An Exploration into the use of Visual Semiotics in Immersive Environments and Computer Games: How to guide the mind.

Descriptive Abstract:

This work has been constructed as an attempt to understand the way in which human players move around an immersive environment, and therefore how this movement can be influenced through the introduction of visual stimuli. By understanding this both time and cost can be reduced for games developers. In order to do this research has been conducted in visual semiotics, proxemics and computer game theory along with many other related disciplines. Primary research data concerning game player's gaming preferences and their views on the importance of visual signs within an immersive environment has been collected and analysed. Alongside this observations have been used to ascertain the difference between player's views expressed in the questionnaire and during game-play. From the analysis of this information a series of immersive environments have been constructed using Unreal Tournament 2004 to practically test the research findings; these findings have then been analysed and conclusions drawn. It is proposed that we can guide the human mind and as such game development time and cost can be reduced.

Keywords: Game Theory, Gamer, Immersive Environment, Proxemics, Unreal Tournament, Visual Semiotics.

Contents:

i. List of Abbreviations:

FPS – First Person Shooter

GW – Game World

IE – Immersive Environment

MMORPG – Massively Multiplayer Online Role Playing Game

RPG – Role Playing Game

RTS – Real Time Strategy

UT2K4 – Unreal Tournament 2004

UT2004 - Unreal Tournament 2004

ii. Notes:

1. Throughout this work footnotes can be found, these highlight authors' notes and the inclusion of additional work which has been placed within the appendixes.

2. Some sections will refer directly to the appendix, this decision has been made as the work