the player is able to navigate anywhere); this inevitably came down to a crude indication on paper, and extensive tweaking through actual play testing.

The workflow utilized relatively cheap software and a free games engine - total cost of tools and technologies used was no more than £300 - which was well within even the most modest of indie developers, and well within any professional developer's budget.

Feasibility for professional development is high since it reduces the impact of changing a design whilst in production as it offers a reduced risk of these late changes occurring late into development where changes can be costly. For indie developers, the workflows are easy to follow and to implement, and do not require any significant resource (i.e. hardware or software).

6.7.4 Future Proofing a Design Methodology

Research Problem 4: *Given the rapid evolution of computer and video games in both design and technology, how does one propose any improvements to either process, technique or a new future framework for VNED?*

The problem here was to find improvements that would not be negated by the ever rapidly changing nature of games development and production. This is a very real and critical issue, if the research is to maintain value and achieve impact it should not ideally produce outcomes that are limited to a technology or situated heavily in the practice of a particular time. What the study demonstrates and offers is a technology agnostic process, this is not specifically written just for use on CryEngine and the design guidelines produced can be used across any game engine where there is a demand for creating a VNE.

As the capacity of game tools and technologies grows, so will the relevance and justification for using alternative disciplines to inform the design of natural spaces. I would argue that the BPD framework is evidence of this. Currently we do not have the haptic, olfactory technologies available for games on a commercial level, but as technology advances in the future, the areas of BPD that consider haptic and olfactory issues will become relevant.

The areas of environmental psychology, geology, landscape aesthetics, etc. are significant bodies of established knowledge. The new design framework proposed can expand using these other subject areas to maintain currency and keep in line with game developments trends.

6.7.5 Cognitive Spatial Mapping for Virtual Environments

Research Problem 5: *Could it be possible to create a VNE containing several distinct landscapes and features that would allow a player to navigate without the use of maps or directional aids?*

There are two parts to this question. The first was addressed by the creation of *ShadowMoss Island*. The second enquiries whether the organisation of these landscapes could be designed in such a way to negate the need to use a navigational aid such an overview map. The original idea of developing a strong cognitive spatial map by using Relph's concept of *place* to anchor into specific points along several routes in the landscape has emerged as both something I believe is critical in developing richer, more immersive and powerful natural environments, whilst my personal play testing of the environment did reveal and highlight how my original design differed or varied from my actual user experience:

- Cyclical interconnecting paths with multiple entry and exit routes (**Figure 53**)
- My ability to traverse and navigate the virtual environment developed very quickly; within 20 minutes of game time I was able to quickly locate and navigate to any point in the map
- My user commentary revealed that I was specifically recalling the visual elements of the environment and 'geomorphosites' that were added in, and these were clear waypoints in signposting.

Figure 53: ShadowMoss Island Route Flow

However it is difficult without additional independent comparative testing to argue that this was not the result of my 'insider' design knowledge. Although I recognise that this insider knowledge (having created and worked on the paper design and then testing the actual prototype) did influence and help form a mental scaffolding for the cognitive spatial map from which I was later on able to paste various places from the actual environment onto, I am convinced and would argue that designers are able to separate previous knowledge and experience and to test their own creations with rigour and critique.

A next step would be to comparatively test if users are able to navigate *ShadowMoss Island* without a map effectively (or whether they are able to recall how various locations are placed in comparison to others after a fixed time period) against another virtual environment where areas of designed placeness/placelessness are not actively placed/mapped.

6.7.6 Analysis of Research Objectives

Table 29 details the study's objectives, identifying if they were met against the appropriate evidence.

Table 29: Analysis of Research Objectives

Objective	Evidence/Notes	Achieved
1. To create practice based work – a game – which reveals, illustrates and exemplifies the findings and whose form and approach can shed new light on the man's relationship to natural landscapes.	See *ShadowMoss Cryengine 3 Level*	Achieved
2. To further refine the VNE framework for development during a second action research cycle.	See Appendix E *Refined Virtual Landscape Design process*	Achieved
3. To explore the concept and components of landscape and to examine if are these can be applied and embedded in VNE design framework philosophy	See Section 4: Literature Review	Achieved
4. To test the theoretical VNED framework by practice, and to test if theoretical design principles hold up when tested in CryEngine.	See *ShadowMoss Cryengine 3 Level*	Achieved
5. To develop a range of production workflow/pipelines that are feasible and realistic for either indie or professional game developers to add to the development cycle of a VNE	See Appendix E *Refined Virtual Landscape Design process*	Achieved
6. To propose any improvements to either process or technique or a new future framework for virtual natural environment design that is able to	See Appendix E 1. ShadowMoss Island Booklet 2. ShadowMoss Island Video Trailer 3. ShadowMoss Cryengine 3 Level	Achieved
7. To create a VNE containing several distinct landscapes and features in a manner that that would enable player to navigate without the use of maps or directional aids	See • ShadowMoss Island Booklet • ShadowMoss Island Video Trailer • ShadowMoss Cryengine 3 Level	Achieved

6.8 Dissemination & Feedback

The game was made available during development to the official CryDev forums: (http://www.cryengine.com/community/viewtopic.php?f=309&t=92173)

- Comments & Feedback (forums)
- http://www.crydev.net/project_db.php?action=project_profile&team_id=3043&project_id=2865

In addition the project was openly play-tested on the BSc CVG programme, and at the AniGame festival. Qualitative feedback is available in Appendix V.

However a much more detailed quantitative and qualitative test will be planned for the game in order to fully test, expose and critique the research aims, the methodology and the resulting success/failure of the output in answering and furthering the research objective.

Peer review is a critical aspect of academic dissemination; however within in practice based research it is problematic, as Smith & Dean (2009) state. This is perhaps due to the nature of the artefacts and makes the identification of 'peers' difficult. Balancing the opinion of such a wide array of possible participants (practitioners, games industry developers, game academic, students, gamers, etc.) felt to be *out of scope* for this study at this time.

Does this mean the research outcome is severely limited by the expectation of peer review? I would argue given the artefacts are shared and disseminated in the public domain the requirement of an evaluation (through a peer review) can be met as long as the artefact and supporting material remain accessible, this position is also shared by Smith & Dean (*ibid*. p26): "*Peer review is only the first stage in evaluation because as long as the artwork is retained in circulation, recorded or documented a re-evaluation can take place later*".

6.9 Critical Reflection

ShadowMoss Island started as an intriguing proposition in an attempt to define both a theoretical design framework and to investigate, design and test practical workflows within a systematic methodology.

6.9.1 Reflection of Assumptions & Expectations

My original assumption, and in fact a development of using a virtual field trip method in the *Virtual Landscapes* project, the field trip to Moel Siabod was more useful in many respects and more powerful than expected. My belief in Ruskin's '*Go to nature*' dictum was affirmed in the work, but was much harder than I had thought to implement in reality. Physically it was incredibly taxing and since it was a limited time-framed opportunity with hindsight I should have used more extensive tools to capture a variety of different data. Carrying around a large expensive DSLR with multiple lenses and attempting to change lenses can be tricky and a precarious activity after six hours of non-stop walking. On reflection it would have been useful to use smaller/lighter technology to capture visual data such as a chest/head mounted GoPro camera, and a digital voice recorder.

Scrivener (2002) recommends that reflection *in action* can be a powerful method when coupled with reflection for and on action. Ruskin's '*Go to nature*' dictum for me embodied developing a sense of intimacy with the natural landscape *"in all heart"* and on reflection I am aware that tools and technologies such as notepads, cameras etc. removed me from that rawness and intimacy of directly conversing with the natural landscape, the experience, even though direct, was still mediated/filtered through these 'lenses', and even a second's distraction of figuring out what f-stop I should have used to capture the beauty of a particular cliff face was a second removed from feeling the knowledge and wisdom the land around me was trying to impart on me.

The Moel Siabod field trip was an incredibly powerful resource on both a creative (i.e. driving my imagination) and observational level (i.e. vegetation patterns), and is most definitely something all landscape designers should undertake at any and every opportunity. Ruskin was correct in asserting such a separation between an idea and reality of even most simplest of natural objects (i.e. a rock formation) and my own experience (climbing a 100ft steep marshy incline) that going to nature reveals the true nature of undertaking even minor activities or insight into the power of even small unexpected occurrences such as a hidden vista. I would argue Ruskin's dictum is more pronounced; one does not simply go to nature for nature to provide its knowledge and wisdom, one must *be in nature,* surrounded absorbed and embedded within it as part of it as opposed to being an

observer or connected for a temporary time, only then are you able to start the journey of comprehending our innate or learned relationship with the natural environment.

Having undertaken the trip and gained some emotional and chronological distance from the actual event I realised that the field trip should have undertaken as smaller and more varied trips spanned across a time period to allow reflection and analysis of the event, with each trip focusing on a particular element (i.e. observation vs. creative) rather than attempting to cram this all into a single trip.

A list of places that I would like to conduct additional field trips with specific landscape design considerations in mind was compiled as a result (e.g. the meaning and impact of the different types of water bodies on landscape preference):

- Alderly Edge (Stormy Point), Cheshire, UK
- Bolton Strid., Yorkshire, U,K
- Lake District, Lancashire, UK

6.9.2 Landscape & Psychology

BPD was a revelation; the 14 aspects of BPD was an incredibly rich and practical framework from which to organise the actual building of *ShadowMoss Island*. Unfortunately, I came across it quite late in the design phase and it would have been useful much sooner; however one has to accept this is the nature of creative practice and research - that new ideas and directions can emerge towards the middle or even end of a creative endeavour.

Relph's concept of *Place & Placelessness* proved to be extremely relevant to the virtual landscape design based both on my own previous design experience and that of designing, building and testing *ShadowMoss Island*. I tried to imbue each region/area with particular landscapes that each had a sense of place. This was done through developing narrative/short stories *for* the creation of the particular regions/landscapes in the environment rather that traditionally occurs with virtual landscapes being created for existing narrative/stories.

The idea of cognitive spatial mapping (based my Moel Siabod trip/own reflections on games) needed much more development. A very interesting realisation that occurred during my play-testing of *ShadowMoss Island* was that visual toxicity or placeness toxicity/overload is potentially a problem if overly applied. Designed placelessness has a part to play in

virtual landscapes, yet I would argue that it is similar to how a palette cleanser functions in an extended course meal (in itself not a meal but useful in cleaning the palette in between rich potentially competing flavours). in creating a VNE that elicits a sense of existential insideness, and one that helps form a stronger coherent cognitive spatial map, I am unable to say with any firm evidence from this cycle of research how this translates into practice (i.e. the distance or density of areas of placeness vs areas of placelessness), but a careful balance of designed areas of placeness amongst areas of placelessness I believe would be far more likely to elicit a sense of existential insideness that one simply overloaded with competing areas of placeness.

Each place has a unique guiding spirit (*Genius Loci*), which is a powerful idea, but I struggled with how in practice this would be broken down into a typology/emotional framework/keywords. What was eventually used in the design of *ShadowMoss Island* was a self-made list of keywords. The usage of *genius loci* to locate and describe a place as ones emotional memory was a powerful and creative alternative to using relatively mundane regional description units alone as it helped embody the spirit of certain places, helped in setting boundaries and influencing design considerations such as aesthetics and selection of natural objects.

I am convinced there is a more appropriate sub-framework that exists in a related body of knowledge currently unknown to me, so this will need to be explored further in additional cycles of practice or perhaps is a question for further study at another time.

6.9.3 Workflow & Pipelines

The selection of virtual 'place' to act as a foundation for the design (high aesthetic concept) worked well as it helped define the feasible size and scale of the virtual environment. Too often virtual landscape design process is difficult as theoretical scaling even when quantified when in practice it proves to be monotonous and time-consuming.

6.9.3.1 Practice: Workflow Geology

a. Research & Reference

During the initial design of *ShadowMoss Island*, the research and reference phase (gathering visual and other contextual research in order to build a visual/information repository to

inform the visual and otherwise construction of the game) my original goal was to focus and create the practical work in order to shed light on theories and questions uncovered in the first cycle, however as my reflection in action (see appendix V,) revealed during this phase: "*Constant referring back to a folder for inspiration does not work as it breaks the fluid process of constructing the level…"*

The need to bring all this contextual data including visual data into a coherent and unified space proved to be impossible given the tools and technologies available. After an exhaustive search and experimentation, no tools came close to what I needed, ultimately resulting in the creation and design of a new tool that formed the third study in my research (Chapter 7).

b. Tools & Technology

The investigation into of the variety of different game engines available led me to Crytek's CryEngine. On reflection after using the software (Software development kit) the engine was fraught with constant server issues. A huge amount of time was lost waiting on server's maintenance and access since the editor was online only and required a working internet connection to even access the work. This became a serious issue several days before my internal evaluation and nearly prevented access to the project work, which was required to demonstrate work that had been undertaken thus far.

Added to this were relatively constant version updates by the developers, meaning some features that I had relied upon (i.e. voxel tool) were removed in later versions, whilst other features were added, so I was forced into choosing a version that I ended up using for the entire duration of the prototyping phase since updating meant constant bug fixing and maintaining work detracting from the design/research process.

Cryengine was an incredibly intuitive editor however, given the expansive editor and toolset, the extensive amount of pre-fabricated assets, and the extensive documentation available online (http://docs.cryengine.com/display/SDKDOC1/Home), looking back at the production notes/process of development I am content with my decision, although I would like to compare and contrast Epic's Unreal Engine terrain toolset to see what aligns with the VNED framework developed so far.

c. World Machine/Geo Control

Both these tools were very useful in adding a rich *time-depth* aspect to the environment in a visual manner by simulating erosion (one could add different types of erosive effects to the landscape and simulate how these would develop over time, finally exporting to a base texture map). This proved to be visually appealing and more of a creative endeavour than based on real geological/weather erosion patterns as given the time frame at this stage of the work could have easily doubled or tripled. On reflection, this needs more automation or pre-compiled scripts to automate varying degrees/patterns of either global or local erosion. One also realises that the science behind this is extensive and does need to be approached in an appropriate manner.

d. Voxel toolset

Incredibly useful tool to quickly build physiographic features such as Cave systems without restoring to additional modelling tools such as 3D studio Max/Maya. Although this was available early in development was removed in later versions. it was used to rapidly build underground cave systems in hours that would have taken days/weeks otherwise.

e. Terrain shaping tools

When using the terrain shaping tools, there was strange sense of fun and enjoyment in shaping the land, almost an act of play. Creating landscapes or manipulating them has been a game genre for many years ranging from *Populous* (1989), *From Dust* (2008) to finally *Project Spark* (2014), but these are still mediated through an array of quite complex interfaces and commands. *From Dust* was possibly the closest to a more intuitive connection to the land (you literally picked up globs of land to build or destroy the landscape), one can imagine that developing this, especially with the advent of VR/AR technologies would be an incredibly fun, engaging and deep way to 'play' landscape design.

An additional realisation was the nature of designing the terrain and testing the terrain often was a slow and time consuming process, since designing slopes/inclines was particularly arduous, constantly having to jump into the game to 'play' each path/trail to ensure a fine balance between being able to traverse and move with some difficulty and not being able to move along it at all due to the incline being too steep or narrow.

One of the main criticisms of these tools is that for the most part did not allow for sharp contours or lines in the terrain (as in crevices/cracks) which eventually led to a *'golf course'*

type terrain of smooth undulating hills and troughs. The voxel toolset was potentially a way to avoid this by allowing custom addition/subtraction to the terrain volume in a non-uniform manner (i.e. it bypassed the constraints on a height map/terrain).

f. Water bodies/effects

The river tool/waterfall tools within CryEngine are relatively good in allowing two types of hydrological features to be implemented, however this could be expanded to take into account the various type of water bodies that one finds in the natural environment (i.e. lakes, marsh, shores, streams).

g. Vegetation toolset

This was perhaps where CryEngine shone; traditionally one would place natural objects onto a terrain in a linear and singular fashion, which for large environments is painstaking and time-consuming leading to repetition and unusual non-natural patterns which would detract and possibly break immersion. The power of the vegetation tool in selecting more than one object (i.e. range of plants) such as selecting variables as density/sparseness, rotation, etc. enabled me to rapidly 'paint' large areas with vegetation, and in fact other objects such as gravel/rocks depending on the regional characteristics.

h. Weather System

The weather system within Cryengine was limited and is essentially reduced to a series of separate variables that one must tweak to achieve any desired effect, and would have been vastly improved if treated like a system similar to the vegetation tool (i.e. able to setup weather/season/climate patters in a visual manner - possibly in a flowgraph - with pre-written script based on archetypal weather patterns).

Weather also plays a role in setting mood and having a range of localised weather (rain, tornados) as well as climate (i.e. tropical, artic) patterns in addition to rapidly compressed seasonal pattern changes (i.e. varying seasons within a few hours) would have been extremely interesting to play with and I have no doubt would have developed and enhanced the *genius loci* of certain places. For instance a gust of wind against dark ominous clouds when a user reaches the top of the mountain would enhance and elicit a sense of foreboding, or conversely increasing the amount of sunshine with reduced cloud cover/blue skies when reaching a forest glade would enhance feelings of immersion. This is of course all

based on subjective personal experience and would require testing against how well each weather/climate pattern enhanced/reduced feelings/thoughts associated with each particular place and its designed spirit to then present as design considerations based on empirical evidence.

6.9.4 Reflection on Game & Play

As I explained in my methodology, a critical aspect of the analysis and reflection on the practice was be to play *ShadowMoss Island*.

6.9.4.1 *ShadowMoss Island* GamePlay Analysis

One of the most critical realisations from the project is that the traditional notions of gameplay (either through the addition of a narrative or inclusion of game mechanics) was required to enjoy or experience a virtual environment. Gameplay conflates into many different areas, of which discovery, mystery, adventure, and exploration are a part; the environment could be 'played' with just these elements.

When playing the game whilst presenting the work to students I was often asked to play certain parts (and often it involved nothing more than jumping off from the virtual waterfall into a lake below). Additional elements would have most certainly helped develop a traditional game; however ShadowMoss Island represented a space, a place that could be played, experienced and enjoyed in its own right. This is something I need to develop further perhaps with a very small additional aspect of traditional gameplay such as a narrative context, but my original assumption of an immersive space being capable of being 'played' purely in itself was true.

6.9.4.2 Gameworld (textures, modelling, etc.)

This moved into developing a texture palette (a range of textures) for regions. This moved the work into a more traditional 2D/3D artistic endeavour at times, which although is closely related to the area of VNED, it was not the original intention. Reflection on my past practice had revealed the nature of games development and reality behind practice: time is limited, creative energy is limited, time spent on other aspects as visual design meant less time on focusing on more critical design considerations such as placement and composition of assets.

6.9.5 Final Critical Reflection

Reflecting on the overall project, I am proud of the work. It has a sense of identity and has grown organically from the paper theoretical design. After the *Virtual Landscapes* study I was left with a huge visual and information repository to sort, admittedly the first cycle was too extensive, and I feared that the divergent paths identified in the original study would prove to be too great to synthesise and bring a sense of coherence in unifying into a design framework but this fortunately did not happen. What happened was actually far more profound, a philosophy of virtual place was developing.

Ruskin and Relph's work brought a deep richness to the underlying design, one that I am convinced is critical to making more immersive places, and not spaces as first discussed. The refined LCA grid now passed through a practical production test appears to be robust and practical. Using a field trip as a method to inform the design that is undertaken by developers building virtual environments, no matter how this is structured is still largely unknown, adhoc and inconsistent. This is a valid process for any developer or designer to undertake. Yet, in hindsight, the experience needs to be planned as the act itself can be physically taxing and attempting to identify and then gather referential observation and creative inspiration data/knowledge can be extremely difficult to do effectively.

6.10 Limitations of Study

The study was limited due to hardware resources constraints. Research funding would have been extremely useful in negating this limitation. Due to time constraints a decision was made to focus on the design and creation of the game, as well as a personal playtest which limited the results. A more developed quantitative and qualitative testing of the *ShadowMoss Island* game would have negated this limitation. The chosen technology (CryEngine) acted as an internal limitation, since it required server side authentication on every test which proved to be very difficult to deploy and test in any public environment as the technology required to run the game also limited the potential audience. A potential method for negating this is to use a games engine (Unity) that can be packaged, configured and ran with little or no work. The testing/feedback that did take place were all external and potentially impacted

the results. Embedding the testing and feedback mechanism into the game is potentially a more suitable method.

6.11 Further Questions

1. To examine and investigate frameworks/process or techniques for capturing a range of data from field trips that could effectively capture both observation of the spatial/environmental features of the landscape as well as the feeling/thoughts evoked.
2. How does the VNED design framework when applied to a 2D gamespace function, effectively cater for the creation of a different type of gamespace?

6.11 Conclusion

In conclusion *ShadowMoss Island* is a practice-based exploration of the theories uncovered during the literature review and the first study in the wider research. The study has examined the meaning and impact that landscapes have had from the 18th century enlightenment to modern day. The study explores the notion of what landscape means, through direct observation and reflection carried out in the form of a field trip. The study proposes that structured field trips be undertaken as a core part of creating new VNEs in order to capture, explore and connect to the unique richness of particular landscapes.

The study reaffirms that landscape Architecture and LCAs are a useful design aid in structuring the creation of a VNE. The study also explored the concept and components of landscape, revealing that landscape is broadly composed of two critical aspects: the physicality of the land and physiological perception we have of it. This was further examined, applied and embedded in the VNED framework philosophy through BPD, LCA, as well as Edward Relph's *Place & Placelessness*, and *Genius Loci*.

The study produced practice-based work: a game, *ShadowMoss Island* which reveals, illustrates and exemplifies the findings and whose form and approach sheds new light on the man's relationship to natural landscapes. Feedback from the game indicated that the virtual environment was enjoyable, exciting and could be 'played' despite lacking conventional gameplay elements. The study also tested the theoretical VNED framework

developed in study 1 by practice, by using the theoretical design principles developed previously in CryEngine 3. The result of which was a further refined VNED framework.

ShadowMoss Island presents a unique VNE containing several distinct landscapes and features, designed to enable the player to navigate without the use of maps or directional aids. This was only partially tested but based on feedback it appears to indicate that the game has managed to embed navigational aids directly into the landscape. *ShadowMoss Island* also offers a range of production workflow and pipelines for the creation of a VNE that are feasible and realistic for either indie or professional game developers to add to the development cycle of a VNED. The study also suggested wider theoretical and practical areas which can be explored by future practitioners.

Chapter 7: Study 3 MindFlow: A Dynamic Multimedia Reference Tool

7.1 Introduction

Underpinning *ShadowMoss Island*, another practice-based experiment, *MindFlow,* was created as a pre-production/design tool and workflow for organising and presenting reference material for virtual environmental design. The proposed tool intents to enable the direct interactive visualisation of collated multimedia (audio, images, video, annotations, design and decisions) in a much more natural setting of a single visual space, allowing designers/artists a single visual space from which they can draw and influence the design and creation of VNEs to enable a greater synergy of different aspects to come together through user defined relationships. *MindFlow* aims to solve the problem of designers/artists having to retain mental maps of image repositories structure by creating a single visual non-folder tree hierarchy-driven virtual digital space from which they can organise and synthesise and be inspired by their contextual research. A prototype created in Microsoft Silverlight and mock-ups created in Abode Photoshop serve to illustrate the intended design. *Mindflow* is composed of two components: a tool for organising visual and non-visual reference material and a supporting framework for pre-production in the form of written guidance.

7.1.1 Research Context

The context of this project is based on further questions raised in Chapter 4 (Reflection on my foundation practice) and Chapters 5 and 6 (Study1: *Virtual Landscapes* and Study 2: *ShadowMoss Island*).

7.1.1.1 Issues identified by Foundation practice

My foundation practice revealed the following conclusions/concerns:

1. The research and reference phase within pre-production of a game is critical to developing richer, more immersive spaces. The material can come from a range of different sources.
2. Primary visual reference can be both inspirational and functional material (Bradford City) (i.e. it can influence the creative direction for a particular piece or act as a functional asset e.g. texture for a 3D model).
3. On modelling Jean Claude Risset, I decided to use a reference photo of him found online as a functional texture, a relatively minor detail considering the scope of the project involved building a large virtual environment, and one that was not designed or a consideration on the onset of the project. During the final show, the composer noted on the accuracy of the final 3D model ("*it has my favourite jacket, how did you know that?*") leading me to believe that sometimes the most powerful responses can be due to consideration of what appears to be relatively mundane details.
4. The metaphor of a museum translating into a visual metaphor for the arrangement and presentation of multi-media in a 3D virtual space revealed insight into not only the efficiency of undertaking a process of translating a conventionally static 2D experience (a learning environment) but into a dynamic, interactive 3D virtual space.
5. It was time-consuming to work in a 3D space as the added dimension of depth increases the complexity

7.1.1.2 Issues identified by Virtual Landscapes study

The *Virtual landscapes* project revealed the following:

- The organisation and representation of a huge visual data set in a coherent single space was a fascinating challenge. Creative users who have experience of working with large amounts of visual data can struggle to effectively use large amounts of visual reference.
- Digital technologies are now developing around delivering massive amount of data in a rich interactive manner. This interactive element can allow users to quickly sort and arrange data in a more efficient, meaningful and creative manner.
- Creating and selecting relationships across information sets across media types is a more natural and useful method in sorting data than a compartmentalised approach.

7.1.1.3 Issues identified by ShadowMoss Island study

The *ShadowMoss Island* project revealed the following:

1. The pre-production stage is often the most overlooked in the overall production cycle within games development as there has been a tendency to rush into actual production
2. There is a problem on how to arrange visual information in a more natural manner that does not rely on desktop paradigm (e.g. folders).
3. How to develop a workflow that enables a user to be embedded and engrossed in a design activity (such as building in 3D) whilst absorbing creative influence and direction?
4. How to build a complex, multi-faceted emergent 3D environment since the design is not a linear process of gathering material; the task is too complex to 'store' mentally and requires a coherent single visual cognitive space in order to effectively use any concept/reference material.

7.2 Questions & Problems

7.2.1 Main Research Question

Given that natural environment design demands are a complex creative and technical process, one that is facing increasing demands from consumers as a result of the increased technological advancements, and given that the stage of researching and referencing with a view to conceptualising a new game environment is critical in determining the final shape/form and impact of the resulting virtual environment, how effective are current workflows/processes tools and technologies in supporting the modern demands of games development?

7.2.2 Research Problems

Problem 1: How do we perceive information/data? Are the current sets of digital tools aligned with our cognitive and perceptive abilities?

Problem 2: What are the current pre-production workflows/practices for creating a new virtual environment in games design?

Problem 3: What does the resulting production workflow/pipeline look like? It is feasible or realistic for either indie or professional developers to add to an actual development cycle?

Problem 4: How is one able to synthesise a variety of contextual media/information into a coherent visual space?

Problem 5: How is one able to create a new interface metaphor for more intuitively presenting visual information?

7.3 Aims & Objectives

7.3.1 Research Aim

To explore and investigate the pre-production stage of environment design, in order to develop new guidelines, tools and processes that can support the creative and technical production of a VNE design practice

7.3.2 Research Objectives

1. To explore how we perceive information/data, and to investigate if the current digital tools are aligned with our cognitive and perceptive abilities
2. To examine and develop new pre-production workflows/practices for creating a new virtual environment for games
3. To synthesise a variety of contextual media/information relating to the construction of a new VNE into a coherent visual space.
4. To test alternative interface metaphors to allow more intuitive presentation of visual information by allowing arrangement of contextual information in a single visual cognitive space
5. To explore the zooming user interface (ZUI) as a theory and as an alternative method of arranging visual information.

6. To further develop the VNED framework for development during a third action research cycle.
7. To create practice-based work: a tool which reveals, illustrates and exemplifies the findings.

7.4 Literature Review

7.4.1 Modern Games Development

Games development and production has developed into a relatively agreed upon framework over the last 30 years. The three main stages of building a game or in fact a creative artefact involve:

1. Pre-production
2. Production
3. Post-Production

However given that the wide scope of modern games development covers a wide range of platforms (PC, console, mobile, etc.) and genres (e.g. sports, horror, fantasy, puzzle) at varying degrees of development time/resource costs range from a single month of development time with a budget of £500 versus ten years at a budget of over £400 million with appropriately specialised and sized developments teams (from a single developer to teams of hundreds working across the world). Therefore, it would be impossible to accurately define games production methodologies as a fixed standardised process given all these variables (Adams, 2013). However what can be presented is a generic structure that is followed by the majority of games developers (see **Figure 54**).

7.4.2 Pre-Production

At this stage the game concept is yet unformed and can either be a spin-off from an existing intellectual property in which case some material exists or a completely new self-contained endeavour in which case no initial material is present. The pre-production stage can be considered to be the *setting of the stage.* The initial game idea (often referred to as the '*High concept'*) is often pitched early on to publishers (in the case of professional development) or

to the public (i.e. through crowdsourcing websites such as Kickstarter). The game idea at this stage is being mostly designed and documented from the start, and as such many developers utilize existing media/work in order to rapidly visualise art direction; this often takes the form of visual references, Moodboards, concept boards, video mashups, etc.

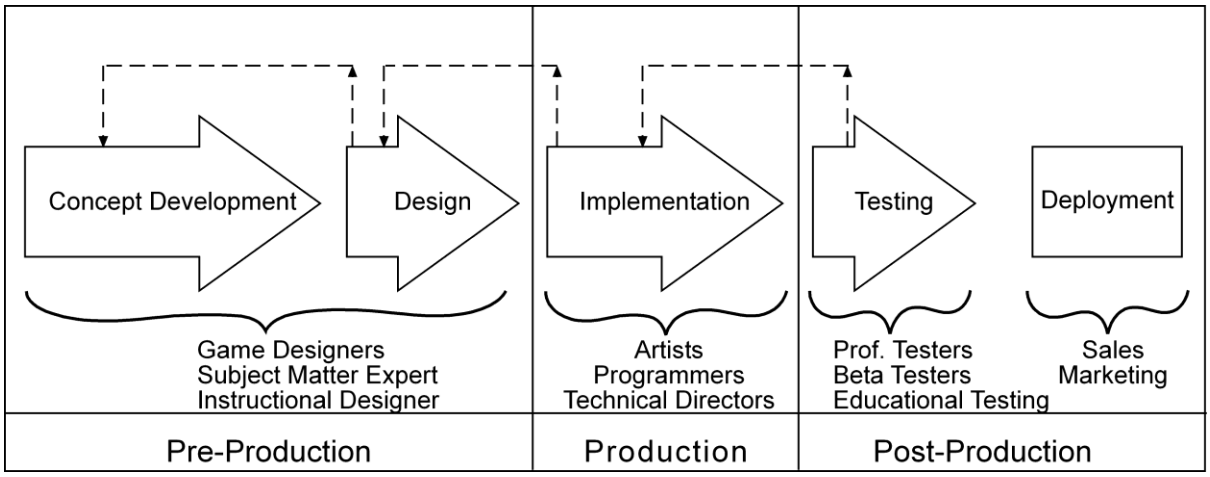

Figure 54: Stage of Games Production 1(Source: e-games.tech.purdue.edu)

The overall 'blueprint' for the game is essentially developed at this stage. Storyboards and the game's underlying narrative are also developed at this point. During this stage the development of a suite of documents is often undertaken to serve as a foundation for the production stage, this normally consists of the following:

- **Art Bible:** Contains all concept work for characters, environment/props, art style in the game
- **Production Bible:** Contains all key tasks, schedule, assets lists, and time estimates and any resource constraints to build the project
- **Design Bible:** contains all design work including but not limited to story and narrative, level design, gameplay and mechanics.

During pre-production, the technical and financial feasibility of the game is often assessed. Many commercial games fall at this stage due to unworkable gameplay mechanics, unrealistic or cost projections that sit outside the comfort zone of publishers' planned budgets, or simply due to changing consumer trends. During pre-production workflows and pipelines, what the artists/designers/ programmers will be doing and how they will be doing it, are created and documented through *Initial Prototyping*. This is where a basic functional prototype of the game is created. It is often a basic working demonstration of a

core game mechanic feature that can demonstrate to a publisher/investor that that core game idea/concept is feasible and workable.

7.4.3 Production

This is considered to be the main stage of games development. In production teams, artists, programmers and designers work together to create assets based on the initial design/art/production documentation. At this stage all the paper designs are realised, and implemented, games engine is built, the 2D/3D environments are created and populated with characters/objects/entities and the world is textured and game mechanics are scripted.

It is not always about following a design document, as this can vary as in games development, like in creative practice, unexpected issues/challenges occurrences in implementation stage cause deviation from the original design. Cost-wise this represents the bulk of the budget, whilst only the leads may be required for pre-production and a skeletal crew for post-production requires the full team.

7.4.4 Post-Production

This stage has increasingly grown more important in the last decade or so, especially with the shift in games from single player driven adventures to massively multiplayer online. This coupled with the ever increasing competition and budgets available, has meant this stage for AAA development can now surpass the original pre-production and production stages. The stage often involves testing and deployment of the project. Testing involves checking the game for 'bugs (unintentional issues likely to damage or prevent the player's ability to play the game as intended). Approval and compliance (in console games especially) takes place during that phase, as well as any legal requirements. Deployment can involve shipping, manufacturing and now with many games supporting online gameplay, maintaining updates/fixes to the game assets as well as deploying incremental game updates such as DLCs[22].

[22] DLC is an acronym for **D**own**L**oadable **C**ontent; extra game content that is often downloaded in addition to the main game.

7.4.5 The importance of the Pre-production

Games development is not always a linear process. Despite the majority of development following the three stages of production, the inevitable problem occurs during the stage of production, and designers are sometimes forced back into concepting and designing a new feature. If we consider a typical production schedule of a 20 months project we can see the corresponding time periods for each stage (as illustrated in **Figure 55**):

- Pre-production (~5 months)
- Production: (~12 months)
- Post-production: (~3 months)

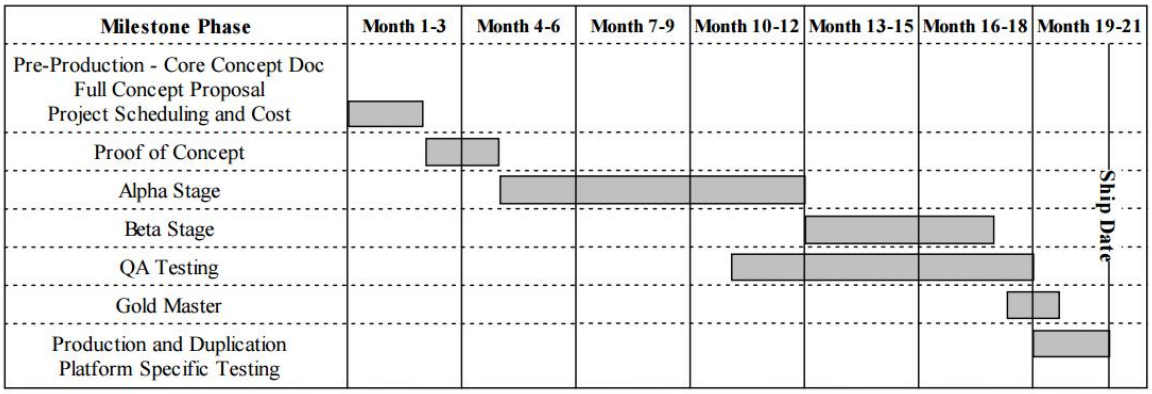

Figure 55: Example Production schedule for a 20 month project (Source: Rabin 2005)

What we can conclude from this is that the production stage is the largest part of the game production. However, a good strong design can save issues later on. It is cheaper to design than to fix production mistakes late on as a strong concept design phase is more likely to lead to originality and uniqueness.

7.4.6 Pre-Production In-depth

If we now consider an analysis of pre-production, generally it can be broken down into to three relatively distinct stages:

- Concepting
- Design
- Prototyping

The concepting stage often involves a *Research & Reference* phase, referred to as visual reference/concept ideation and several related terms. This often is about collation of visual resources, building reference material relating to aspects of the original game idea. In some instances these databases of visual reference can span 100,000 images for a large commercial product.

7.4.7 Multivariate Information

This inevitably leans towards the collection of visual references, photographs and images of related works. However, in reality creative inspiration is never contained or embodied in a single form as it is found in the most unlikely of places. Goodall (2010) notes one particular example from the 2006 fantasy film *Pirates of the Caribbean: Dead Man's Chest* in which the face of the main protagonist, Davy Jones (a 3D model) was textured after an artist working on the film spotted a mouldy coffee cup; the cup was scanned and the resulting 'texture' applied to the 3D model to give the character his unique look. Creative inspiration can be found in the strangest and most unexpected places and can take many forms including photographs, images/artwork, writings, sound and music, hence it would be far more appropriate to refer to this body or collection of references as *multivariate contextual information* rather than simply '*visual reference*'.

7.4.8 Beyond Visual References

Within creative production, whether it be a film, an animation or a game, the design of the world, the story, the film sets, etc. often have their own distinctive set of attributes but the designs that ultimately achieve critical or commercial success often exhibit a strong sense of coherence across the entire piece; every piece or asset is interconnected in some way.

If one searches for the term of visual references in relation to games design, the majority of articles/books refer to *visual references* as an artistic process i.e. one that is undertaken by 2D/3D artists in order to create more visually realistic or pleasing environments/ characters/props. The issue that comes to light is the intent behind the use of references and the final experience outcome.

The use of references to inform an aesthetic quality (e.g. visual appearance of a character) is not under scrutiny or argued in this thesis, however I would argue that digital

games are far more than simply a collection of characters; environments are visual assets, they are not 2D static visual representations, they are immersive interactive spaces - an aspect that defines the very nature that separates games from other media. We experience these games on far more than a visual level and whilst added realism or engaging aesthetics arguably may deeper immersiveness by no means should it be the *only* consideration. If we experience these virtual spaces with the range of our perceptive and cognitive senses and abilities, then surely one can argue that virtual environment designers need to consider attributes in addition to visual elements of any reference material in order to build something that is more than a visual construct.

The idea of *visual reference* is often discussed, however, the logistics or actual process of how one organises the references are never fully developed - the approaches are limited and small scale (tens of images) and reference material is limited to visual reference. There is very little or no mention of the wider contextual material available or one that users can generate their own material which although time-consuming can sometimes lead users to exactly what they may be searching for.

Design ideation material goes beyond purely visual information since it includes auditory, experiential and olfactory information and could span across a range of media (e.g. text, video, photographs, sketches) hence this should be about communicating an idea and not just about a collection of still images.

7.4.9 Industry practice

We will now consider standard commercial games industry practices to determine if there is a difference in practice/process between amateur and AAA developers. During pre-production development, art/design teams will in some instances travel to real-world locations to research and capture visual (and other) reference material to serve the concepting and design stages. Remedy, a Finnish games company, is one such developer that took this approach for their critically acclaimed 2010 survival horror game, *Alan Wake*, which took six years to develop and was rated by TIME magazine[23] as their top game of 2010.

[23] http://content.time.com/time/specials/packages/article/0,28804,2035319_2034548_2034549,00.html

Alan Wake sees the protagonist (whom the game is named after) being chased by 'The Taken', across a remote wilderness in and around the fictional town of Bright Falls. The game features several locations (including wilderness) such as a farm, national park and a forest area. The game was critically acclaimed and received praise for its story, visual style and strong use of a range of popular culture from TV and films within the game's many elements.

As the post-mortem[24] interview with Remedy's managing director Matias Myllyrinne (Gamespot, 2010) revealed the motivation behind this was about *"….taking something familiar to people as an element, and building something of your own, and hopefully something unique in games, but still familiar from other forms of entertainment"*. What is interesting to note is the material/references used which bear a strong resemblance to their origins. Remedy wanted this familiarity to come through in the final design for the game and wanted to bring a sense of familiarity as well as uniqueness to their game. So how was the process of bringing familiarity to the environment design undertaken in *Alan Wake*? In a response to a user question on their official forum Mikko Rautalahti (a developer on *Alan Wake*) articulated the process in how the developers drew their inspiration for the in-game locations[25]:

> *"Most things you see in the game are based on something that our guys saw during our research phase. We took something like, oh, I think it was 60,000+ photographs in and around Washington start to get that whole Pacific Northwest look down, so things look pretty authentic. (We did comparatively little concept art; we tended to use photographic references instead."*

From Remedy's response we are able to highlight several development practices:

1) Developers undertaking primary research to collect visual reference data (**Figure 56**)
2) Collecting large amounts of photographic data (60,000) to bring a sense of authenticity to the game
3) Using photographic reference as a preferred source of inspiration and art direction in environment design over self-generated concept art.

[24] The post-mortem is an analysis often done by developers after a game has shipped, reflecting on the entire process

[25] http://community.remedygames.com/forum/games/alan-wake/5572-town-of-bright-falls-where-did-rmd-draw-inspiration

Figure 56: Crab & Seafood Warehouse Photographic Reference & In Game screenshot from Alan Wake (Source Dreadcentral.com 2015)[26]

The process of using extensive photographic reference to inform environment design was by no means unique to Remedy's *Alan Wake*; Eric Russell (n.d.), a specialist photographer, discusses[27] the metrics involved in how much data they generated for Codemasters' 2009 racing simulation *Dirt 2*:"*Our assignment, to document over 11 kilometers beautiful central Utah landscape for the new its new DiRT 2 rally video game. The deliverable, one 774 GB perfectly organized directory containing over 26,400 raw images to be dropped into a Codemasters proprietary development engine*".

What was astounding to hear is both the size of the final deliverable (under 1TB of data) and the quantity of photographic reference data (~26,000 images) collected for the game. Unfortunately the exact workflow in how this huge amount of data was organized (the only indication was via an "*organized directory*"), shared and how the reference was used is not discussed. One can only assume that navigating a series of folders/sub folders would have been the most probable method, one that would have been extremely time-consuming and laborious activity to undertake without an additional interface.

Lars Martinsson (2014), lead character artist on '*Ryse, Son of Rome'*, a third-person action adventure game developed by Crytek Frankfurt, discusses this in his SIGGRAPH 2014

[26] http://www.dreadcentral.com/news/17738/exclusive-the-real-world-of-alan-wake/
[27] http://ericrussellphotography.com/news/codemasters-trailblazer-reference-photography/

presentation on *Ryse's* character creation art pipeline. Martinsson eludes to the process of gathering references images:

> *"Once the concept is approved we would gather real life references to get a better understanding on how things were built and what materials was used in real life. We ended up with a huge database with mostly pictures from the internet, the ones on this slide was taken by team members during a field trip."*

However we again see reference to large 'databases' but no indication on how they were managed and organised. This highlights the difficulty that many amateurs/novices wishing to learn about the actual process of development face as information is often critically limited when it concerns specific process/naming of tools that a novice (such as a student) is unable to even attempt to test out the workflow for themselves.

Despite the rare insight and glimpses of professional game development practice offered, Remedy's and Codemasters' responses highlight a potential problem of how the game industry disseminates its practice, and the difficulty novices face penetrating the 'foggy' area of exactly what constitutes low level development practices. What would have been extremely useful is insight into *how* this process of managing and using visual - including photographic - reference was managed, what process if any was followed in identifying, collating and organising the huge amount of photographic reference, did the developers use any techniques to identify the types of visual information they were looking for i.e. realistic reference. Were any existing or propriety tools used at any stage? Was the photographic data tagged in any way? Was the photographic reference collated in any intermediary form (i.e. moodboard) to be used whilst building the environments? How did the designers/artists feel about the process? What worked and what didn't? Was the process as simple as photographing as much as possible and each individual developer (artist/designer/etc.) taking an independent and proprietary approach to their specific tasks?

Where the process underlying the use of photographic/visual reference is discussed by professional developers it tends to only briefly note tips or recommendations as opposed to functional guidelines and/or in depth process; the current workflow can only be approximated as a result but indicates that organisation and management of these references involves nothing more than to use a series of named folders, where references are organised according to genre/theme/sub-theme and topic in a branching hierarchy.

Chris Smith (2013), a veteran of the games industry, discusses the process of visual reference in his blog[28]. He proposes a relatively simple workflow that includes *selection, organisation* and *accessibility* as the main areas of consideration. Smith proposes the use of digital folders to organise material, however there is no real organisation system proposed apart from naming folders. Although Smith recommends collating visual references at every opportunity, there is nothing on establishing systems to help identify why the references are collected (i.e. specific attribute such as colour, function, form) and one can imagine it would be extremely difficult for even a professional developer to remember why and how a particular visual reference is to be used or digested later on, since even the same image shown to the same person can evoke different meanings and be interpreted differently depending on the person's mood and current thinking.

A popular resource for environment designers and developers, especially indie developers, is the web resource World of Level Design[29] (WoLD) created by Alex Galuzin. In his book '*29 Ways to Become a Better Level Designer*' Galuzin (2009) recognises the value of visual references in creating *"real, authentic and high quality environments"* as not undertaking this critical step leads to designers potentially having *a "hard time creating something that looks real, authentic and high quality…"*. Galuzin goes a step further than Smith's recommendations in attempting to present a more structured approach in collecting types of reference material. **Table 30** lists the proposed categories with key considerations. Nevertheless, it is disappointing to note that the guidance appears to be incomplete; there are no considerations for 'environment' and prop reference, and the use of 'environment' is also confusing as there are no indications of whether this refers to visual references about the natural/wider environment or everything that is not classed as 'architectural' reference.

Galuzin's process does recognise that designers should:

a) Only collect reference linked to what they intend to create.

b) Limiting reference material to no more than 1-2 images to inform a final composted piece created in Photoshop.

Again a noticeable issue with this process is that, although this is primarily for indie developers, the advice on collecting and using references is significantly different to

[28] http://gamedesigndiary.com/2013/05/17/collecting-visual-reference/
[29] http://www.worldofleveldesign.com/

Remedy's or Smith's practice/recommendations. Secondly, there is little or no identification of why the reference was selected (no annotation or notes) and thirdly there is nothing beyond a simplistic single combined image at the end of the process since there is no composition technique beyond a static digital photo album with its foundation clearly rooted in the desktop metaphor (**Figure 57** & **Figure 58**)

Unfortunately a common practice in modern games development, in particular AAA development, little is revealed beyond minor references, often found in marketing and promotional material (i.e. interviews, responses on user forums) about the actual processes and practices involved in key areas of games development. Many publishers often regard these working practices to be the 'secret ingredients' in making a game unique and achieving for commercial success. Developers are therefore often restricted in what they are able to share in the public domain in fear that competitors are able to absorb these practices into their own, potentially threatening a commercial success the original game may have achieved.

Table 30: World of Level design Types of Visual Reference & Considerations (Source: worldofleveldesign.com)

Reference Type	Considerations
Architecture reference	Collect images of buildings, streets, shops, back alleys, etc. As you are collecting architectural reference, you will begin to get a more clear idea on what it is you will need to create in architectural details and prop assets.
Environment reference	
Light reference	Collect lighting reference Lighting reference is anything that has relevance to the lighting of your environment you are trying to create. Is it daytime? Night? Evening? Is it raining? Overcast? Foggy? How hot/cold is it? Temperature has an effect on lighting. All of these will determine how the lighting will look in the environment
Prop reference	
Inspiration reference	When collecting inspirational and style reference, it is the visual and the emotional reference. Emotional response you have to an image will determine if that image is what you need or not. If the image does not evoke an emotional response, find an image that does.

Figure 57: Collated WoLD Reference Sheet (Source worldofleveldesign.com)[30]

Figure 58: Example Visual Reference Board (Source: worldofleveldesign.com)

[30] http://www.worldofleveldesign.com/categories/level_design_tutorials/guide-to-collecting-level-design-reference.php

7.4.10 Pipelines and Workflows

7.4.10.1 Overview

Games development is complex and considering the range of development platforms, types of games, the scope of the design and the resources available, the production process, within the practice itself and across the development team and within it, are referred to workflows and pipelines. The terms are used interchangeably yet they embody different aspects of how development actually works.

7.4.10.2 Pipelines

Within game development one can look at the entire process as the development pipeline, and within that several smaller pipelines often centred around discipline areas i.e. art, programming, sound and design pipelines. A pipeline differs from a workflow in that it deals with the main sequence of steps involved in moving from concept to final assets (i.e. engine, model, sound, level) and not the specifics of *how* each particular step is to be achieved, thus it does often not include reference to software/hardware. Pipelines are often documented early on in pre-production due to cost implications. A pipeline can therefore be defined as: *The sequence of operations carried out across the area of activity from concept to completed asset that often involve more than one individual.*

7.4.10.3 Workflows

A workflow as opposed to a pipeline can be defined as: *The specific sequence of operations in a specific area of activity (i.e. 2D character art) undertaken on an asset, often carried out by a single individual*. **Table 31** illustrates what a typical character modelling 'workflow' might involve.

Alsup (2009) discusses the relationship between workflow/pipelines in relation to an individual/team stating: *"work is done by a single artist, we call it a workflow, and when the work is divided among a team of artists working on successive or parallel portions of a workflow, it becomes a pipeline. Each artist's portion is that artist workflow. The whole is the pipeline."*

A critical point to consider is that workflows can differ significantly between developers and even within teams depending on factors such as an individual's expertise, experience and access to software/hardware. Workflows within game development are often unique to each individual artist/programmer/designer, whilst the end-product may

be required to meet certain internal quality standards, hence the exact process in how the end product is achieved is often not standardised. Only in the last few years we have seen training and educational programmes (such as higher degrees) appear offering a semblance of uniform working practices across a discipline. Previous to this many artists and designers have been self-taught meaning that a standard agreed workflow for a relatively minor asset creation was extremely difficult to reach consensus on.

Table 31: Example Workflow (Source Adapted from Polycount.com)

1. Block out in zBrush from an existing basemesh
2. Find out what pieces need to be modelled separately in 3ds max.
3. clean up all the sculpting work
4. Decimate everything
5. Assign polypainted colours to different material types.
6. Export HP meshes (amount depends on what is the best for baking)
7. Retop in 3d coat for sculpted things and meshes that need to be embedded in one mesh.
8. Copy and reduce polygon count of separately modelled pieces from 3ds max inside 3ds max
9. Bake using Xnormal , Normal , AO and vertex colours (polypainted mask)
10. Texture in photoshop and judge in 3ds max using xoliul shader
11. Put in game and see how it works

Workflows can be incredibly useful for novices to understand how to replicate creating an asset within a game since they act as a guide, often providing a step by step detail on precisely how an asset (such as a 3D character model or object) is created. Unfortunately since they are largely based on an individual's knowledge and experience and often a process of trial and error, they are also rarely documented and disseminated, meaning specific practice workflows within disciplines rarely make it into the public domain unless a developer shares it via a personal blog or rarely via developer conferences such as a GDC/Siggraph.

One such important workflow is how artists and designers sometimes use a dual-monitor workflow, one that allows artists to use multiple screens, side by side with each screen dedicated towards a particular task (Snell, 2009).

7.4.11 Perception & Cognition

Our capacity to absorb, hold and recollect vast amounts of data has been recognised across numerous studies. Not only are we able to perceive, sort and categorize various types of information, we are able to do this at speeds and in volumes that even the world's most powerful supercomputers are unable to match. In fiction we have seen interfaces where users are able to trawl thousands of pieces of information in mere seconds, effortlessly moving through streams of data to find something, and able to make ad-hoc relationships across data types to identify patterns or clues in an intuitive and fully-immersive and interactive manner. A fictional example of a future interface was demonstrated in Steven Spielberg's 2002 futuristic thriller *Minority Report* where Tom Cruise's character was able to effortlessly navigate vast amounts of information including audio, images, video, location data in an instant, and to arrange selected pieces of information in a truly organic and unique manner in order to find clues about a perpetrator identity and motive. (**Figure 59**)

In reality research by Standing (1973) demonstrated an accuracy rate of over 83% when users where asked to identify previously seen pictures, this may not seem impressive until you realise Standing used an image bank containing 10,000 pictures in total.

7.4.12 The Digital Paradigm Shift

The digital revolution has changed the way we view information, in ways that are still being understood. In less than a few decades we have moved from working in the physical world on paper and physical media to sometimes entirely digital processes. The digital revolution changed the way we work, but this was clearly grounded in the legacy of how we used to work in the physical world. Old world paradigms and metaphors were transformed into the digital realm and have shaped how we experience this new realm, the most significant of which was the *desktop metaphor* which will be discussed next.

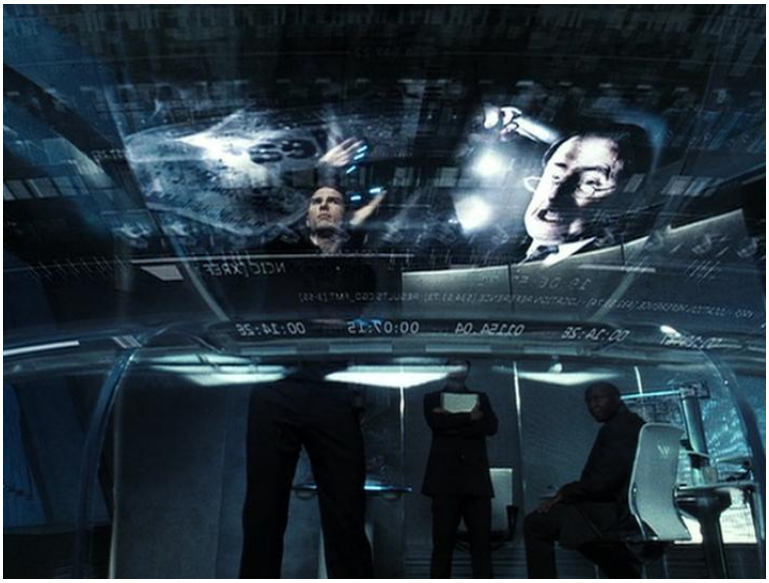

Figure 59: Minority Report Interface (Source hellodesign.com)

7.4.13 The Desktop Metaphor

The first interface designers were faced with a problem: how to navigate and present data to the ordinary masses that went beyond the rudimentary command line interface of the operating system. The year of 1972 marked the birth of the desktop environment at a Xerox research centre as a result of research carried out at Stanford's Research Institute (SRI) and Xerox's Palo Alto Research Centre (PARC).

Alan Kay's (a research scientist) reflection of his experience of using windows noticed that the side-by-side screens became easily crowded. Kay began to "*regard the screen as a desk, and each project, or piece of a project, as paper on the desk*" (Levy, 1994, p.61). Like real pieces of paper on a desktop, windows could overlap; and so the desktop environment based on the desktop metaphor was born. This later had a significant impact on the modern GUI. Steve Jobs was one such individual who was deeply inspired by his visit to Xerox "*After seeing a graphical system representing a workspace, Jobs set about implementing a commercially viable system that incorporated a desktop and workspace metaphor; what became Apple's Lisa and Macintosh computers.*" (Reynolds, 1998, p.2). This in turn had an impact on the other dominant market leaders at the time; Microsoft and IBM with their respective Windows and OS/2 operating systems later becoming the dominant paradigm in how users accessed information digitally which is for the majority of people today the only digital environment most users have ever experienced.

In an attempt to use a friendlier interface for its Windows platform in 1995, Microsoft attempted to use the desktop rather than a metaphor but as a basis for simulation with its "BOB". Users were presented with the interface of the inside of a house, complete with rooms, and were presented with icons to directly interact with virtual facsimiles such as a wall clock, or a pen and paper to access a word processor (**Figure 60**).

Figure 60: Screenshot of Microsoft's BOB interface (Source: toastytech.com)

The interface however was widely criticised by users and derided by the press, making it into the top 50 worst inventions in TIME magazine in 2010[31]. What the failure does suggest is perhaps demonstrating that a direct simulation of an existing system rather than abstracting it through a metaphor is not likely to lead to a user-friendly interface, especially when limitations of the physical environment are carried over to the virtual domain. The desktop environment is an implementation (i.e. practical expression) of the desktop metaphor and as Love (2005) states *"as a cognitive and visual framework for the organisation and presentation of information on the computer"*.

7.4.14 Interface Metaphors

As Love (2005, p.84) argues, interface metaphors are regarded as a method for "*Reducing people perception of the complexity of the system they are using*". However as Diehl (2007, p.31)

[31] http://content.time.com/time/specials/packages/article/0,28804,1991915_1991909_1991855,00.html

states, metaphors are not without issues and that *a "common problem is properties that we transfer from the source to the target domain might be different that originally intended by the designer*". Diehl (2007, p.32) discuss the concepts of visual metaphors and in particular discusses the landscape metaphor: *"three abstract dimensions span the 3D space and real world objects such as hills valleys or rivers and streets are used to represent abstract entities or relations"*.

This concept of the landscape metaphor as an interface metaphor was developed in a literal manner by Sato et al (2004) in the development of the NEZ system. NEZ was developed as a dynamic visual reference system for assisting in the design of an environment (**Figure 61**). The system visualised multimedia including *"various types of data such as 2D pictures, 3D model, video and audio" within a virtual 3D environment."*

Figure 61: Screenshot of the NEZ Tool

It is interesting to note how the team used and considered NEZ. The tool reflected the designer's belief in iterative design, and having a tool that was responsive to the designer's needs. Although the NEZ tool was primarily created for urban design, it does reveal several useful design ideas:

1) Users are organically able to move reference images in order to stimulate idea evolution
2) 3D environment design is an iterative process - it is not a case of using the references images in a linear process i.e. images are viewed/digested, and then users move to a stage of building the environment based on their memories of the reference material.

7.4.15 Alternative Interface Metaphors

What NEZ demonstrated was the use of alternative metaphors applied to the visualisation of digital information, an experiment which was mirrored in the virtual Jean Claude Risset project (2004) which involved creating a virtual learning environment based on a traditional 'lecture' delivered by the French composer, Jean Claude Risset. The project was in part simulation, in part abstraction of the experience a user would encounter in a real museum applied to a virtual learning environment to create a virtual '*knowledgespace*'. Fuchs (2004) describes[32] the project as: "*A lecture by French composer Jean-Claude Risset has been transformed into a Virtual Knowledgespace, which allows users/ listeners to interactively navigate through the 3D environment consisting of Risset's words, music and images*". What is interesting to note about the project was the interpretation of the museum as a visual metaphor for the arrangement and presentation of multimedia in a 3D virtual space (**Figure 62**).

Figure 62: Screenshot from virtual Jean Claude Risset computer game (Source: © Mathias Fuchs 2005)

The project's post-mortem and dissemination revealed the theory of translating a conventionally static 2D experience (a virtual learning environment) into a dynamic, interactive 3D virtual space but also the reality of building/actual user experience of

[32] http://creativegames.org.uk/art/Risset/

navigating a 3D space in a non-desktop environment whilst accessing a variety of multimedia references.

The project highlighted the following:

1) The process of arranging and presenting reference material should take more resource and time than what it is intended to be used for; the ultimate aim of the project was a virtual *knowledgspace (*an extended learning environment) not navigating the 3D space.
2) Arraying contextual material in 3D virtual space presents its own unique challenges; there are certain expectations in how the 3D space is used that are informed by existing user experiences which need to be understood to achieve a comfortable user experience and not negate the ultimate aim (deliver knowledge)
3) The introduction of depth (z axis) complicated access to material asusers would spend time searching for information and having to remember locations of certain material in 3D space; a feat which may be useful in a limited learning environment, but any expansion beyond a handful of images/video/audio clips would prove to be extremely difficult to design and manually implement in the 3D space.
4) The process of arranging images/audio/video manually was very time-consuming, one that is not feasible in commercial development unless carried out procedurally.

After the experience of working on the JCR project I found myself hesitant of using 3D virtual space, although I have no doubt that the museum as a visual interface metaphor is helpful, there is a delayed immediacy to the experience. There is a careful balance to be struck between attempting to break free of the desktop environment and use an alternative interface and what you are trying to achieve. In the case of the JCR project at times the visual interface (3D navigation) became a distraction from the intent (a teaching environment).

RedHat, a world leading software company summarised what many in the interface and interaction design community have stated in recent years, "*For us the traditional desktop metaphor is dead – it is a dinosaur. Users are not sitting at their desks in isolation any more. They are collaborating, working and playing online" (*Computing, 2007).

So if the desktop metaphor can be considered to be an outgoing and inefficient legacy interface, why is it still in use? One of the reasons is that the desktop environment/WIMP interface was quickly taken up by two of the leading operating system developers during

the early years of the home computer revolution. Apple and Microsoft with the Max OS and Windows operating systems dominating the market to this day has meant it is the only user interface the majority of users in the digital realm have ever known; it may not be the most efficient but the metaphor works extremely well for relatively simple needs.

However, at the heart of the desktop interface design is the metaphor of the office; the home office for the individual, the use of the desktop metaphor and the resulting desktop environment was relevant in the 1970/80's mainly because it serviced the limited needs of users at the time and was far more intuitive than a command line interface, but the games industry had barely emerged at this time, meaning as is grew, the gulf between what traditional desktop environment offered to service game development needs (which have grown exponentially over the last three decades) has become increasingly wider.

The reality of growing modern day gamer/consumer demands is that game developers will increasingly face difficulty by continuing to work under the legacy desktop environment which will struggle to service the modern needs of increasingly complex games development. This is particularly evident when considering the graphical evolution of games and the exponentially growing quantity of references/assets used/created for a modern commercial game. The file/folder system pays homage, or more accurately will forever be grounded in its roots of the 1970's home office environment, and arranging and digesting vast quantities of high resolution visual data in a more natural, intuitive manner is something that was never considered at the time of the desktop environments inception.

Throughout the years many developers (including Microsoft and Apple) have attempted to develop software/apps to build on the desktop environment specifically for managing visual data such as photographs/images however the majority of photo-applications still rely on desktop environment characteristics and as such adhere to hierarchal and grid-based visualizations, restricting how the user is able to sort, arrange, and access the information.

Organising design inspirations, tools such as *FFFFOUND, VisualizeUs, Imgfave, We Heart It, PicoCool* are examples of online visual bookmarking tools. Whilst they remove the need to save and manage images offline, they still offer limited pigeon-holed management of visual information. The tools do offer the ability to group themed images as collections/sets, however they are essentially still based on the desktop metaphor.

7.4.16 File/Folder Data Structure

One of the defining characteristics of the modern desktop experience is how the data structure in the desktop environment is visualised and managed (i.e. the file/folder metaphor). The file/folder structure is a remnant of the home office filing cabinet, where files could be stored according to categories and subcategories and accessed in a singular branching tree hierarchical fashion. This was based on the parent-child relationship: a parent folder may open up to more 'child' folders which in turn become parent folders for additional 'child' entities. Whilst this defining characteristic of how the desktop environment has operated for the last three decades this relatively unchallenged metaphor breaks down. Marcus (2002) states:

> *"the desktop metaphor is longer appropriate for new technologies and interaction paradigms since it does not address the reality of organising visual information such as photographs in a conducive manner for creative practitioners where the relationship of an object such as an image is more than what the single parent-child limitation would allow".*

The File/Folder data structure is inherently limited to a single parent-child structure and as such offers no 'visual persistence' or record of preceding or succeeding or adjacent categories. The structure is suitable for 'container' file types such as documents and not for information such as images.

An experience that many legacy desktop environment users share is time lost searching for a particular file that has been categorised in a particular sub-folder in a folder amongst many others that are similarly named; the only way to find a 'missing' file is to systematically go through each folder/sub-folder where the suspected file lies and to search each one. As Shim (2012) states *"taxonomical data structure is centred on where to look for files, but instead we get lost in its hierarchical structure trying to find 'where it is'."*

An additional observation with the single hierarchical folder structure is that there is no visual persistence of either the preceding, succeeding or adjacent related material; every folder is essentially isolated from its counterparts. If a user is limiting their use to 'container' file formats such as a word document this may not present a problem, however what if a user wishes to view a collection of files including images scattered across multiple directories? With the constraints of the desktop environment a user cannot view images in a single 'visual space' without either placing them in the same folder or resorting to another

additional piece of software to build a catalogue. **Figure 63** and **Figure 64** represent the classic folder structure for a small level within a larger game environment, containing reference images collected for an environment.

A user is only able to access and therefore utilise the visual information for "*durdle door*" or "*sea archway & caverns*" as separate (cognitive) spaces without having to resort to making additional collages/montages. Despite the limitations the desktop metaphor the rise of proprietary tools has meant experienced game developers are still able to develop coherent creative works as evidenced by a number of video games where the game environments have been commercially and or critically acclaimed.

However, indie developers and novices (such as students) do not have equivalent budget, time or expertise to allow them to write custom tools or to buy expensive off-the-shelf solutions, so the questions arises: if indie environmental designers were able to arrange and access visual information in a more organic and natural manner without resorting to the file/folder structure, would this change the workflow and elicit a deeper use of reference material resulting in more authentic and therefore immersive spaces?

- Creative ideation often starts with a single design idea/concept most often a central image from which other ideas start to grow from,
- Node based relationship patterns can help organise complex information in a more digestible pattern
- Would this branching node based structure be more conducive for incorporating contextual references and drawing elements together?

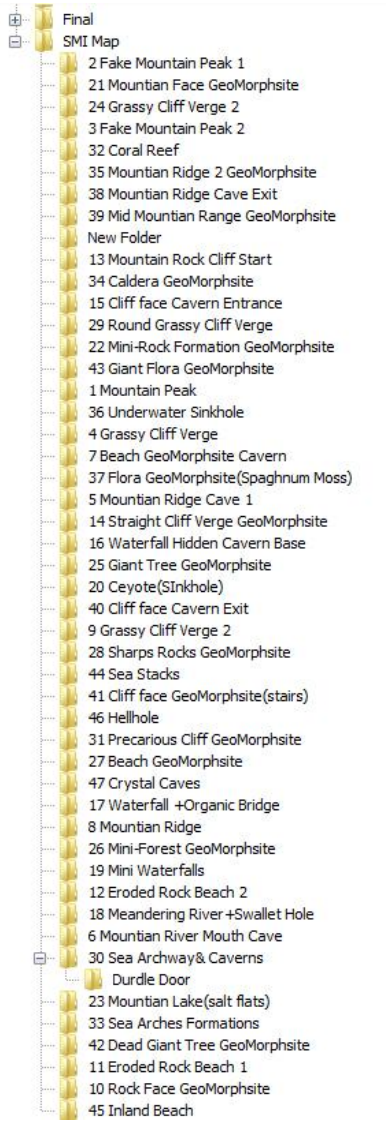

Figure 63: Folder Structure for ShadowMoss Island Reference images

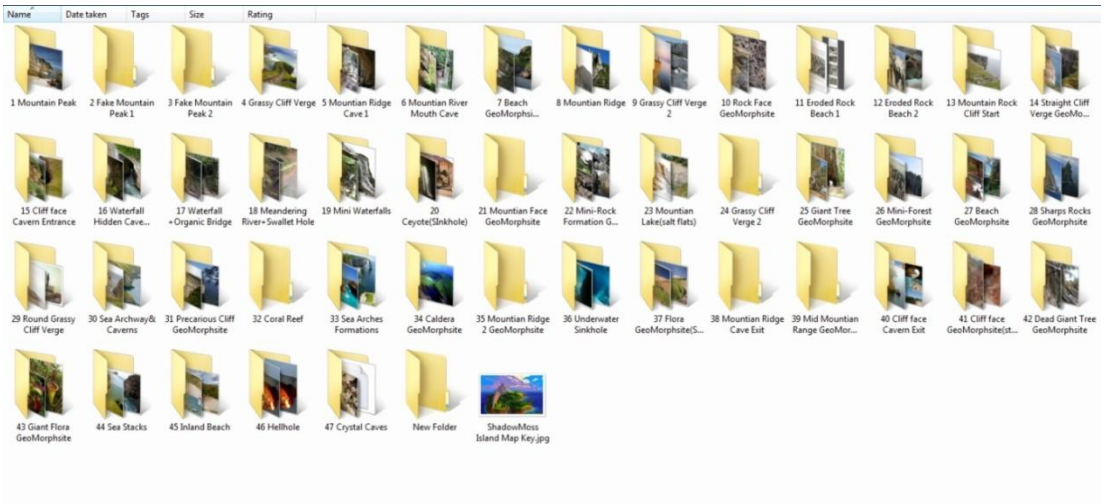

Figure 64: Image View for ShadowMoss Reference Images

7.4.17 Zooming User Interface

Zooming User Interfaces (ZUIs) are a dynamic interface and an alternative to the dominant WIMP (Windows, Interface, Menu, Pointers) paradigm that became established through the desktop environment and are a relatively new concept in interface design only emerging in practice in the early 1990's. Raskin (2000) proposed that "*The zooming interface paradigm can replace the browser, the desktop metaphor, and the traditional operating system*". Raskin argues the ZUI is superior in comparison with conventional interface paradigms. ZUIs unlike the WIMP interface are based on the alternative metaphor of the infinite 2D place/canvas as users workspace with the ability to zoom in and out to an infinite Level of Detail (LOD). Scott & Neil (2009, p.154) state "*ZUIs provide the ultimate virtual canvas; by extending the concept of the page, the user never actually leave the page*". Objects such as images placed on this canvas are placed at the discretion of the user, in any manner in which they see fit; there is no hierarchal and grid-based structure that users are required to conform to, and in many ways reflects the real world interaction in arranging (through manually positioning) files/photos in an openly expanding manner whether on a board or a desk.

The ZUI differs from the traditional desktop/wimp interface as it allows the arrangement of data in a non-grid based manner, freeing users from the constraints of a traditional desktop environment which has become an increasingly restrictive and counter creative bottleneck. Users can also navigate 2D space in a more 'natural' manner, and as Perlin and Fox (1993) argue this is due to ZUIs tapping into our geographic and natural spatial ways of thinking. Perlin and Fox also created the first ZUI system called *Pad* - a single shared workspace where any part could be viewed in real-time and later built upon by other interface designers. ZUIs are unique as despite being a 2D interface they in fact allow users restricted pseudo-navigation of 3D space since users are able to move in the x, y and z axes but in a linear fashion (i.e. rotation around z axis is prevented - only move along it).

I would argue ZUIs as an alternative to the desktop/wimp environment interface are far more appropriate when working with large amount of references that are now increasingly becoming common in even modest game development projects. Seifried et al (2011, p. 97) argue: "*the workspace is not limited to the visible screen and becomes virtually infinite in size and resolution*" and as such the amount of objects a user is able to work with in real-time in one visual space is theoretically infinite, but in reality, restrictions imposed by

software such as the OS or hardware limitations meant the early ZUIs in practice could not deal with extremely large amount of data.

Nevertheless, there are problems associated with ZUIs as Jul and Furnas (1998) describe the problem of users encountering the '*desert fog*' (i.e. it is easy for a user to get lost without the presence of a WIMP interface). Salmoni (2004, para.6) explains that *"Without any cues, users have been noted to wander around at random… due to a complete lack of scent"*. However this can be easily avoided by enhancing the ZUI with aspects of traditional WIMP interface.

7.5 Reflection on Teaching Practice

Analysis of the literature and industry practice can reveal insight into the current body of knowledge and professional practise that exists, however reflection on teaching practice can reveal what current practice has in reality filtered down (through formal and informal teaching) to novices wanting to engage in the practice of creating games

7.5.1 Reflection on Teaching Pre-Production

I have taught games design and production on the BSc CVG programme for over 12 years, with a specific focus on the final year major project in which students work on the pre-production, production and testing of a wide variety of game prototypes over a year long period. Students were provided with insight and value of effective and methodical pre-production stages including the importance of collecting, building and using reference material. Over the course of more than a decade in teaching I observed the following:

1. Students would assume contextual material to mean purely visual. Despite developing issues later on in production in working in non-visual based areas (i.e. sound design) many students every year would fail to realise that contextual material includes text, visuals, auditory and anything that is potentially relevant.
2. Students would often collect reference material because they are told to do so; the result was extremely limited reference libraries with no more than a handful of images.
3. The visual information was for the vast majority of time through secondary sources, and mainly through *a google image search*, and many were hindered by not possessing a rich enough visual language to be able to effectively describe what they were

looking for. Keyword searches were limited and students often gave up after only a few attempts.

4. Primary Data: in rare instances students undertook field trip only when guided by staff to create and collect primary visual data/reference data, whether this was concept work or photographic, the result was often far more creative and original projects.
5. The process of collecting reference was for many students more of a hindrance, the 'threshold concept' of collecting and using reference images was for the most not achieved.
6. Organisational: Students rarely moved beyond using folders, in many cases these were offline and static archives, only relatively recently have some moved to online repositories such as Dropbox. Many were unable to cope with sorting more than a 100 or so images effectively.
7. Where image sets were organised they were often reduced to a single canvas such as a statistic Photoshop PSD file. The result was often limited and uninspiring; even by the students' own admission.
8. Students would for the vast majority of time (only seen this once in a decade) not identify or develop interconnecting relationships between reference material
9. Students generally did not annotate work; this led to huge implications later on, in one instance a student worked on building reference material for a character, which was built by another student based on the reference image. The final result was a model which "*looked nothing like my reference image*" according to the student, both were adamant they used the reference image in mind when designing the character. The issue occurred because the student used an image with a variety of visual information (i.e. texture, colour, form function, font) but did not state the context on why it was selected (no indication on what or why it was selected and what was to be drawn from it). **Figure 65** illustrates a visual reference for a character. **Figure 66** represents an annotated version of what a student recognised as critical/important features in the work, whereas **Figure 67** illustrates an annotated version of what another student may recognise as critical/important features in the work. As you can see there is a marked distinction between features that both students recognised and those that were exclusive to each student. I encountered this phenomenon frequently in my teaching practice; this divergence would impact the final character

design/build if the ambiguity on what was critical (and from what perspective) was not removed at a very early stage, later potentially cascading into serious issues of developing a coherent design/art direction when expanded to hundreds of visual references shared across a team.

10. Students generally 'lumped' the entire process into one activity; there was no separation between the initial data gathering stage, sorting and presenting stages, very few models existed that provided students with a framework they could use to divide the process into discrete stages. Where they did they were specific to staff delivering the teaching and based entirely on their individual professional practice.
11. Collaboration: The majority of the work was individual, students would undertake the collation/sorting and presentation of reference material as an individual activity; very little cross-collaboration occurred despite areas that were researched being worked across several individuals.
12. Late into the production cycle, students would struggle to achieve a unique or realistic feel to their prototypes and by their own admission in post-project reflection they were *"bland"* and *"boring"* or exhibited elements of unintentional nonsensical design, as many were attempting to reinvent the wheel (without even showing a picture of what a wheel was).
13. Any feedback given by tutors was rarely used as students would either listen to feedback and not act upon it, best case scenario feedback was limited to writing a series of short comments in a text document, which on later referral to, many students admitted did not make sense, additionally there was no ability to embed feedback directly into the work in a live manner.

Figure 65: Original (non-annotated) Witch (Source Sven Geruschkat (http://www.svenger.de/)

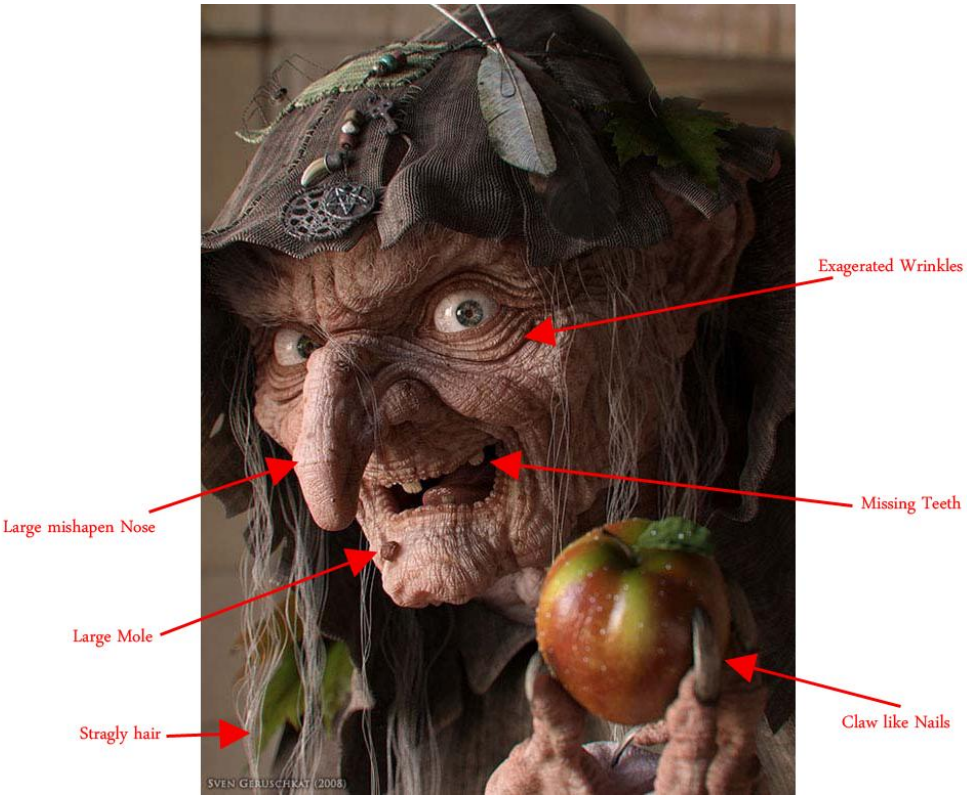

Figure 66: Annotated Witch Reference: Interpretation A Example

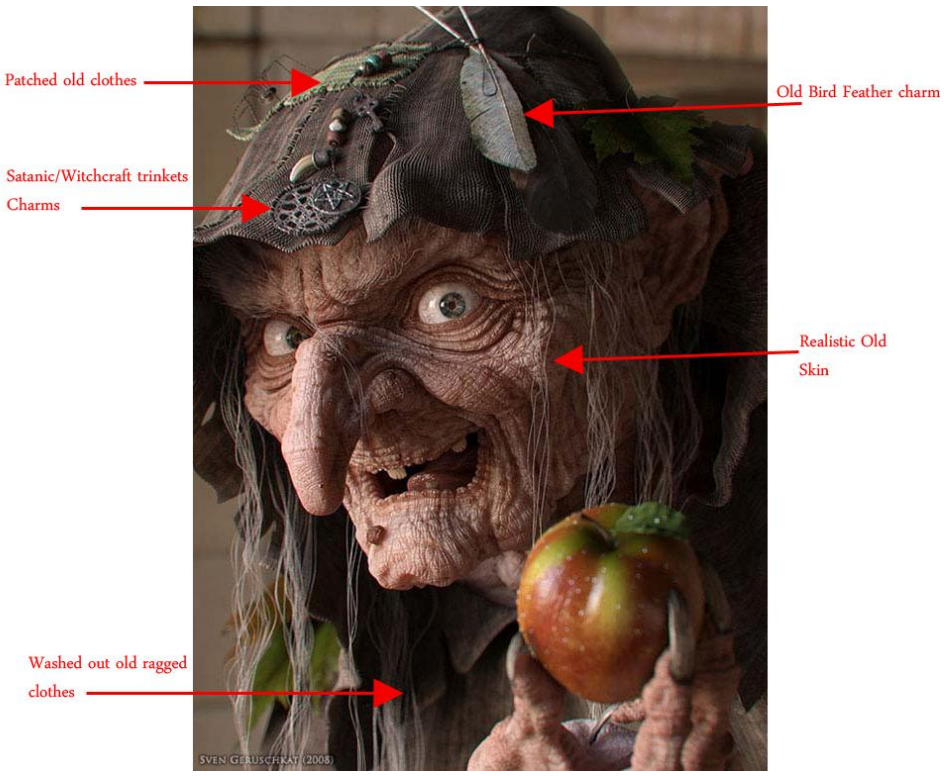

Figure 67: Annotated Witch Reference: Interpretation B Example

7.5.2 Reflection on Teaching Summary

1. Developing a deep understanding of the importance and use of contextual reference material.
2. Understanding of contextual information is more than visual information which is more than a google image search.
3. Recognition that contextual reference material can be existing or self-created material
4. The ability to organise large amount of information effectively with a range of tools, i.e. creation of a catalogue/index of reference
5. The requirement of any informational repository to be able to act as a collaborative space and to absorb feedback directly into the work as an inherent quality.
6. The need for annotation as key tool in removing ambiguity.
7. The requirement for information to have more than a linear relationship with other information in a more natural manner.
8. There was a systematic and logical process within contextual research/referencing; mainly gathering, sorting and presenting

7.6 **Process/Methodology**

7.6.1 Overview/Research Strategy

The methodology focused on a strategy of experimental practice, reflection on both teaching and creative practice, from which a set of user/design requirements was extracted. From these design considerations an initial paper design of the *MindFlow* tool was prototyped. Once I have a more developed vision of how the tool should operate, I investigated and trialled a variety of software, selected the most appropriate, built, deployed and tested the prototype. Finally, I reflected on the experience of using the tool and the framework in a practice-based experiment (*ShadowMoss Island*).

Table 32 provides an overview of the range of research methods employed and the justification, in this chapter.

Artefact/Project	Research Methods Employed	Justification/Notes
MindFlow Tool	5. Experimental Design 6. Computer Aided Design 7. Action Research 8. Reflective Practice	• Allows direct experimentation with concepts that have yet to be explored in commercial practice (Matias & Stern, 2005)

Table 32: Research Methods Overview

A diary was kept during the practical experimentation, and involved capturing reflection-in-action, which was then analysed and reflection-on-action was used as a basis to analyse the project and the critical reflection upon it. The methodology can be broken down into discrete steps, and was as follows:

1) Investigation (trial and error) of appropriate software
2) Reflection on teaching practice (draw out framework for managing the process of using visual/contextual reference)
3) Identification of user requirements through triangulation of reflection on teaching practice, and analysis of *ShadowMoss* design journal)
4) Practical experiment: Creation of a ZUI Reference board
5) Prototyping of *MindFlow* ZUI Tool: paper design
6) Prototyping of *MindFlow* ZUI Tool: Digital Mockup/Wireframe design
7) Prototyping of *MindFlow* ZUI Tool: UX Board
8) *MindFlow DeepZoom* Composer Experiment
9) Analysis & Critical Reflection on using the tool/framework.

7.6.2 Specific Methods

1. **Experimental Practice:** The *design, making and testing* of both theoretical designs and actual tool artefacts as a method to explore design theory and practice.
2. **Documentation:** Extensively illustrated *documentation* of artworks from design to testing/evaluation, utilizing mind/concept maps, flowcharts and diagrams
3. **Computer Aided Design**: A wide variety of *computer software* was used for data extraction/generation to the visualisation of non-conventional data sets.
4. **Action Research:** the mind-set of Schon's 'reflective practitioner ', cycles of action research and reflection in/on and for action was used to inform practice and drive the

work towards a resolution. Outcomes from the creation of each artefact form a place from which to *reflect on action* feeding into an eventual *reflection for action* in a future research cycle.

7.6.3 Process

7.6.3.1 Documentation Overview

Table 33 lists the associated creative production/process documents fort this study.

7.6.4 Analysis of ShadowMoss journal

Creative practice often starts with a problem or a desire to explore a particular subject, and more often than not during this 'foggy' stage there is often confusion and finding your way through trial and error (as is the nature of an emergent methodology) when you encounter or lack the ability to do something you look for a tool to assist you, if an existing tool is insufficient then you search for another.

Table 33: Document Reference Appendix

Area	Document/Reference
1. *ShadowMoss* Journal Analysis and Reflection-in & On Action	See Appendix V
2. *MindFlow* SMI AOI Lis	See Appendix S
3. UX Board for *MindFlow*	See Appendix X
4. *ShadowMoss* Journal - MindFlow	See Appendix U
5. Refined Virtual Landscape Design process.	See Appendix T
6. *ShadowMoss* PrePReP	See Appendix W

7.6.5 Review of Existing Design Software

7.6.5.1 Software Summary

During the investigation several methods including physical and digital prototyping were explored. **Table 34** lists each method, a brief description and the strengths/weakness of each approach.

Table 34: Summary Review of VNE Prototyping Software

Method	Description/ Link	Strengths	Weaknesses
Physical Prototyping	**Landscape maquette**	Non digital, No requirement to learn software skills Immediate design iteration	Time consuming Expensive Studio space required Not a rapid-prototyping tool
Digital Prototyping	**SpiderScribe**	Supports word, image, URL files Advanced semantic based tools Scribes can be shared online and exported	Limited to single instances Not free(subscription) Limited file type support No offline version
Digital Prototyping	**Microsoft Moodboard**	Integrated Browser, no time lost lost switching between platforms Direct integration with photo-editor Easy to use (no technical no how) Not limited to grid based arrangement Rapidly prototype moodboards	Does not support large amount of data Limited to visual information Not ZUI based
Digital Prototyping	**Vue 10**	Powerful toosel, inc rock, tree, terrain tools Built in asset pallet; not required to build from scratch	Expensive (£100-£500) Professional tool-difficult to use without training Time consuming to Suited for CG production Not a rapid-prototyping tool
Digital Prototyping	**GeoControl** http://www.cajomi.de/GeoControl/	Very powerful toolset for terrain creation	Complex software; not user friendly Limited to terrain/geographic assets production
Digital Prototyping	**UDK**	Very powerful game engine Integrated int	Time consuming, meant for production of games rather than rapid prototyping or managing references
Digital Prototyping	**Imapbuilder** https://www.imapbuilder.com/	Easy to use interface Online and collaborative options Offline version available.	Limited information\document types Limited canvas space Suited for conventional map building

Digital Prototyping	**amMap** https://www.amcharts.com	Interactive java based maps Cross platform(online) Collaboration possible	Java based programming expertise required Very limited file types No ZUI based(no image support?)
Digital Prototyping	**Pinterest** pinterest.com	Online tool Easy to use Collaborative Low technology barrier to entry(ios, andiod, browser)	Grid based organisation No Offline version available No export facility Based on legacy desktop metaphor, folder based organisation
Digital Prototyping	**Ultramashupstudio**		Limited support(defunct as of 2015)
Digital Prototyping	**ImageGalaxy** http://www.imaginalaxy.com/		Limited support (defunct as of 2015)
Digital Prototyping	**ImageSpark** http://www.imgspark.com	Online Integrated with browser Cross platform(browser based) Ability to create Moodboards with bbuilt in editing canvas	Limited to specific canvas sizes Limited support (defunct as of 2014)
Digital Prototyping	**MoodStream** http://moodstream.gettyimages.com/	Ability to blend audio and video and mood settings to determine selection/presentation.	Limited to video/images, Cannot arrange information, limited to single images
Digital Prototyping	**Stixy** http://www.stixy.com/	Online Easy to use shareable Web-based bulletin boards called Stixyboards	
Digital Prototyping	**Compendium concept mapper**	Visual Problem mapping Easy to use support drag and drop (urls and images)	
Digital Prototyping	**Deepzoom Composer**	Supports large amount of data Can be deployed online Offline version available Very easy to use software Ability to add links to image data Based on ZUI design Minimal tech requirements,	Limited file types(although they can extracted into visual form Offline standalone version requires programming knowledge. Based on Silverlight (stopped development in 2013) Not supported by modern browsers as requires a NPAPi based plugin

7.6.6 Advent Interface Metaphor

The advent calendar is on one hand a functional high level object in itself (the calendar) but also within it are individual, unique self-contained entities (days); each day holding an unknown gift/sweet that was to be revealed/eaten in a sequential order. The design of the typical advent calendar is both highly appealing and clearly comprehended by even a young child without much explanation once the idea behind a calendar is grasped. **Table 35** lists how the advent calendar translates to the design elements for *MindFlow.*

Table 35: Advent Interface Design Vs MindFlow Interface Design

	Advent Calendar Interface Design	Mindflow Tool Interface Design
1	Large central picture/theme acts as home, contains access points	Large central themed photo reference acts as home, contains interactive access points
2	Access points are Sequentially numbered	Interactive points are sequentially numbered
3	Access points are 'Doorways' to reward	Access points are doorways to additional photo reference

I found it intriguing and a design challenge to utilise this 'interface' as an interface metaphor for guiding a user around a large array of visual information. An initial design mapping exercise was carried out to 'map' features of an advent calendar to the proposed *Mindflow* tool design. In addition, based on this idea of an advent-type Moodboards, an initial design of how this would function was sketched (see **Figure 68**)

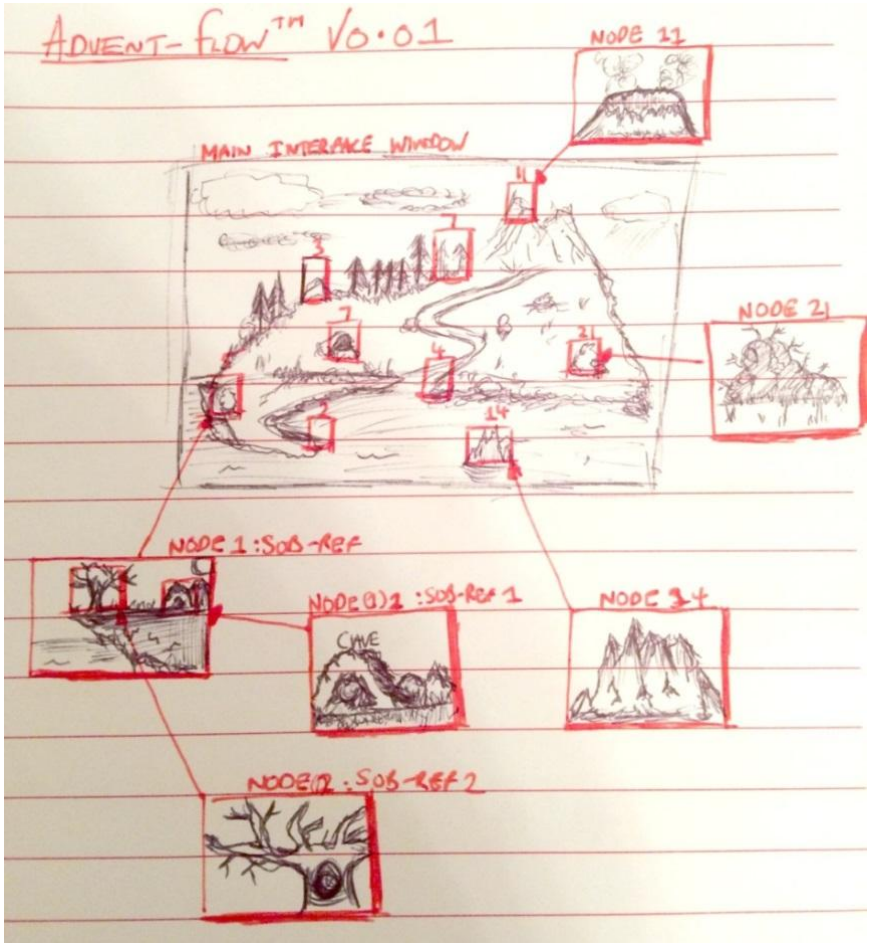

Figure 68: Sketch of MindFlow Advent Interface

7.6.7 Reflection on Teaching

Using the observations from my teaching practice (section 7.5); I constructed a basic framework from my experiences of students and my own practice. The combined reflection of Contextual Research process fell into four distinct stages:

1. **Identification:** Users identify what is needed, what they need to collect i.e. genre/sub-genre, character/environment. This can be largely defined if using existing project with requirements or very open if the concept is not formed at this point. Users need to find sources of inspiration as well as functional references, this is critical to achieving authenticity in what is collected and how it is used.
2. **Gathering**: Users gather contextual material; this can be primary or secondary reference material. This is often the main bulk of the work.

3. **Sorting:** Users often undertake this stage parallel to the gathering stage or can undertake this in a linear fashion after gathering, Themes across the reference material are developed, grouping/tags/metadata are applied and relationship across pieces defined.
4. **Presentation:** The work is adapted /presented in a usable or more coherent/easily accessible form.

This was used as a basis for the initial pre-production design planning (see Appendix W: ShadowMoss PrePReP).

7.6.8 Design Considerations:

A further step in the methodology was based on the *ShadowMoss Island* project and reflection on past practice to define a set of user requirements and user experience in order to methodically design how the *Mindflow* tool would function and to focus selection when considering a variety of software/platform choices. The following areas were considered and a set of user requirements was laid out:

a) Interface

1. The tool must be contained in a single screen, based on a dual monitor workflow or at worst a single window.
2. The interface must have minimal or zero latency/lag when moving around high resolution visual data
3. Time to Access (TTA) should be at least 50% less than conventional file/folder data structure.

b) Content

1. The tool must be able to support hundreds of pieces of contextual data
2. The tool must be able to add visual/text based data
3. The tool must be able to support very high resolution data
4. The tool must be able to support weblinks/URLs

c) Accessibility

1. The tool must be able to be viewed remotely and locally

2. The tool must not use a significant amount of system resources (memory, specialist graphics card, etc.)

d) User Experience

1. Users should be able to rapidly prototype creative spaces without the need of extensive editors or more than one piece of software.

7.6.9 MindFlow Design

7.6.9.1 Paper Design

Figure 69 illustrates the initial sketch of the *MindFlow* tool created during the investigation into appropriate natural environment pre-production (reference management) technologies.

7.6.9.2 Wireframe Mockup

Figure 70 illustrates a wireframe mock-up created by moqups[33] (beta)

[33] Moqups is an online wireframing tool available at https://app.moqups.com

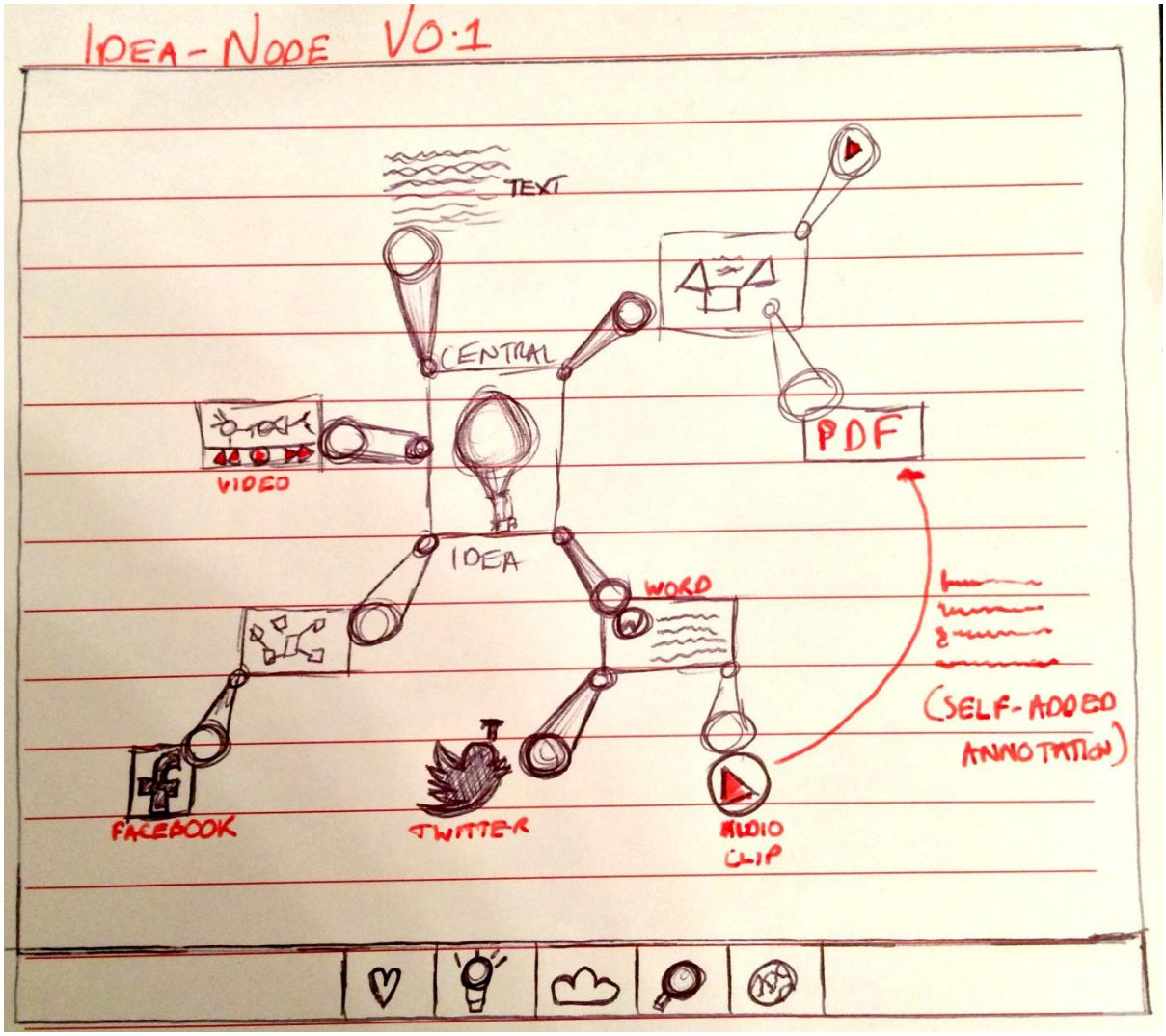

Figure 69: IdeaNode Sketch

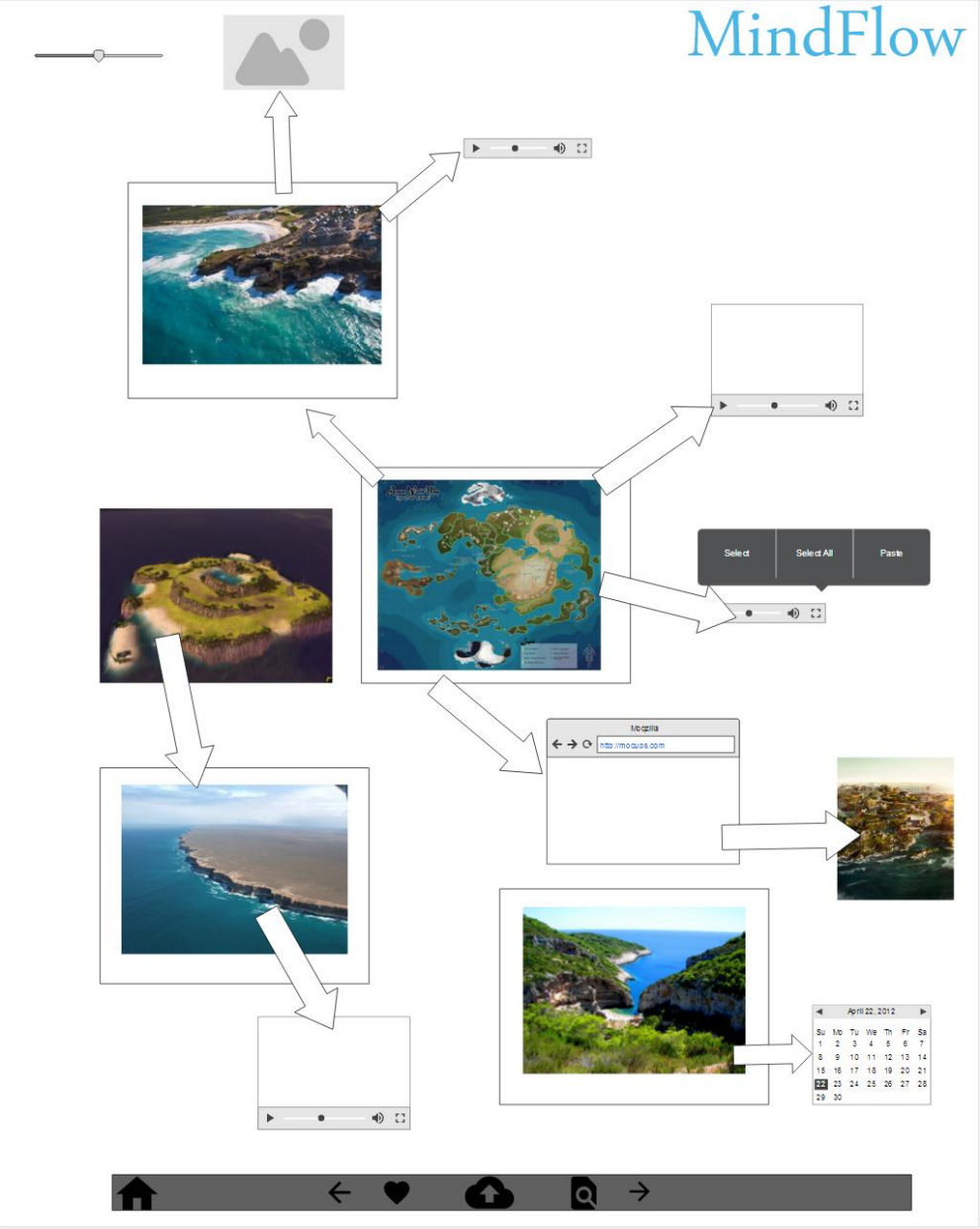

Figure 70: Wireframe of MindFlow

7.6.9.3 High Concept Image

Based on the initial mock-up/wireframe a further developed version was created in Adobe Photoshop utilizing static images to create a High concept image of the *MindFlow* tool. **Figure 71** illustrates the concept image with an emphasis on multivariate information.

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Figure 71: High Concept Mock-up of MindFlow Tool

7.6.9.4 UX Design 'Experience Board'

A detailed overview of the theoretical user experience of *MindFlow* can be found in Appendix X. This details the user experience at major points in using the software. **Figure 72** illustrates the UX Storyboard for Theoretical *MindFlow* Design.

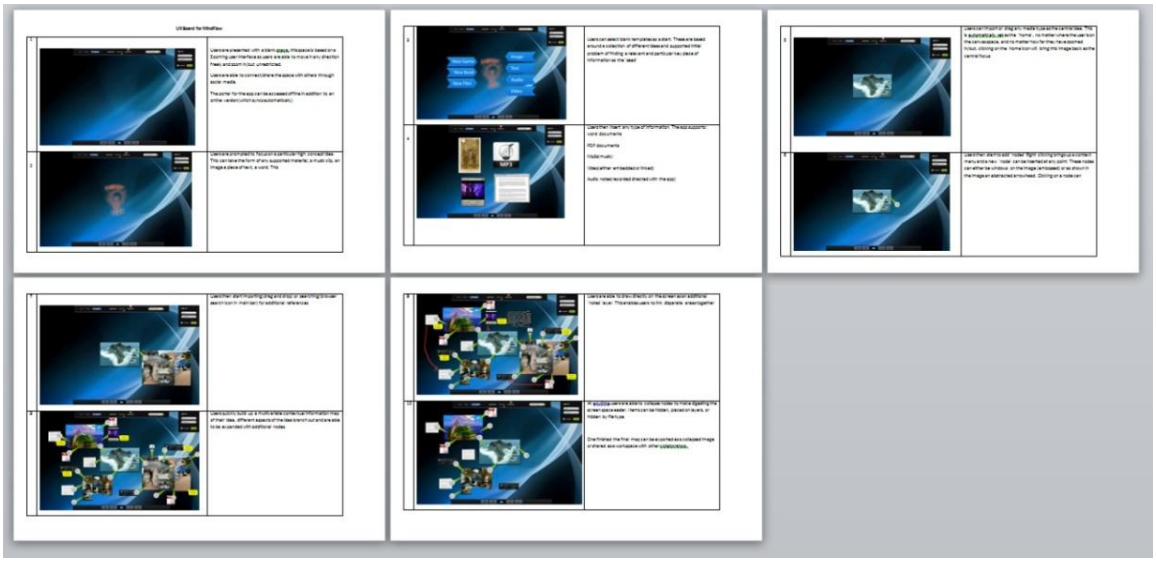

Figure 72: UX Storyboard for Theoretical MindFlow Design

7.6.10 MindFlow Pre-production Design Process

1. Research High concept (key image). Image selected was environment art asset from Legend of Kyrandia (**Figure 73**).

Figure 73: Kyrandia Environment Art Asset (Source: legend of Kyrandia)

2. Upscale and cleaned image in Adobe Photoshop (**Figure 74**)

Figure 74: Upscaled Kyrandia Environment Art Asset

3. Identify and highlight key areas of interest (AoI) using Photoshop (add embossed window) (**Figure 75**)

Figure 75: AoI Identified and highlighted

4. Number Areas of Interest (AoI) windows sequentially in Photoshop using text tool (**Figure 76**)

Figure 76: AoI Sequentially Numbered

5. Use Design Grid to define areas of research
6. Use grid to search for information/convert any non-image date into visual (i.e. export pdf/word as images).
7. Arrange in numbered folders (**Figure 77**).

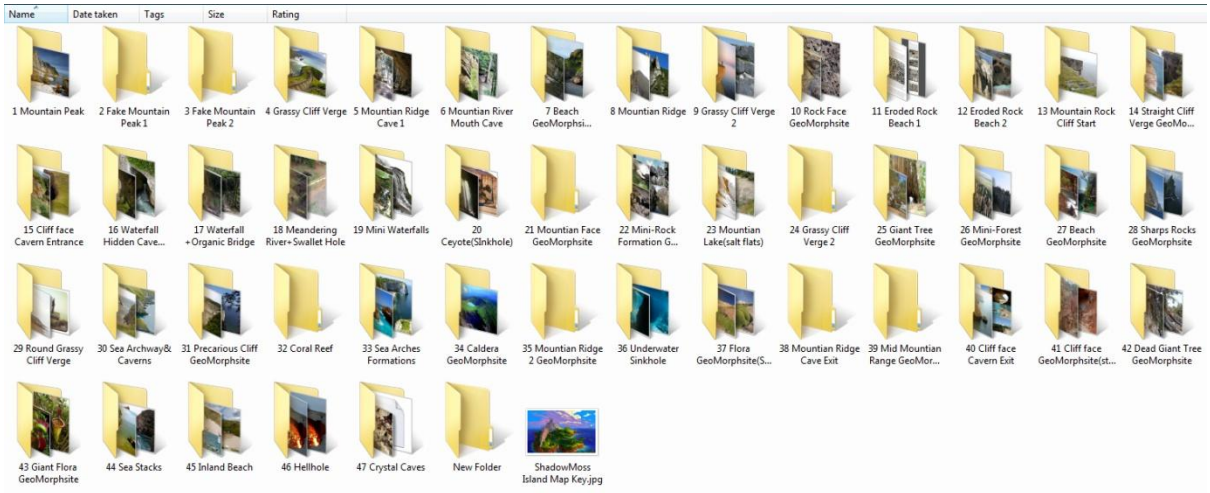

Figure 77: AOI Folders

7.6.11 DeepZoom Composer

1. Open Deepzoom, import main image into central canvas space (**Figure 78**)
2. Import additional images folder by folder
3. Enter *Compose* section of Deepzoom composer. Import images from folders 1, arrange images as required (relationships based on importance colour, form, etc.)
4. Add 'hotpsots' to numbered window on key island image
5. Drag and drop another hotspot onto entire image set from step 6
6. Link main AOI hotspot to corresponding hotspot from step 6 (**Figure 79**)
7. Repeat for all folders from AOI folder.
8. Move to export section of DeepZoom Composer and export with following settings (**Figure 80**)
9. Open the exported deepzoom file with a compatible browser.

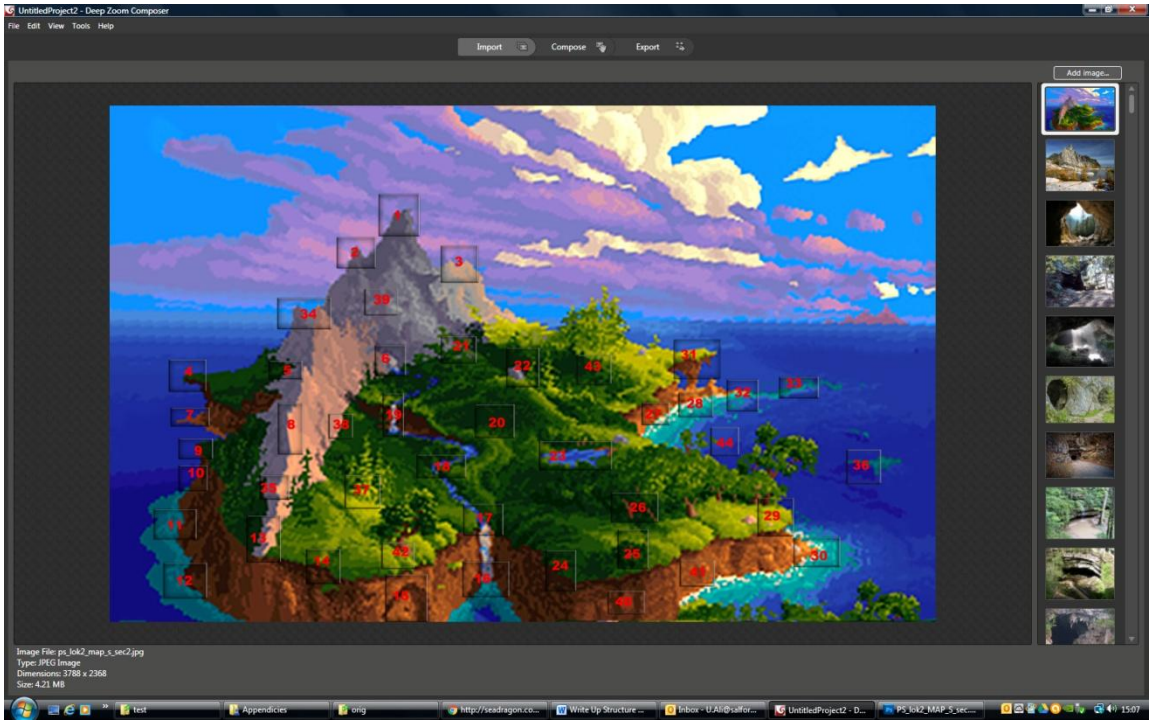

Figure 78: DeepZoom Composer Import

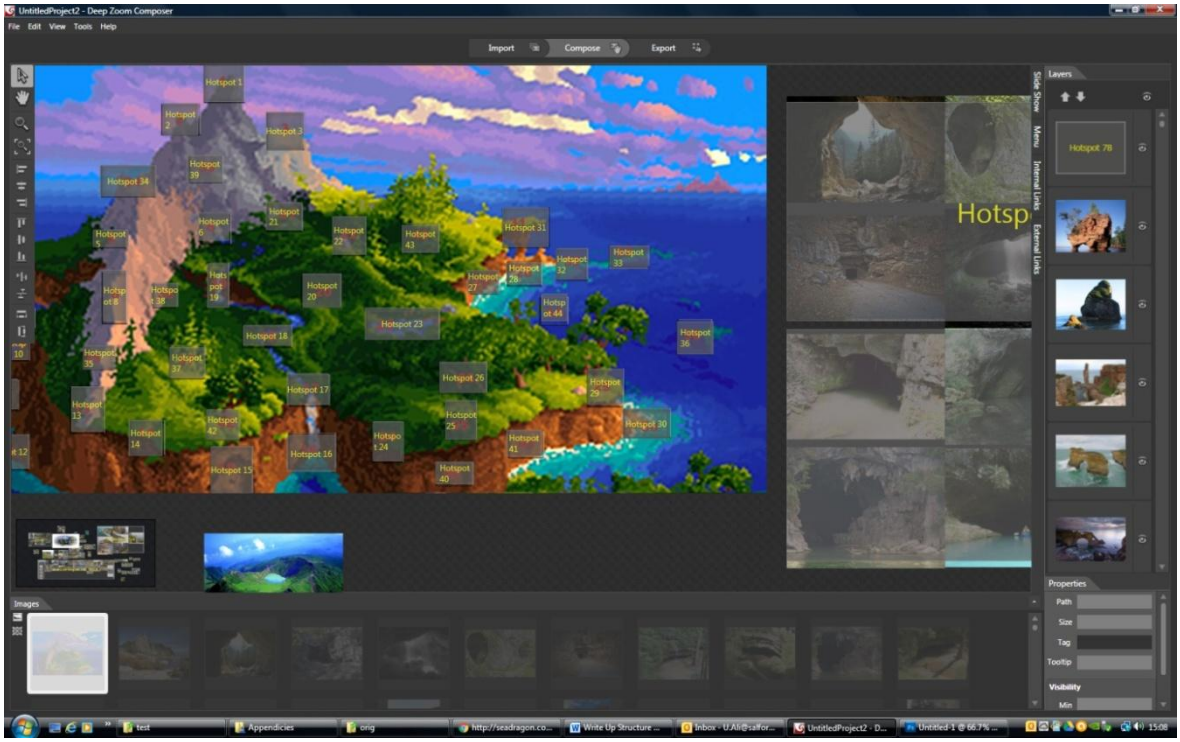

Figure 79: Image & Hotspot image composition in DeepZoom Composer

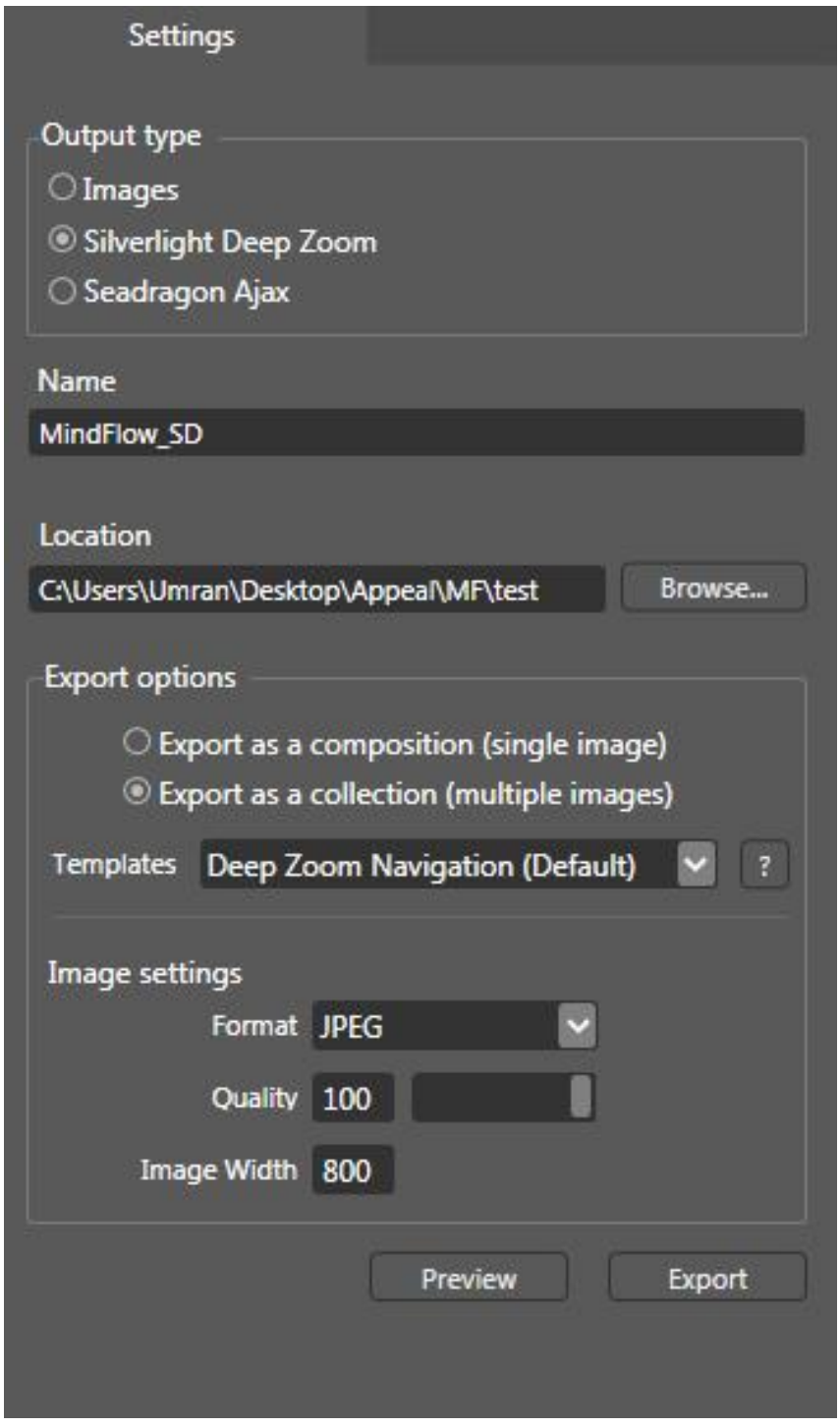

Figure 80: Deepzoom Composer Export settings

7.7 Practice Based Outputs

Table 36 lists the outputs of this study and offers a brief description of each and reference to where they can be found in the appendices.

Table 36: Summary of Study Outputs

Output	Description	Reference
***ShadowMoss* Interactive *MindFlow* Deepzoom Map**	A prototype of *MindFlow* as created in DeepZoom composer.	See external media drive
***ShadowMoss* UX Design Board**	A theoretical user experience 'storyboard' detailing the user journey in creating and using *MindFlow (theory)*	See Appendix X
***ShadowMoss* Interactive *MindFlow* Video Demo**	A short video demonstration of *MindFlow*: Deepzoom in operation.	See external media drive
***MindFlow* Pre-Production Design Guidelines**	A design framework and guidelines for students/developers to use in managing the multivariate contextual information process.	See Appendix P

7.8 Analysis

MindFlow serves as a tool that can be used to collate contextual research relating to any project outside games design. The tool can effectively present a large body of visual reference/information in a single screen space, thereby removing the cognitive storage barrier problem (trying to effectively store an overview of large body of visual references).

7.8.1 Pre-production Contextual Information Pipeline

Analysis of the contextual research process revealed that the process occurred in four distinct stages:

Identifying: In this stage users identify what is needed, what do they need to collect i.e. genre/sub-genre, character/environment. This can be largely defined if using existing project with requirements or very open if the concept isn't formed at this point. If an existing game design mechanic or narrative structure/other content exists then this can be used as design parameters/guidelines.

Gathering: In this stage users gather contextual material; this can be either be undertaking primary or collating secondary reference material. This is often the main bulk of the work

Sorting : In this stage users often undertake this stage parallel to the gathering stage or can undertake this in a linear fashion after gathering, Themes across the reference material are developed, grouping/tags/metadata are applied and relationship across pieces defined. This can be done in folders initially for ease of use, or through another application.

Presenting: In this stage research is undertaken to find the most appropriate technology in order to align with the project needs (e.g.is it an individual project or collaborative, does it need to be a shared workspace? Is approval needed - one time versus regular approval? If it is a collaborative space does it need to be accessible online? Are there any 'offline' capability built in the software?). After selection the work is adapted/presented in a usable or more coherent/easily accessible form. This can be in the form a visual map, context board etc.

Table 37 details how each stage can be further expanded, with each activity presenting the user with questions/tasks they must consider.

Table 37: Pre Production Referencing Process Guidelines

Stage	Activity	Questions
Identifying	1. Identification	Users identify what is needed What do I need to collect/build
	2. Inspiration	Users identify areas where they find any and all contextual information i.e. where the information is to be found.
Gathering	1. Collation	Users build a repository of references initially in a basic rudimentary system for ease of access, i.e file-folder structure.
	2. Observation	Users Select, identify, and annotate appropriate parts of information
Sorting	1. Synthesis	Users start developing themes across information's sets
	2. Organisation	References are organised according to
Presenting	1. Appropriation	Users research appropriate tools & technologies aligned to size/type of contextual information gathered, these are then appropriated
	2. Implementation	Users build & implement an interface to share/disseminate the contextual information

7.8.2 Analysis of ShadowMoss Journal

Schön (1983) discusses *reflection-in-action* as a process which allows practitioners to find out what is happening at the time of an event in terms of decisions made, feelings and creative processes, and provide an additional source of information (some of which may be lost on post-project reflection) which can be triangulated against *reflection on and for action* in order to provide a more meaningful and a more truthful insight into practice.

During creative action, unusual situations occur, and one is forced to follow alternative courses of action that were not originally planned or designed. During the development of *ShadowMoss Island* a diary (see Appendix U ShadowMoss Journal - MindFlow) capturing *reflection-in-action* was kept. The following is an analysis of key entries in the reflective diary (see Appendix V: ShadowMoss Journal Analysis and Reflection):

1. Using the current folder/file organisation of even small amount of visual data is difficult.
2. Managing reference data with traditional methods becomes a barrier to creation action and achieving a sustained creative flow
3. The current system of file/folders does not allow for relationships across reference data to develop over time in a natural manner. Emergent design is a real phenomenon and one that can be a positive design experience that should be allowed.
4. During pre-production the creative desire to move into production is strong, however since time is often limited at this stage, the focus should be on emergent, quick, and reactive iteration.
5. 3D tools are an unnecessary distraction as they complicate the process of pre-production unnecessarily.
6. Practitioners should avoid using a tool/process that in-itself becomes a mini-production; emphasis is on speed of rapid pre-production.
7. Within pre-production 3D tools are an overkill, a 2D interface is sometimes more than adequate.
8. Quick, streamlined, efficient are user requirements for rapid prototyping a 3D environment

9. Physically prototyping a 3D environment can be a distraction from the entire process without appropriate experience or tools in place, however there is an immediacy to shaping an environment by hand that should be explored.
10. Tools to service the conceptual development of 3D environment modelling in the concepting stage are limited.
11. Pre-production tools should be available offline and online, even if worked on by an individual and is an evolution of mind mapping,
12. References are not limited to images, but incorporate a variety of multivariate information and bring a sense of coherence across media types of existing information to derive new work
13. Fragmentation of multimedia types with proposed usage
14. Identification of keywords is pivotal in locating creative practice in a wider context; this is especially important in emergent areas and significantly impact on locating any practice to existing domains of either research or creative practice.

7.8.3 MindFlow Deepzoom: Qualitative Assessment

MindFlow was intended to serve as a fast, iterative, efficient tool for servicing the need of 3D environment design. Whilst the theoretical design was not fully implemented in the deepzoom experiment *Mindflow* still resulted in a much improved and smoother creative workflow than originally anticipated or experienced in the past.

Using *MindFlow* side by side whilst building the 3D environment of *ShadowMoss Island* there was a real immediacy felt as there was a tremendous difference from working in a traditional linear workflow where contextual information is absorbed/digested in pre-production and then individuals move to a process to the parallel workflow whereas I was able to build whilst being immersed in the visual reference (**Figure 81**). Deepzoom never crashed; it never caused system instability over the 12 months it took to build *ShadowMoss Island*. Once uploaded it became accessible anywhere, and worked well on PC and mobile (via SeaDragon application on the iPhone). The ability to effortlessly move from one image to the next without delay, enabled my focus to be completely in a mental design space that felt pure, unbridled by distraction of tools and technologies, as I thought I was able to create, and I was able to be sincere to my design aspirations.

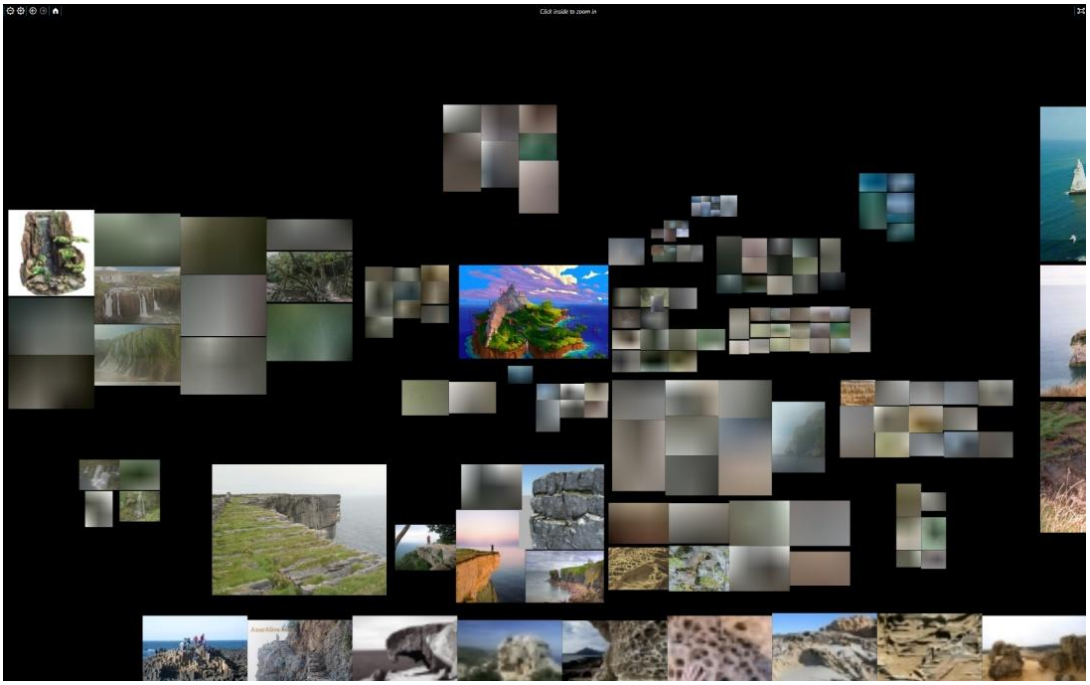

Figure 81: Screenshot of MindFlowDeep Zoom Interface

The added ease of working with a dual monitor workflow was unmistakable although, moving to a single monitor workflow did not lessen the experience and the reduction in wasted time browsing through folders. There is potential here to investigate the effectiveness of dual monitor (and in fact extended visual workspaces) workflows and if they should be incorporated into teaching as well as standard technique/process based areas.

7.8.4 MindFlow Deepzoom: Quantitative Comparison

In an attempt to quantify the system usage for both a DeepZoom implementation of *Mindflow* in comparison to Adobe Photoshop, an analysis of the file size, memory footprints were carried out comparing DeepZoom to Adobe Photoshop to Windows Image viewer. The original *ShadowMoss* visual reference folder consisted of 400 images, 50 folders with a total size of 300MB size.

MindFlow Deepzoom Prototype: 1 folder, total size 370MB, total memory footprint 180MB (difficult to estimate as was opened in Chrome, Internet Explorer and Firefox).

Adobe Photoshop: 10 images (selected at random from *ShadowMoss* folder) in a single canvas in full resolution, file size 350MB total memory footprint ~1000MB memory space

Windows Photo Gallery: 1 file (10 images) on a single jpeg canvas, 30MB, total memory footprint ~100MB

The above statistics highlight that even using a small (2.5%) of the total number of images, Adobe Photoshop has a much larger footprint (~ 500%) than *MindFlow* Deep zoom implementation, although this is largely due to the programme itself taking up system resources. However once we start to scale up the amount of images used in DeepZoom in applications such as Photoshop, it is evident (both Photoshop & Windows gallery app crashed and were unstable when attempting to open a file with more than 200 images) that the algorithm within DeepZoom is handling the image data far more efficiently at hundreds or thousands of high resolution data, and more importantly does so in an extremely stable manner, which critical if a developer is working with other applications at the same time. A more detailed analysis and controlled testing environment is needed in order to accurately determine the precise system resource (such as memory) required and then to ascertain the impact of any significant differences on user and system performance.

7.8.5 Analysis of Research Objectives

Table 38 lists each of the study's objectives against the appropriate evidence.

Table 38: Analysis of Research Objectives

Objective	Achieved	Evidence/Notes
1. To explore how we perceive information/data, and to investigate if the current digital tools are aligned with our cognitive and perceptive abilities	**Achieved**	See Section 7.4 Literature Review
2. To examine and develop new pre-production workflows/practices for creating a new virtual environment for games	**Achieved**	See Section 7.6 Methodology
3. To synthesise a variety of contextual media/information relating to the construction of a new VNE into a coherent visual space.	**Achieved**	Mindflow Prototype (See external drive)
4. To test alternative interface metaphors to allow more intuitive presentation of visual information, by allowing arrangement of contextual information in a single visual cognitive space	**Achieved**	Mindflow Prototype (See external drive

5. To explore the zooming user interface (ZUI) as a theory and as an alternative method of arranging visual information.	**Achieved**	See Section 7.4 Literature Review
6. To further develop the VNE framework for development during a third action research cycle.	**Achieved**	Appendix P
7. To create practice based work – a tool – which reveals, illustrates and exemplifies the findings	**Achieved**	Mindflow Prototype (See external drive)

7.9 Critical Reflection

7.9.1 Reflection on Assumptions & Expectations

MindFlow was originally created purely for the development of *ShadowMoss Island* in Cryengine. Developing or creating a tool was not even a consideration up until late into the pre-production stage; it was an emergent and unexpected problem and almost by serendipity the tool was created *out of necessity.* In fact, while reflecting and reading through my development diary it was discovered as a result of initial annoyance and frustration that led me to create *MindFlow.* There was never any intention or conscious effort to explore a research question. *MindFlow* occurred because it *had to* since no other tool satisfied a creative process that I was required to undertake.

7.9.2 MindFlow as a Design Tool and Alternative to Concept Art

MindFlow became a design tool; moving, arranging images for creation of an environment, this is spatial design, as CryTek Frankfurt demonstrated with the production of *Ryse: Son of Rome* that reference images do not necessarily have to serve concept art as a precursor step and it itself can function as 'secondary concept art'. The experience that resulted from using *Mindflow* was that there was no need to sketch *ShadowMoss* out in a paper design, it was built purely from the *MindFlow Deepzoom* map.

A problem many practitioners encounter is that one does not know what they are searching for if the process is relatively undocumented or part of a newly emerging practice (e.g. game development). The early stages of creation experimentation means one lacks the grammar and the syntax in order to fully describe what is needed, as you spend more time

investigating you start to uncover keywords or terms that describe discreet parts of what you need; these terms are generally set by external/collective practice. Eventually these words/terms start inter-connecting and you end up with a sentence that with clarity describes precisely what you need.

7.9.3 Pre-Production Referencing Process (PrePReP)

The process of collating references images gravitated towards visual data as primary information and was almost a subconscious undertaking. The pre-production process needed more development to include contextual information, notes and documents which were all vital but could not be incorporated into the design because of my limited technical skill.

The PrePReP provided focus as it is too easy for designers to fall into "*feature creep*"(unnecessary addition of design features). As a designer you are constantly bombarded with new influences, many are ignored but some are simply too alluring to ignore and the temptation to add these to an ever growing design is always there. The PrePrep system forced me to consider what I needed within a controlled system.

My initial reflection on the process and activities led me to suspect that it is a far more appropriate process and method than what is currently taught to undergraduates students on the BSc CVG game programme.

7.9.4 Designers & Programming

A realisation that occurred early on was that that programming is an extremely powerful way to express ones creative desires; especially when coupled with a designer's perspective. The current array tools and technologies around serious application design are still however geared towards programmers and although there has been an emergence of recent tools that allow designers to create basic applications (heralded by the app phenomena) anything that is more complex than a simple pre-scripted or template drive design requires a moderate to expert level of coding. If one wishes to create new complex tools then a strong grasp and skillset in C++/C# would have been invaluable. In hindsight more effort should have been made to learn at least some rudimentary programming in order to free myself from the constraints of simply being a designer.

7.9.5 Game Development Tools

Tools such as 3DStudioMax, Maya, Visual Studio, etc. exist for critical or critically perceived aspects of game development but pre-production tools were difficult to source. A realisation occurred very early on that specialised pre-prod tools is an area that will inevitability expand. The sad realisation is that there is no guidance or tools for novices. I was lucky in being able to navigate and access a wide range of software technologies to assess suitability and to experiment with DeepZoom as a technology. Most students or amateurs do not have the time or experience, and as such I am far more aware of how difficult the pre-production stage can be for novices entering natural environment design.

7.9.6 Deepzoom

At several points during the prototype development the inability to program greater functionality into the DeepZoom App was extremely frustrating. It appeared to support some features that I was interested in developing further; and the ability to rapidly survey a large amount of self-organised non-grid based visual data in real-time delivered the majority of what I needed in the tool and as such I remain convinced that is an appropriate technology for the collation and presentation of massive amount of data. Yet, it lacked development support, as is the nature of experimental tools. The ones that are useful can fall by the wayside and are no longer supported or used if they do not gain critical traction by a large body of users. DeepZoom is the perfect software platform from which to prototype a ZUI application. However, as the investigation and prototyping developed several issues emerged/became apparent:

- Deepzoom Composer was no longer updated, meaning conflicts with other software, stability became more apparent and difficult to fix.
- Deepzoom Composer was based on Microsoft's Silverlight technology which as a NPAPI technology/plugin was made redundant by Google and other browser companies around 2014 onwards meaning running the app in a browser (one of the features of *MindFlow*) was no longer possible.
- Microsoft Live Labs was dissolved and staff moved to Microsoft Bing department. MLL was instrumental in several technologies of interest (deepzoom, pivotviewer, deepfish, etc.)

- Silverlight was discontinued in 2013 with Microsoft ceasing developed except for patches and bugfixes, and as a result became increasingly difficult to gain either support from the developers or on user forums, as the rise and fall of Deepzoom/Silverlight occurred at the same time as this research cycle.

Whilst Deepzoom composer offered a rapid, flexible powerful manner in which to organise and manage a large amount of reference data into a single cognitive visual space using the ZUI technology, it is unfortunately still static; users are unable to ad-hoc add new references without first compiling a new version through the software, nothing can be added or removed, and given the dynamic nature of environment/games design this does impact the usefulness of the tool to a degree although it does not negate other aspects such as ease of access. On reflection a review of alternative ZUI tools and technologies, would have been beneficial from the onset.

7.9.7 Workflow

The dual monitor or second window as a complimentary visual working space: both an incredibly intuitive and effortless design, there is such a strong immediacy to using a second screen or direct access to content in a second window that reduced the time to access down from minutes to mere seconds.

The ability to find a reference through almost a mental node-based map was easy compared to having to remember the traditional workflow of browsing file/folder structure folder directories which was almost impossible; after a few uses the *MindFlow* map formed a mental map which I could navigate. Building *ShadowMoss Island* was far more intuitive and ultimately a fun experience, drawing on the references in real-time without the need to go up/down and in/out apps such as Photoshop meant much more time was spent on the creation and design of *ShadowMoss Island* and this is a key success. Creative practice can at times descend into monotony or the laborious; tools and technologies rarely deliver what our minds are able to create, practice is mediated through the available tools which are in themselves a constrained expression. Anything that delays the process of transforming creative thought into creative practice is a barrier, and the experience has taught me that the intent behind using contextual reference material (to increase the authenticity and originality/richness of a creative artefact's design) was partially negated by the actual

process. The best tools are in fact invisible or transparent to the user, they enable without becoming a distraction or a focus, as the design of the paintbrush becomes an extension and evolution of the fingertips so should digital tools. As Jonathan Ives once said: "*we spend most of our time getting design out the way*".

MindFlow as a tool was different; it had become transparent. I was no longer distracted by delays in searching for visual information or searching for 'missing files' but I was deeply immersed in the making of the 3D environment of *ShadowMoss Island;* that deep constant referral in one 'cognitive visual space' was far more intuitive as a user.

I have worked on creating 3D environments for over a decade and I am unable to go back to my previous method of using files/folders after working through *MindFlow*. My initial assumption of the desktop environment being out-dated and not aligned to modern development needs was correct, and even more pronounced after using *MindFlow*. On one hand a lot of time is wasted in searching or remembering folder trees, on the other hand the immediacy of design thought and action is delayed. I still have not seen *MindFlow* developed to its full potential, but as a tool it supported the pre-production framework for visual information.

A final realisation is that *MindFlow* represents a tool that has uses far beyond games design. *MindFlow* serves as a tool that can be used to collate contextual research relating to any projects outside games design. This idea could easily be applied to organising a wedding, a catering event, any activity where a range of information is required and generated.

7.9.8 Collabortaive ZUI

There is now no requirement for 'legacy' practices such as using files/folders full of references offline. The tool offered a true collaborative space where users were able to access on a PC/Mac/mobile as standalone or at the same time. In essence, *MindFlow* was functioning as flexible shared visual workspace, one that was accessible to all on any platform and required very little hardware/software requirements. This collaborative or platform agnostic feature is something that would benefit students in being able to work and share any user collated reference material with ease.

7.10 Limitations of Study

Although DeepZoom proved invaluable it has limited the functionality of the final prototype. Hence the prototype was not fully developed due to limited exploration and suitability of available technologies. In addition, lack of programming knowledge specifically Ajax, Seadragon, Deepzoom and related software, meant that any higher level functionality could not be programmed in the prototype at the time. These extra functionalities required intermediate/expert programming knowledge which was beyond what I could achieve at this point in time and also beyond the scope of this research. Another limitation of the study is the lack of user testing of the prototype. This is something to consider for the future.

7.11 Further Questions

1. Several questions developed as a result of this study: What other alternative ZUI technologies exist and how, if at all, could these be used to support the pre-production process?

2. How is the pre-production process, specifically in other media such as films, TV managed? What systems/tools are used to manage the range of reference material?

7.12 Conclusion

In summary *MindFlow* was created as the result of an unexpected design problem. Whilst these types of creative problems are often tangential to the research, the problem was incorporated into the study and as such was investigated using practice as a method.

The study developed a set of theoretical design triangulated from observation and reflection on teaching practice, analysis of *ShadowMoss* game development diary, and a literature/software review. These designs ranged from initial conceptual designs of the interface to a user experience storyboard. A range of possible software choices were explored and one (Deepzoom) was selected. A prototype of *MindFlow* was then built and used in the creation of a 3D game environment (*ShadowMoss Island*). The experience of using

the framework and the tool was then analysed and reflected upon and a series of new recommendations and an improved design was proposed.

MindFlow's innovation is in the use of a ZUI and infinite canvas metaphor combined with the interface of a traditional advent calendar as alternative to the desktop/WIMP environment. Users are free to arrange content based around a single idea (or group of ideas) and are able to arrange the data in an intuitive manner. *MindFlow* goes beyond traditional photo and image reference managing systems by presenting both a set of guidelines for a pre-production referencing workflow and a tool to enable users to work in a more fluid and naturalistic manner. The prototype presented, has been received well by students, who described it as engaging, unique and an enjoyable learning experience.

The limited testing of *MindFlow* indicated that users were engaged with the interface and the opportunity of improving environment design offered by the tool. *MindFlow* enabled the organisation of reference images and contextual information in a workflow that was aligned better to current 3D environment production. The study also suggested a wider theoretical design which can be explored by future practitioners.

MindFlow has not been developed to its full potential, but as a tool supported the pre-production framework for visual information. A final realisation is that *MindFlow* represents a tool that has uses far beyond games design.

Chapter 8: Scenism

8.1 Introduction

This chapter introduces the exploration of what the work means so far. A range of tools, processes, artefacts and extensive recommendations have been made so far. Artefacts were created as a result of the exploration around landscape design both physical and virtual. This chapter discusses how the disparate elements can be brought together to form a unified and coherent construct, one that communicates the research in a more manageable and human facing manner.

8.2 Questions & Problems

8.2.1 Main Research Question

Given the range of improvements to the VNED process, including tools, techniques, guidelines and a new theoretical framework for VNED that has been presented by the research so far, how is one able to synthesise these together into a coherent form, one that manages to capture the range, breadth and depth of the work but does not overwhelm, but rather inspires and motivates as well as supports a potential user of the work? This leads us to the main research question for this study:

> **Q:** How can the research outcomes be presented in a manner which inspires, motivates and embodies the beliefs, processes, techniques and tools developed and proposed thus far as a concise entity?

8.3 Aims & Objectives

8.3.1 Research Aim

To unify the elements of VNED and the wider study into a coherent system that combines beliefs, functions, tools and processes.

8.3.2 Research Objectives

1. To create a construct that unifies the elements of VNED into a coherent system that combines beliefs, functions, tools and processes.
2. To derive a name for the ideology, philosophy/tools/process developed so far
3. To create practice-based work to illustrate and exemplify the research to a wide variety of audiences.

8.4 Reframing of Ideas

One of the most critical aspects of any work, scientific, creative or otherwise is the reception, and feedback it receives when discussed with anyone outside the research. Often this step is both stress-inducing as well as being empowering. It could be stress-inducing when the research is not understood for what it is, but empowering when the feedback highlights its uniqueness or points to innovative/original aspects of the research.

8.4.1 Critical Incidents

An important part of reflection is to capture critical incidents, incidents that reveal or identify a flaw or an opportunity or evolve the research in a certain direction and one such critical incident occurred when the research was being presented to a small group of academics. Feedback from supervisors is especially critical in doctoral research as they represent an embodiment of the wider academic world - a point of contact between the researcher and the wider academic body. The first critical incident occurred when the research was discussed with my co-supervisor. During one particular feedback session with

my co-supervisor Professor Erik Knudsen, it occurred to me that the 'disconnection' that may sometimes occur when a researcher is isolated for long periods had actually happened. As the research grew in volume and complexity, and reaching the point of feeding back in a succinct and coherent manner what the research is and aimed to accomplish, I found that the idea, which was well formed in my head, struggled to be coherently and effectively conveyed, even to a seasoned and experienced academic such as my supervisor, who asked the question: *"How can you bring this all together into one concept or idea?"*. I was unable to do so at the time, because all the elements were so disconnected it was hard to link all the smaller studies into one main concept or idea. This meeting prompted a deep reflection on what I was doing, and whether the research was simply a process?

The second critical incident occurred when the research was being presented to a small group of academics. A question was asked at the end of the presentation on my wider skills, and experience as an academic, including aspects of my research: *"so this thing, you've created what do you call it?"*. The question took me by complete surprise; the research was not a thing, and it was just research. I asked the academic to clarify; the response was: *"Have you named the entire thing, a neologism for instance to describe it?"*. My answer was to simply respond with the truth: I had never considered it. Shortly after I begun to explore the idea of creating a unifying entity that could capture and contain all the research elements into a single idea or mental space that could be easily described. I first started with a definition of neologism to ground me in what it was. The Oxford English dictionary[34] defines 'neologism' as *"A newly coined word or expression"*.

Shortly after, I 'experienced' (a term I prefer to use as simply using the term 'watched' ignores all the related activities including immersing myself into the wider mythology, story and ideas behind the film) *Tron Legacy*, a sequel to an earlier American science fiction film *Tron* released in 1982, in which the film's protagonist, Kevin Flynn is transported via an experimental 'digitisation' process to inside the digital cyberspace of his company's mainframe computer. In *Tron Legacy* (2010), the film reveals the fate of Kevin Flynn after disappearing for 30 years and his son's quest to find him. In one particular notable scene Flynn is seen building the virtual world around him (a dark empty void to which he brings both architectural form as well as artificial intelligence). He is essentially the creator, the

[34] http://www.oxforddictionaries.com/definition/english/neologism

architect of the 'grid' (a virtual world he shaped from inception but is now beyond his control).

This was a transformative moment for the research, as it was my first encounter with the strong personification of the notion of a *Virtual architect;* Kevin Flynn was not simply a programmer, but an architect who built an entire living world in the virtual digital domain, and he did so, from outside the world, but also from within. An extract from the character's fictional book (Advanced Computer Programming) has a particular quote where Flynn evokes a beautiful and poignant vision of what I imagined the next generation of virtual world architects would experience.

Kevin Flynn stated:

"*I'm designing the outlands of my latest experience. It's a game to end all games: as the user, I want to feel Iike I'm there, on the game grid... to brace against the digital breeze whipping past my face, unforgiving and undefined. It feels like I'm on a precipice and I can see the promise land just across the way, there –a land when the biological and virtual worlds meet. Now all I need is a compass to navigate ever forward*". (p.56)

After these critical incidents it was apparent the initial notion that the research was simply a process had gone; this was something far more than it needed to be. On a conceptual level it is far easier to relate to a thing, that unifies the work, especially if the work is grounded in creative practice, and on a personal level as a practitioner, I was not just exploring and presenting tools and processes, but a belief system, a way of thinking, a way of behaving, and it required exploration it is own right.

The following *High Concept* was written as a guiding principle in exploring how the research could be culminated into a single coherent idea/construct:

- *A neologism that describes a philosophy of natural environment design exemplified by a process specific to digital natural spaces created by the tookit named after a mythical object.*

8.5 **Methodology & Process**

The methodology for creating this new 'thing' was not straightforward as it was completely new and unexplored territory. Whilst previous areas of study in the research were previously practiced, this was an area that had truly emerged from the work so far.

8.5.1 Summary of Process

1. Critical Reflection on the entire work to date, and sorting of the types of generated outcomes (see **Table 39**)
2. Identification of core areas the new creative 'container' needed to capture
3. Research of other 'Principles of Design' frameworks for practice that could inspire the creation of a new VNE philosophy.
4. Identification of research/process keywords
5. Research into portmanteau/acronym generation
6. Convergence of Ideas

Table 39: Research Output/Type

Project /Chapter	Outputs	Type
Review	Literature Review	Principles of Design Theoretical perspective
Virtual Landscapes	*Virtual Landscapes* Blog *Virtual Landscape* Book PivotViewer Database	Digital Archive/Database Books
ShadowMoss Island	*ShadowMoss* Design guidelines *ShadowMoss* game	Game Experience Design process
MindFlow	Deepzoom Prototype	Tool

8.5.1.1 Critical Reflection

The work has developed through a combination of scientific and artistic practice in an attempt to formulate, test and propose a new way of thinking about virtual natural space design, as such the following critical aspects of design emerged from the work carried out over the course of the research.

- **Extended Reality:** The most critical realisation was that these virtual realms were mere representations, facsimiles, copies or mere virtual spaces that are inferior to physical space. They may lack conventional physical attributes but they had real

impact and meaning - they held real connections for individuals, real meaning and impact and should be considered, appreciated and respected.

- **Independent Existence:** These gameplaces were entities in their own right, they did not require or need to be filled, layered or built upon to be enjoyed or experienced, their existence was sufficient and themselves more than ample itself justification of their creation. The addition of other entities may have added and enhanced the spaces and allow their meaning to be explored but by no means were critical to the enjoyment of them.
- **Holistic Design:** There appears to be no limit to the foundation disciplines, traditions or philosophies that VNED can draw from whether it be psychology, geology, ecology, aesthetics, spirituality – whatever the intent of the new virtual space, drawing in elements from these disciplines into a guiding framework/core tenants for the design can be important.
- **Gameplace**: A memory and or experience of a place that exists in a virtual space that holds or evokes a reaction and holds an emotional, cultural or other value to an individual or a group/community.
- **Habitats:** These spaces are inhabited spaces and increasingly more so, these spaces should be dealt with sincerity, wisdom and knowledge - the rest will follow.
- **Macro Micro - Branching Design:** A fractal approach to designing these spaces should be used starting from building a sense of place in smaller constrained units and building into larger more coherent and consistent spaces.
- **Be one with Nature:** The virtual spaces analysed were creative expressions of tangible real spaces. Designers should as Ruskin argued '*Go to nature'*, touch it, feel it, breathe it, engorge their senses within these spaces and remain connected to how they them feel; the natural world is not simply something to be observed and replicated but to be absorbed, experienced and shared.

In addition, the work to date had produced a number of research outputs. Table 36 summarises the range of outputs the research produced against the type of output.

8.5.1.2 Identification of the core areas

After reflecting on and analysing the outcomes of the research it became clear the work fell into two broad categories with a central idea that ties both together:

- **The wider idea**: A word, a neologism or acronym that defines the entire system and integrates the philosophy and principles developed in the work thus far
    - **Process & Technique**: A term used to describe all the workflows, pipelines for creating Virtual natural worlds
    - **A Toolkit:** A term, a neologism or acronym/ portmanteau used to describe the tools used to create these worlds

8.5.1.3 Research of other 'Principles of Design' frameworks for practice

In '*Illusion of life: Disney animation',* a book by Ollie Johnson & Frank Thomas, (1981), one of the most striking and significant contributions the work makes is offering 12 basic principles of animation, principles that deal with both creating a believable illusion of characters, and addressing the more abstract 'rules' of animation. The principles offered are short, concise, powerful and are considered to be among the most insightful, useful set of design principles in Animation, and the book is often cited as a core/key reading for any prospective animation students or professionals. Grounded by this notion - that offering a set of 'commandments' is far easier to remember, engage, and absorb and to ground one's practice - I was intrigued of whether this method could be applied to VNED as one that reduced the complex and sometimes transient nature of the work down to a set of ideals, beliefs and practical tips that anyone could remember, follow and implement.

8.5.1.4 Identification of research/process keywords

The following keywords were selected based on the literature review as well as the individual studies. **Key Words:** *Virtual, Landscape, Design, Process, Geology, Psychology, Natural, Environment.*

8.5.1.5 Research into portmanteau/ acronym generation

A range of websites was used to generate a range of acronyms, portmanteaus of the keywords (from step 4, section 8.5.1.4). **Table 40**, **Table 41**, and **Table 42** illustrate the outputs from the online generators.

Table 40: Keyword Output Test Results 1

Output Test 1	
VirSign	Virtual Design
Lasign	Landscape Design
VED Process	Virtual Environment Design
GILD	Geology Informed landscape design
RILD	Richly informed landscape design
Dived	Deeply Informed Virtual Environment Design
DiNeD	Deeply Informed Natural Environment Design
RINED	Richly Informed Natural Environment Design
VNED	Virtual Natural Environment Design
VNLD	Virtual Natural Landscape Design
VirLanD	Virtual Landscape Design

Table 41: Keyword Output Test Results 2

Output Test 2	
RAINED	viRtuAl natural envIroNmEnt Design
VINES	VIrtual Natural Environment deSign
VIRTUES	VIRtualnaTUrallandscapE deSign
LAND	virtuaL nAturallaNdscape Design
DELTAS	DEepvirtuaL naTurAl environment deSign
DENTED	DEep virtual NaTural Environment Design
RVNED	Rich Virtual Natural Environment Design

Table 42: Keyword Output Test Results 3

Output Test 3
Keywords: virtual genesis
vinesis, venesis, visis, vesis, vis, virtuanesis, virtenesis, virtuasis,virtesis, virtuas, virtis, virnesis, vgenesis, v irsis, vnesis, virs, vsis,virtualnesis, virtgenesis, virtualsis, virtnesis, virtuals, virtsis, viesis, viis,virtuaesis, virt uais, virenesis, viresis, viris, virgenesis, virtualesis, virtualis
Keywords: genesis virtual
gertual, girtual, gel, gual, genertual, genirtual, genel, genual, genesirtual,genesil, genesual, genrtual, gvirt ual, genl, gtual, genesrtual, genvirtual,genesl, gentual, genesisrtual, genesvirtual, genesisl, genestual, get ual,genetual, genesitual, geirtual, geual, geneirtual, geneual, gevirtual,genevirtual, genesistual
Keywords: digital genesis
dinesis, denesis, disis, desis, dis, diginesis, digenesis, digisis, digesis,digis, digitanesis, digitenesi, digitasis, digitesis, digitas, digitis, dignesis,dgenesis, digsis, dnesis, digs, dsis, digitnesis, diggenesis, digitsis, digits,di gitalnesis, digitgenesis, digitalsis, digitals, diesis, diis, digiesis, digiis,digitaesis, digitais, dienesis, digienesis, digigenesis, digitalesis, digitali

8.5.2 Convergence of Ideas: The Final Concept

During the exploration of finding a suitable phrase to capture the spirit and essence of the design philosophy the research was proposing, the research moved into areas of philosophy and theology; this concerned the creation of the virtual world, albeit virtual. Theology, in particular the Abrahamic faiths, are grounded in a shared belief that the world, the universe was created out of nothing, or to use the Latin term commonly used in theology, '*Creatio Ex Nihilio'* (C.E.N). I was drawn to this phrase immediately, as it embodied the feeling and experience I had encountered in my creative practice. When creating these virtual spaces one often starts with a void. Staring at this void, an empty black space in which there is nothing, one starts to bring a form and meaning, and eventually a world is created (the ground, the sky, the air). In theology, and strangely even in science, we are asked to believe in this 'creation out of nothing', and theologians and scientists have wrestled with attempts to either prove or dispute the act. However in the virtual domain this is not a theoretical notion but one that can be seen and experienced first-hand, from nothing more than a thought, vast, complex, rich virtual world's spring from the void.

However, many still feel the virtual world, is just that, a virtual simulation, a replica of the 'real' thing, nothing more than a *simulacra*, a fake copy that as Plato argued was a distortion and a deviation of truth. The word *Simulacra (*Latin for likeness and similarity) has

long been a focal point for philosophers, with its roots stemming from classical Greek philosophy, in particular Plato's dialogues to the modern day as Jean Baudrillard, the postmodern social theorist, who unlike Plato argued the simulacra was not a copy but in fact a truth, in its own right: "*The simulacrum is never that which conceals the truth--it is the truth which conceals that there is none…..The simulacrum is true*." (Poster & Mourrain, 2002, pp.166-184)

However Baudrillard still held a negative perception of the *simulacra*, arguing there were four types of representation:

1. A reflection of reality
2. A masked and perversion of reality
3. A masked absence of reality and
4. The Simulacrum, which bears no relation to reality.

Plato's and Baudrillard's negative perceptions of the simulacrum was not shared by Gilles Delueze, a noted French philosopher. Delueze (2004, p.299) stated*:* "*The simulacrum is not a degraded copy. It harbours a positive power which denies the original and the copy*". From this description, I hold to the position that the word s*imulacra* is not be applied to the virtual worlds as a negative term indicating a mere deviation or perversion of the real physical world, but as a term used to indicate that they are a truth and object in their own right. In essence the creation (out of nothing) of these *simulacra* worlds can be summed up by four words: *Simulacra Creatio Ex Nihilio.*

It is almost by serendipity that in searching for a phrase or neologism that defined and could contain all the various aspects of the work, I realised the acronym for *Simulacra Creatio Ex Nihilio* was SCEN, which bore a strong resemblance to the word *scenic* and *scene* (terms closely linked to the natural world, in particular landscapes, and the visual appreciation and perception we have of them). The word *scenery* embodies an experience tied to perception, (i.e. how we perceive the world, in particular the natural landscapes, something that is enjoyed, something to be experienced), whereas the word *scenic* evokes thoughts and feelings of picturesque landscapes.

However, the 'grand idea' was not yet complete until I reflected on the core of what it was I was trying to convey - a practice, a set of beliefs or worldview, perhaps a philosophy and/or ideology, arguably, a philosophy that tries to change the world or artistic movement, which can be succinctly summed up in a small yet powerful suffix in three simple letters, an –ism.

SCEN-ism was born - a phrase to capture the essence and spirit of the research, the values, beliefs and principles underlying its philosophical aims, and how it should be practiced.

8.6 Research Outputs

The main output is a design ideology/philosophy as well as a term used to describe the process of embedding *Scenism* and the toolkit used to implement it.

8.6.1 Scenism Framework

Figure 82 illustrates the various components of the new proposed framework which is composed of two main strands; theory (blue) and practice (orange) embodying the various projects (yellow) , prototypes (green) and guidelines/documentation (purple) that make up the framework thus far.

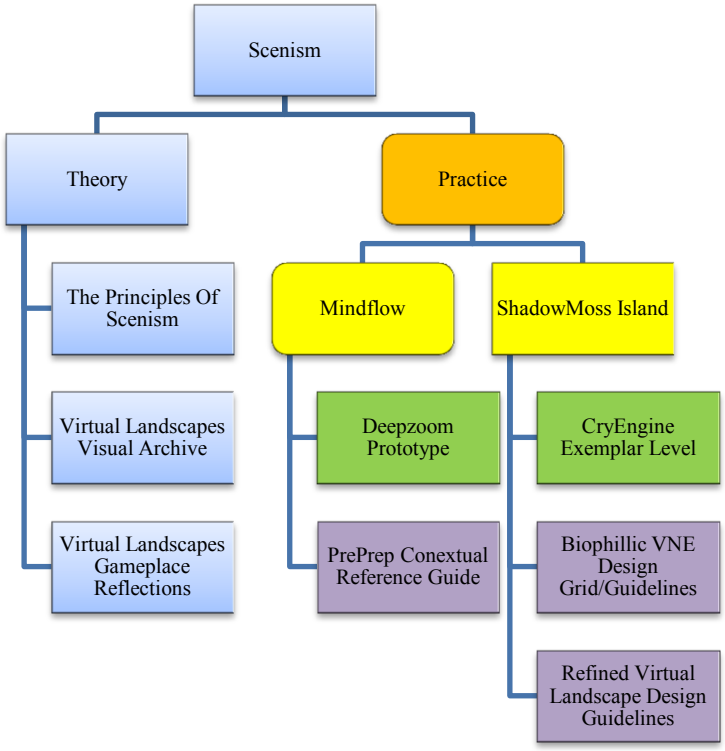

Figure 82: Scenism Framework Components

8.6.2 The Principles of Scenism

1) **Extended Reality:** The most critical principle is that these virtual realms are not mere representations, facsimiles, copies or mere virtual spaces that are inferior to physical space. They may lack conventional physical attributes but they are real - they have real connections, meaning and impact and should be considered, created and respected equally to real physical locations. Therefore, designers should be sincere in their creations and open-minded in how these spaces might be used.

2) **Independent Existence:** These gameplaces are entities in their own right, they do not need to be filled, layered or built upon to be enjoyed or experienced, their existence is sufficient and in itself justification for their creation. The addition of other entities may add and enhance the spaces and allow their meaning to be explored but they are not a requirement.

3) **Holistic Design:** There should be no limit to the foundation disciplines, traditions or philosophies that *Scenism* draws from. Whatever the intent of the virtual space disciplines such as psychology, geology, ecology, aesthetics, spirituality – can bring valuable insight into the design of the elements and guide the design framework.

4) Authentic Places: Virtual Architects should focus on creating *gameplaces:* a memory and/or experience of a place that exists in a virtual space that holds or evokes a reaction and holds an emotional, cultural or other value to an individual or a group/community.

5) **Future Habitats:** These spaces are the future territories and habitats of man, these spaces should be treated with sincerity, wisdom and knowledge and the rest will follow.

6) **Macro Micro - Branching Design:** Places become a landscape, landscapes become the environment, and environments become the world. A fractal approach to designing these spaces should be used starting from building a sense of place in smaller constrained units and building into larger more coherent and consistent spaces.

7) Be one with Nature: These extended spaces are expressions of tangible real spaces around us; one cannot recreate these from just memory, as this would be untruthful

and insincere. Go to nature, touch it, feel it, breathe it, engorge your senses within these spaces and remain connected to how they feel, let the natural environment act as a conduit (natural environment→person→virtual environment) to bridge the realities. The natural world is not simply something to be observed and replicated but to be absorbed, experienced and shared.

8.7 **Analysis**

The main aim of this study was to unify the disparate elements of the research outputs into a coherent entity that could both become a focal point and 'entry point' for presenting the research to the wider world.

What is offered by *Scenism* is a construct that unifies the elements of VNED into a coherent system, one that combines beliefs, functions, tools and processes into a single entity. The name derived for the ideology, philosophy/tools/process developed so far. *Scenism* feels right, both as homage to the feelings and thoughts evoked from the prefix *SCEN* coupled with the suffix 'ISM' denoting a world/view set of beliefs/philosophy. As an acronym it describes the creation of the simulated natural world out of nothing, and ultimately as a focal point, a gateway from which to enter the beliefs, processes, tools, techniques and principles of design proposed by the research study.

8.8 **Critical Reflection**

8.8.1 The Philosophy of Scenism

Scenism is not simply a tool or a database or a set of guides and but it is in addition to the above a philosophy combining a deeper, richer, design mind-set in approaching the creation of new VNEs combing elements of philosophy, geology, psychology, landscape architecture joined through games design to create virtual spaces that connect with our emotions and memories, spaces that entice us to explore and immerse ourselves and to recommend ways of creating more engaging and captivating (authentic) virtual natural landscapes and environments.

This is much bigger than natural landscapes or games as this is about the creation, ***ex nihilo*** of new planes of existence. After becoming immersed in the ideas behind *Tron* I imagined 'Flynn-like' virtual architects of tomorrow standing (this will be in the literal sense given the emergence of technologies such as Occulus Rift) in vast voids of virtual emptiness and shape these new lands out of the void with nothing more than a spoken word, a hand gesture akin to how a conductor stands and guides the orchestra, using tools in essence to wrought a new symphony, so will these Virtual Architects (or *Virchitects* as I refer to them) will create new worlds, new bio systems, complete ecospheres in the void, lands, new skies, living digital systems will spout into being. These architects will be able to manipulate the virtual architecture (or *virchitecture* as I refer to it) on a micro and macro scale, no longer constrained by biological limits, either on a physical or time-based level, they will be able to manipulate the digital DNA of the smallest digital micro-organisms, vast mountain ranges with entire ecosystems, to whole planets, terraforming the empty digital void, with new virtual landscape (*virscapes*) created not from the outside through abstracted and unfamiliar tools, but from within the virtual void with nothing more than a few words and a few simple but powerful natural gestures.

8.8.2 Scenism as an 'Experience'

I imagine the design of VNEs in the near future will integrate elements of gameplay into the design process and will start on a much wider scale (i.e. with the creation of the cosmos). Users will gather small blue particles of gaseous matter with their hands, compressing them into a 'ball' (i.e similar to the game Osmos) then slowly the mass will begin to take shape, and build into a critical mass, a blue radiant energy will start to emanate from the sphere, then all of a sudden the hands compress the sphere and the sphere ignites into a star (sun), orange flames now flicker with solar flares jumping out from the newly formed sun. The '*SCENicist*' then uses their hands to 'zoom' in on a small swirling of gas to focus and once again concentrate the mass into a point, this eventually become a molten ball of lava (similar to the 'genesis' effect) and 'zoom's in once again, this time becoming human size the molten digital lava spews forth. I imagine *Virscaping* as the process of creating these gameplaces with a focus on Virtual Landscaping using Vi.N.E.C.T (Virtual Natural Environment Construction Toolkit).

The world of today has changed, the digital revolution will only grow in its complexity and its offering, and the digital domain offers an ever increasingly attractive, immersive and engaging manner to escape, and offers the freedom to create worlds and spaces we can choose to live in, worlds that are built by the one, for the one, representing true freedom (as Flynn wrote we simply must find a way to navigate ever forward).

These habitats will increasingly become our homes. In the early days we escaped reality to live in these virtual habitats, the future will see escaping these virtual spaces by going back to our physical realm.

8.9 **Implications of the Framework**

The framework has the following implications for practitioners, students and academics.

1. **New Paradigms:** Scenism provides a foundation from which practitioners are able to view digital games from new and relatively unexplored perspectives for games design.

2. **Partnerships:** Scenism promotes the expansion of VNE design through partnerships with appropriate experts; this should take the form of informal and formal partnerships such of consultancy, working/advisory groups collaborating on the creation of these new virtual spaces.

3. **Spatiality as Raison D'etre:** Scenism embraces and develops the perspective of spatiality as one of the defining attributes of digital games and as such should be core focus of implementing a 'scenistic' approach. This perspective offers game developers an opportunity to develop engaging spatial experiences using an array of game technologies that may not use 'traditional' elements of gameplay, but instead focus on emergent spatial-play elements such as exploration & discovery, prospect and refuge.

4. **Training & Education:** The framework reinforces the need and requirement for practitioners to study and incorporate other design traditions that may aid in

creating more powerful and immersive game experiences, in particular Scenism embeds aspects of landscape architecture into virtual environment design. This has particular relevance to those studying games (in particular VNE) design within further or Higher education, and strongly encourages that institutions wishing to develop expertise in this area, should look towards trans-disciplinary working as a method in achieving a 'scenism' aligned curriculum (i.e. by allowing students to undertake modules in geology alongside games design/art)

5. **Architects of Place:** Scenism promotes the idea of gameplace 'architects' in addition to the range of game/level designer roles within digital games production. These architects should have a broader training that traditional level/games designers have had. These future architects should have a deep understanding of gamespace types and how these spaces can be transformed into a variety of gameplaces.

6. **Gameplace:** Viewing virtual spaces as inhabited spaces that can connect engage and evoke strong emotions in users as such these spaces becomes places. As such practitioners should educate and immersive themselves into notion of spaces vs place, with particularly reference to the notion of embedding placeness and placelessness into the virtual environments to suit the needs of gameplay.

7. **Field Study:** Scenism promotes a deep respect for natural places informing design, as such practitioners should not only engage with the natural environment as a means to gain a deeper understanding of these spaces but they should also develop methods, process and tools in order to capture the experience and observations of natural spaces in the field.

8. **Principles of Scenism:** The principles provide an easy entryway for practitioners, artists, and students etc… to gain access to the research. The principles provide theoretical and philosophical tenets can guide any production/development in a more readily digestible fashion.

9. **MindFlow:** Mindflow provides a prototype tool as well as extensive documentation and guidelines on how the contextual reference stage within pre-production is managed. MindFlow offers students in particular a staged and transparent approach for a process that has been argued can be difficult to undertake, this is supported by the 'PrePrep' reference sorting guidelines, which should facilitate a more efficient and creative pre-production stage.

10. **Virtual Landscape Archive:** The archive acts as a repository of existing gameplaces that can be used by practitioners to consider issues of placeness and placelessness, the range of archive types (i.e. books, online gallery, interactive database with online search) offers academics, practitioners, students a flexible manner in which the visual & reflective data can be integrated into their initial research phase of development.

11. **ShadowMoss Island:** Within the framework, ShadowMoss Island provides a working exemplar of how field study could be conducted (capturing the field experience data in the journal/log) and provides a step by step guide in how a VNE design process should be staged in a contemporary (2015) games engine. The framework also offers the game level as a tool for those interested in experimenting with Scenism based approach, the pre-production documentation; the assets and the final prototype are available to offer a deeper insight into the how *Scenism* can be applied in practice.

8.10 Limitations of Study

There are no real limitations to this particular study since it does not follow or argue existing knowledge or propose new knowledge, it is merely a potentially new perspective of pre-existing ideas and objects. However, perhaps one limitation of this 'study' is due to my own limited understanding of the range of philosophies/ideologies that exists, there is a strong possibility that one, aligned to the work exists, furthermore the meaning of 'cyberspace' has not been fully explored, although the notion of the *simulacra* was briefly touched upon, there is a significant body of work that could potentially inform how *Scenism* is presented and where it can be situated.

8.11 Further Questions

Scenism opens up a raft of further questions:

1. Is *Scenism* comprehendible as a philosophy/framework/set of principles?
2. Does *Scenism* inspire and evoke celebration of landscape and place?
3. Is *Scenism* useful outside of games design and production, and can it serve as a useful framework for related disciplines such as animation, film, etc.?

8.12 Conclusion

In conclusion, *Scenism* was a serendipitous revelation, one that came about only through sharing and discussing the work with the wider academic community. *Scenism* offers an alternative worldview of how virtual spaces should be viewed, experienced, designed and considered. It would be arrogant to assume that this as a notion is without flaws, but it is presented as both a gateway into the research and as an output in its own right. *Scenism* has not passed through the lens of experiences, thoughts and reflections of other individuals (i.e. researchers, members of the public or developers), but in the future I hope to share this and receive valuable critique on whether or not *Scenism* offers something innovative and unique, or it is just simply a useful manner for me alone to conceptualise and frame the research.

Chapter 9: Discussion & Conclusions

9.1 Introduction

This chapter offers a discussion of how and if the research objectives have been met. The chapter also presents a summary of the main research findings and a critical reflection of the research methods chosen for the study. The contribution to knowledge is also summarised here. The limitations of the research are discussed next. Finally, avenues of future work/research are offered.

9.2 Discussion

The research has passed through many stages and many different perspectives from its inception to its ultimate conclusion. The review set out to explore the perception, and concept of virtual landscapes, specifically the importance, reception of these spaces and the underlying design theories, practices and perspectives driving the development of natural environments in video games. In order to see how the research was able to fully or partially answer the research questions posed at the beginning of the journey each question will be analysed separately.

9.2.1 Research Question 1

Q: *How have VNEs evolved in CVG over the last 30 years in both technological and design innovation and what has been (if any) the dominant design paradigm?*

Study 1 (Chapter 5 – *Virtual Landscapes*) demonstrated that VNEs have a long, significant and established history in video games. The literature review revealed games as a complex phenomenon that can be defined as an amalgam of technology (hardware/ software) and design. Despite the rapid evolution of game technologies, shifts in popular culture and difficulties in simulation, VNEs have enjoyed increased popularity. With the emergence of advanced software and hardware technologies, gamespaces have evolved, and so has the ability to simulate new types of natural spaces, in a variety of different ways ranging from

physiographic simulation (i.e. terrain) to now replicating phenomena such as weather and its impact (i.e. erosion). Study 1 also revealed that the dominant design approach has been heavily grounded in the aesthetic/visuals of how the environments looked; only recently have developers started to look into other disciplines to inform natural environment design.

VNEs are now increasingly becoming larger, more engaging and immersive due to technological advancements, and due to increased understanding of game design, this has resulted in the expansion of gamespace (i.e. emergence of openworld games, the majority of which utilize representations - either realistic or surreal - of the natural environment).

Study 1 also revealed the lack of digital (or otherwise) repositories and/or archives specifically for video games. In addition, there is limited visual research and historical archives of gamespaces. This is compounded by the rapid evolution of computer and video games, the move from physical to digital storage media, and both the limited lifespan and number of physical storage media, hence there is serious risk that these environments (which currently only exist within the games themselves) will eventually be lost as the limited physical storage media either degrades past a useable point, or the number of functional copies in circulation is reduced. Given the importance of these environments/ spaces and the strong possibility that future researchers will at some point require these increasingly rare games to further our understanding of how and why the medium has evolved along certain directions, it is critical to recognise the preservation of games as artefacts. This is something that the *Virtual Landscapes* study attempted to achieve.

9.2.2 Research Question 2

Q: *How have VNEs been perceived and experienced in games in CVG over the last 30 years?*

Study 1 clearly illustrated through personal reflections and external feedback that VNEs are more than virtual spaces; they bear hallmarks of 'place' as they are able to evoke strong emotions in players, many of whom stating that they form a critical part of the wider experience. These VNEs have been/can and are enjoyed in their own right. The literature review revealed that both game theorists such as Aarseth (2007), Jenkins & Squire (2002) and architects such as Brouchoud (2013) believe that virtual environments deserve to be recognised as more than a support mechanism, but rather as a focal point, as they state the *'raison d'être'* of a game. These gameplaces are entities in their own right, they do not need to

be filled, layered or built upon to be enjoyed or experienced; their existence is sufficient and in itself justification of their creation. The addition of other entities may add and enhance the spaces and allow their meaning to be explored but these are not a requirement.

Study 1 also demonstrated VNEs can exist as artefacts outside of the games as a medium, and is of interest to individuals who enjoy either real natural landscapes or other artistic expressions (i.e. art, photography, etc.). The work was able to connect with a wide audience of individuals (e.g. artists, authors, print makers, landscape architects, non-gamers) to incite celebration of these spaces and more importantly discussion about the importance, function and future of VNE design.

Virtual environments form a major component of gamespace and play a significant part in the resulting gameplay experience. Adams (2009) has argued that a critical dimension impacting gameplay within gameworlds is the physical dimension and spatial dimensionality is a key element within the physical dimension. The research has demonstrated that boundaries have lessened due to technological advancements therefore spatial dimensionality has a critical influence on how the wider gameworld can support or undermine gameplay.

The literature review revealed that game theorists Jenkins & Squire (2002) view that games should be viewed as spatial art. This study has shown that this perspective, from which to view virtual environments, is not only valid but should be the dominant perspective from which games are viewed. The research demonstrated that viewing games as spatial art has a theoretical foundation and suggested how these can be informed by areas such as landscape art, architecture, gardening and park design (environmental storytelling); however, these areas were not fully explored but were indicated as interesting areas for further study.

The research also demonstrated that changing practices/alternative perspectives of design in commercial games development, as well as experimental data (Study 2, Chapter 6) could create more emotionally rich spaces. Jenkins & Squire (2002, p.7) stated that "*as game designers dig deeper into these artistic traditions, they may develop more emotionally evocative and meaningful spaces*".

The most significant finding was that these VNE realms are not mere representations, facsimiles, copies or mere virtual dreams secondary to the physical spaces but *Extended*

Realities. They may lack conventional physical properties that the physical world has, but they are real - they have real meaning and impact on the player who can connect on deep personal and emotional level. Thus, they should be considered, created and respected equally to real physical locations. Developers need to consider how these spaces are actually used and experienced. These spaces are the future territories and habitats of man, these spaces should be generated with sincerity, wisdom and knowledge.

9.2.3 Research Question 3

Q: *Can the intangible essence of natural landscapes be distilled into a structural production-based framework for virtual landscape design?*

The first step in the investigation was to explore the often romanticised term of landscape into a tangible and definable term through the literature review which identified useful notions of landscape, which were used to arrive at a definition of the term landscape, and as a construct that is made from the abiotic (physical) and perceptual (psychological) components. The literature review as well as Study 1 identified and illustrated that under the abiotic (physical) aspect of landscape, *Landscape Character Assessment* (LCA) offers a practical framework for structuring and classifying the abiotic elements of virtual landscapes. Although more work needs to be done to fully reconcile LCAs with VNED, Study 2 demonstrated that it was, from a practical perspective, viable to use the LCA framework to guide the production of a VNE with the outcome being an engaging and evocative space.

In addition *Biophilia*, specifically *Biophilic Design*, was identified and tested (Study 2) as a useful and practical alternative to LCA in offering a framework to structuring the abiotic elements of an imagined VNE. In order to develop a framework for the perceptual/psychological elements of a landscape, several elements were tested from geology (Relph's notion of *place*), *Genius Loci* and cognitive spatial mapping. Relph's theory of *place* and *placelessness*, in particular *existential insideness*, was identified as a useful design goal for environment architects to aim for in order to avoid environments that exhibit '*golf course design*' - a term that was created based on observations from visual data in Study 1 - and evoke feelings of '*placelessness*'. These theories were used to bring a sense of place and uniqueness to the VNE design of *ShadowMoss Island* (Study 2). Cognitive spatial mapping was used to try and embed spatial mapping into the VNE with a view to aid players navigate; although the

initial analysis and reflection appeared to indicate this was a useful theory not enough quantitative testing was carried out in order to arrive at any useful conclusions.

The second step was to theorize, experiment, test and reflect upon a practice-based framework for building a VNE. Using a range of theoretical perspectives as a foundation for the VNED, a range of design templates were tested in Study 2, and concluded with presenting a viable production based framework for combing the abiotic/perceptual elements of natural landscape that was tested in a modern games engine.

Practice methodologies (workflows and pipelines) from a designer's perspective are extremely limited in supporting natural environment design creation. This became especially apparent while searching for appropriate guidance/literature. The research indicated that this is impacting students or novices entering the practice more than professional developers.

During the research, the literature review revealed the works and philosophy of art critic, John Ruskin. By applying his philosophy of art practice (that both observation and imagination should be grounded in reality and that one must '*go to nature'***)** Study 2 demonstrated that using field trips to ground environment design offers designers a method of collecting and capturing contextual natural environment information. Using Ruksin's *'go to nature'* dictum, a field trip to a scenic natural environment (Moel Siabod, Wales) was undertaken in order to explore the concept of landscape from a personal perspective. These extended spaces are expressions of tangible real spaces around us, one cannot recreate these from memory, as this is a distorted truth.

However, these trips are a costly resource, and given commercial development constraints, the process should be supported by guidance (observational vs psychological). Study 2 provides both guidance and recommendations on what should be observed (using either Biophilic design/LCA as a foundation). Nevertheless, there is scope for developing this guidance further.

9.2.4 Research Question 4

Q: *How can one employ a practical approach to natural environment design which goes beyond the dominant paradigm exemplified by narrative/visual driven design?*

Study 1 identified and used landscape architecture through the LCA framework to create a theoretical VNED. Study 2 applied the theoretical approach gained from the previous study to formulate, and employ a practical approach to the creation of a VNE in a modern game engine (CryEngine).

The literature review revealed that VNE design guidelines for practice was minimal, where it exists it was primarily an artist-driven process, or narrative-driven. However game theorists such as Totten (2014) have presented alternatives (games as spatial art/architecture). Virtual environment design can and should be, where possible, grounded on both observational and emotional data; the use of field trip to inform the design of virtual spaces can add richness and a deep quality to imagined spaces.

The research also presents a practical '*Macro Micro branching design*' system (i.e. landscapes become the environment, the environments become the gameworld). There is a fractal pattern and approach in environment design that starts from building a sense of 'place' in smaller constrained units building into larger coherent and consistent entities.

9.2.5 Research Question 5

Q: *How can one create a framework for VNE designers that incorporates (external design and otherwise) traditions but remains connected to the reality of games production?*

The final culmination of the research is presented as a holistic ideology: *Scenism*, which incorporates elements from landscape architecture, psychology, geology, HCI design. There are now a range of extensive technologies available for creation of realistic landscapes, however there appears to be very little theoretical underpinning the foundation behind usage beyond visual preferences (realism) (i.e. geocontrol/world machine and the theory of erosion (which implies time-depth) for instance.

9.2.6 Research Question 6

Q: *How can one go beyond the current paradigms in organising and managing multivariate contextual reference data in the pre-production phase of creating of a virtual environment?*

Study 3 (*MindFlow* – Chapter 7) and the literature review investigated design tools for the research and reference phase in games development. This revealed they are limited and

currently are struggling to effectively support design practice; research was geared toward visual reference material (multivariate) and the pre-production phase of creating a VNE.

Study 3 revealed that the ZUI interface metaphor is more naturally aligned to the workflows and practice of designing, implementing and creating virtual environments in a more natural manner, than using tools based on the conventional desktop metaphor. Study 3 also experimented with the idea of exploring alternative paradigms of organising visual data and using Microsoft's DeepZoom technology which produced a prototype tool that was used in the creation of a game artefact in study 2 (*ShadowMoss Island*).

9.2.7 Research Question 7

Q: *How can one present and illustrate the research findings and any practice outcomes that will appeal to wide audiences (researchers, games, developers, students, etc.) in order to incite cross-disciplinary discussion and development?*

The research was disseminated in a wide variety of formats. A blog, a series of print books, a series of digital books published on the two major mobile platforms (IOS and Android) and stores (iBooks and Google Play) and a website for the *Virtual Landscapes* project. Each study was disseminated in a number of ways. The resulting visual data was easily transformed into various forms of highly accessible material in order to engage, inform, inspire and help the various groups listed below.

Study 1 (Virtual Landscapes) utilised grounded theory and produced the following:

- **Researchers**: access to the literature review and to a large archive/repository of visual data from VNE historical visual analysis that was coded and categorised
- **Gamers/developers:** access to three volumes of print/digital books on a range of platforms.
- **Students:** access to the visual material/books, as well as the *Virtual Landscapes* interactive archive.
- **Members of public/ Non-gamers**: access to the *Virtual Landscapes* ebooks, through iTunes/Google Play and the *Virtual Landscapes* Blog.

Study 2 (ShadowMoss Island) utilised experimental practice and produced the following:

- **Researchers/Gamers:** *ShadowMoss Island* Artefact provides an outcome that can be tested/critiqued as well as experienced and enjoyed.
- **Developers/Students**: production guidelines for *ShadowMoss Island* can be used as a starting foundation to test new theoretical designs, or for novices/students to use in building their own VNE.

Study 3 (MindFlow) utilised experimental practice and produced the following:

- **Researchers**: *MindFlow* tool
- **Developers/Students:** production guidelines for *MindFlow* tool can be used as a starting foundation to test new theoretical designs, or for novices/students to use in building their own tools.

In concluding the work I am drawn to a quote from the film *Inception* (2010) where during a discussion the film's main protagonist, Dominic Cobb, offers Ariadne the opportunity to work as a dream 'Architect' designing 'levels' for his next project.

> *"The chance to build cathedrals, entire cities - things that have never existed, things that couldn't exist in the real world..."* Dominic Cobb (Inception, 2010)

In the film these 'architects' are responsible for the creation of surreal imagined worlds, (part dream, part design) which are underpinned by powerful technologies enabling a designer to define and control the architecture of the designed reality from within. After the journey I have undertaken with the research, through existing practice, my own experimentation with process, technique and perspective, I started pondering, thinking and questioning the nature of the different realities around us.

9.3 Summary of Main findings

9.3.1 Space in Digital Games

The research has demonstrated that space within games (virtual environments) should be and, in many instances, was perceived as the primary aspect of digital games. The literature review explored the defining qualities of games revealing Aarseth's (2007, p.44) belief that "*The defining element in computer games is spatiality*", and this study supports this position as virtual environments are more than capable of being the *raison d'être*' of a game, and they can either be enjoyed in themselves, as they are able to elicit play through exploration, or are capable of acting as a vessel for other important aspects of a game such as a narrative device.

As Aarseth (2007) and Brouchoud (2013) argued, spatiality is a defining aspect of digital games and although this view is recognised within the field of game studies, virtual environments are still considered by developers to be a secondary or support mechanism to other elements within a game. This research suggests that viewing games as spatial art is an under-recognised perspective, and that this is valid approach to take, and as such should be explored and developed.

9.3.2 Gameplace

The literature review identified a key term '*gamespace*', often discussed alongside 'virtual environments' or particular spaces within a game. The review revealed *Gamespace*s are archetypal forms of how space within a game is embodied and presented to, and experienced by the player; it is however a generic term. The research viewed the notion of space and place from a geographer's perspective noting the strong distinction between '*space*' and '*place*'; the former is a term used to describe a quantifiable dimension/location/position that is abstract and without meaning, whereas the latter, although it still has spatial qualities, these are in some way bound in meaning and context. The research therefore suggests that programmers build space, whereas designers build place.

Furthermore, this study proposes *gameplace* as a complimentary term to sit alongside *gamespace*; gamespace may refer to the particularly arrangement/configuration of the virtual space/environment in a game, whereas *gameplace* refers to a particular and specific location

within a gamespace that evokes meaning, whether that is to an individual or a group on a personal, cultural or otherwise level.

9.3.3 Landscape Architecture & Games Design

As games technology has advanced, realism (and the notion that increased realism leads to greater immersion) is increasingly being embedded into virtual natural gamespaces, as such it is reasonable to conclude that given the size, scale and complexity of these new spaces, traditional architecture in its variety of forms will be increasingly required to create these new realities.

Brouchoud (2013) and Walz (2010) believe that games have the power to forge the future of ludic space-time. The research so far supports this assertion that architecture, specifically landscape architecture, will increasingly be fused with game design to create a new type of design and will herald new roles crossing the boundaries between games design and art. The research not only presents a theoretical model but also presents a practice-based outcome (game) to illustrate that this can be a creative and feasible approach.

The research also suggests that scientific subjects such as environmental psychology, landscape architecture, geology and/or landscape aesthetics have significant established bodies of knowledge that can directly support, improve and enrich the development of more immersive VNEs. The identified subject areas are useful in further developing the education of the next generation of natural environment designers but also in evolving the creative and technical aspects of computer and video games practice.

Collaboration would be best achieved by game developers directly engaging with subject specialists as consulting partners on specific areas of design, and experts from the range of subjects mentioned above being made aware of the similarities between their subject areas and games design and production.

9.3.4 World Architect

Games design is an immature discipline, the field, has not been crystalized yet and is still in a 'feuding tribal' era with pockets of theorists arguing with competing theories that are almost a minefield to navigate for novices/students.

The role of game designer is relatively new and only emerged as a response to the technological innovation in digital games outpacing the ability/skillset of the core role of programmer. The discipline has seen two fundamental shifts from its focus and it its changing nature of the role:

1) Games design has seen a shift from programming-centric design to aesthetic-centric-design
2) The role of designer has fragmented from the over-arching game designer into the core role of level designer, which recently has evolved into the role of world builder.

This new role, responsible for the planning and implementation of space within games, is growing in critical importance and will become a discipline in its own right. The research indicates that the eventual role of *World Architect* will emerge as a major role within game development, in response to advancements in technology and player demands for new types of more immersive gameplay and gamespace. Subsequently the education of these architects should involve a much wider understanding of the meaning and impact of different types of spaces/places.

9.4 **Effectiveness of Research Methods**

The research strategy was informed by the literature review which identified a lack of appropriate grounding of the existing VNE associated areas of research. There was little or no relevant work that had presented VNE in any significant form that could be discussed or analysed. Based on this, a decision was made to establish a firm foundation from which to explore the subject. The research relied on a *methodological bricolage* (i.e. mixed-methods to triangulate where possible all the data). This involved a variety of different methods, often with competing perspectives (artist vs. researcher). This proved to be invaluable in locating and identifying the gap in the knowledge space, as well as guiding the practice, and ultimately the research outcomes in order to have an impact/use for a variety of audiences (i.e. researchers, students, developers).

Practice-based research formed a major component in the research, and on reflection this caused both difficulties and successes. The research engaged with practice as a result of

previous practice work indicating that this was a viable and useful approach in finding a solution to a complex and unexplored area.

Action research was also utilised to drive cycles of practice, reflection and then action, with each study providing a foundation for the next. On reflection this worked extremely well; however the first cycle took far too long. This is something that was to be expected, but the process of finding ones feet in the first point of engaging with practice, the confusion and difficulty in trying to satiate the demands of artistic practice against the requirements of a rigorous and methodical research process meant that the first cycle took over three to four years when it should have taken no more than two in order to work through at least three to four cycles.

Reflective practice has been an incredible useful framework, although more work should have gone into assessing different models of reflection, the act of reflection in, on and for action has resulted in key and critical observations that have helped me identify and separate interesting ideas worthy of further investigation.

The first part of the research utilised visual grounded theory as well as practice to provide a foundation from which to start building a new theoretical framework, which was later on tested through experimental practice. This was an exhaustive and time-consuming method; however the intention was to build a repository of primary data that was not clouded or tainted with bias of the beliefs or perspectives of others. The difficulty was in choosing the type of analysis to carry out, and traditionally this would have been focused on textual analysis, though since the visual element of VNE spaces is a conducive entry-point in aiding reflection and analysis, a decision was made to use visual grounded theory through photography in order to produce primary data which could then be sorted and analysed in order to identify trends and build into a theoretical framework from which to test in the second cycle.

The study used visual grounded theory as a basis for the first research cycle as it is a useful research method for gaining insight into practice where the visual element is a major component, and offers a less difficult entry-point for reflection and analysis, both individual and collective.

9.5 **Limitations of study**

The lack of relevant previous studies is perhaps the most significant limitation this investigation has faced, an inherent weakness of games design research. The area of games design, specifically games and landscape architecture is new, and as such still has not yet crystalized as an established field of enquiry. In one respect the lack of equivalent studies is an indicator that the work is original, unique and noteworthy, on the other hand it makes it more difficult to build and sustain arguments, to find a suitable gap in the knowledge space, when there is a paucity of relevant literature in the field

A second limitation is that the embryonic field has mainly focused on pure game theory, with passing reference to exemplars of practice (most often these are references to games that are sometimes decades old). In addition to this, games (as artefacts) embody a great deal about the subject, but the process, theories and practice underpinning development is not accessible or in the public domain in readily accessible form.

This is also compounded in practice, the lack of equivalent practice that was research-focused was minimal; time and resources must be spent laboriously testing out tools/technologies, rather than using existing work to build upon.

On a methodological level the study was limited by the use of an emergent methodology; whilst this provided a reflexive and reactive approach to the changing nature of the investigation, it also slowed it down in comparison to a study using a more traditional methodological approach.

The following is a breakdown on how each component of the research was potentially limited.

Study 1:

- Selection of artefacts (review): Due to time constraints, artefacts were chosen by a personal selection and based on wider recognition, however this needed to be informed by a more reliable and non-biased opinion, with hindsight and additional resources, and the benefit of the literature review, a more stringent and appropriate selection list could have been drawn up.

- The main focus on LCA: a greater level of inquiry into other possible alternatives should have been conducted.
- Limited hardware and software resources to deconstruct games: due to a lack of technical expertise (i.e. programming knowledge) and availability of games (some were only available in physical format) this limited the study. With increased software and technological advancements it may be possible to overcome these issues, however at the same time, as the industry matures, the risk of older physical storage bound games being lost or the inability to emulate them on new platforms may increase.
- There is also the added limitation of intellectual property laws: the research had to tread a careful line of using academic "fair use" and falling foul of anti-piracy laws (such as the Digital Economy Act, 2010). A considerable amount of time was spent on navigating this grey area to ensure the research did not engage in any aspect in illegal activity and maintain its intention of celebrating and inciting discourse on the value and importance of VNEs and games as important cultural artefacts.
- A greater sample size for the testing of the interactive app and/or the use of the pre-existing UX/UI questionnaire.

Study 2:

- The second study was limited due to hardware resources constraints; research funding would have been extremely useful in negating this limitation.
- Due to time constraints a decision was made to focus on the design and creation of the game, as well as a personal playtest which limited the results. A more developed quantitative and qualitative testing of the *ShadowMoss Island* game would have negated this limitation.
- The chosen technology (CryEngine) acted as an internal limitation, since it required server side authentication on every test. This proved to be very difficult to deploy and test in any public environment as the technology required to run the game also limited the potential audience, as such a potential method for negating this is to use a games engine (Unity) that can be packaged, configured and ran with little or no work.

- The testing/feedback that did take place was all external to the game and potentially impacted the results. Embedding the testing and feedback mechanism directly into the game, in order to remove any bias or loss of the experience, is potentially a more suitable method.

Study 3:

- There was a limited exploration of technologies to develop the prototype. Although Deepzoom proved invaluable it had limited the functionality of the final prototype.
- Study 3 was limited by a lack of programming knowledge specifically Ajax, Seadragon, Deepzoom and related software. Higher level functionality was available but accessible only with intermediate/expert programming knowledge.

9.6 Contribution to Knowledge

The research has made the following contributions to knowledge:

1. The research has implications for games as an industry, games as an educational subject as well as Architecture. The study presents working models, as well as practice that can be utilised in these areas.

2. The research produced a rich, interactive, visual media repository consisting of a review of the historical and contemporary state of VNEs over the last three decades. This digital archive is unique and is an open and public repository available to researchers, gamers and developers to use in any manner they see fit.

3. The research reviewed the current state of games environment design and outlined some of the challenges and issues that have developed, and how these can be addressed by using a new approach grounded in landscape architecture. The research contradicts traditional conventions of environmental design in games, in that it should be a design-driven process rather than art-driven process.

4. The work provides an experimental assessment of using landscape architecture as a foundation to design and build an immersive VNE, and produced guidelines and extensive practice-based guidance for students and novices entering the profession. This includes software, hardware and creative guidance.

5. The research combines disparate elements such as geology, landscape architecture, psychology, with games/environment design proving that an inter-disciplinary approach is effective, practical and a more evolved approach in creating rich and immersive spaces. This approach is presented as a new ideology/philosophy for how natural space in games should be perceived, designed and experienced.

6. The research builds on theoretical principles such as games as spatial art, and demonstrates how it can be applied in practice; this is evidenced by the range of documentation demonstrating processes/techniques as well as presenting functional guidelines for students/novices wishing to explore the field.

7. The work offers a strong theoretical foundation for the use of landscape architecture in games that is grounded by commercial practice and the needs of students. The study also introduced a new term into game theory (gameplace) and offers confirmation that games should be viewed as spatial art.

9.7 **Further Questions**

There have been periods of elation when new ideas spawned from the original research investigation were explored, however not all of these tangential questions were fully or even partially explored, to do so would be a disservice to those areas that demand and deserve a thorough and sincere exploration. From a personal perspective, these are issues that I may very well explore after this study, either through pure practice or research or both, and I could happily spend the next several decades exploring these areas, and only learn a fraction of the land of knowledge I see on the horizon.

The research attempted to study the perception, impact and creation of virtual natural landscapes and whilst it has explored and answered a number of research questions, it would be an omission to state that an extensive array of further questions were not raised by the research. These are:

1. The literature review identified a variety of forms that gamespaces many take including the 3D openworld game. This became the focus of the work presented in this thesis but a recent phenomenon in games, the surge in 2D ‘retro’ games, has

highlighted a future area of study: how do the VNE principles and design guidelines produced so far work in a game that utilises a 2D gamespace? A 2D gamespace can involve lower technical and resource demands than a conventional 3D game, and may offer the opportunity to rapidly create, deploy and test a VNE design.

2. The research also briefly looked into the relationship between believability, immersion and realism within games. An opportunity for further work lies in further exploring these elements with regards to how VNEs are experienced and or perceived.

3. The study, in particular the practice work so far was based on realistic simulation of a natural environments, however there is scope to examine how a surreal or abstracted VNE could be created using *Scenism*. Is the proposed VNED framework able to effectively support the creation of a new surreal VNE?

4. A paper by Jenkins & Squire (2002) proposed viewing games as spatial art. The idea of viewing games as primarily a spatial experience, and informing their design using by traditions such as gardening/park design was something I had very early on suspected to be something interesting to explore, however this came very late into the research and as such the work has not explored these particular aspects: VNE design informed by gardening/park design.

5. The literature review, as well as Study 1 illustrated the changing nature of gamespace; however only in the last few years, with the release of new VR technologies, there have been indications of a significant paradigm shift, and that digital games are about to enter a significant period of change with the emergence of a range of stable, affordable and mass-market VR and AR technologies. Given the naturalistic manner in which space is experienced in VR (i.e. offering a greater visual and perceptual alignment compared to a conventional 2D screen) there is scope to examine how VNEs are experienced differently (if at all) when viewed in VR, and how this would impact and change the design of these spaces.

6. As my knowledge in this area grew, coupled with an increased confidence and insight into the practice, I became convinced that VNE's can and should be viewed as pure experienced spaces without the need for traditional notions of gameplay, or as

secondary considerations; they have value in their own right. There were indications in related research (not investigated due to the scope of the research being limited in order to maintain coherence) concerning the possible restorative effects, and how these virtual natural spaces are experienced by non-gamers.

7. An area of interest that developed during Study 2 was the idea of *cognitive spatial mapping;* a term used and researched extensively in geography/cartography. The field trip to Moel Siabod and my previous hiking experience had sparked interest in exploring cognitive mapping techniques for navigation purposes, and this was further highlighted by the literature review in Chapter 7. A further question arises in how can the *cognitive spatial mapping* techniques be designed and embedded in a VNE.

8. The literature review for Study 2, as well as the process of creating a VNE identified the time-consuming nature of creating unique places in a VNE. The review identified work by Richard Dube '*Natural Pattern forms: a Practical Sourcebook for Landscape Design'* (1997), which appeared to align very closely with the demands of creating *ShadowMoss Island*. An opportunity for further work lies in adapting Dube's work with its foundations in landscape design to a Framework (i.e. a visual dictionary of archetypal spaces) for natural pattern forms for contemporary VNED.

9. Study 3 investigated the use of visual imagery in the research and reference phase of game development. However during the creation of practical work (*ShadowMoss Island*) it became apparent that relying on an image, which is open to misinterpretation as meaning is constructed based on the individual's experience, values and beliefs, leads to an interesting problem: how can one add metadata to any image including annotations that would enable a more accurate representation of the meaning that is attempting to convey?

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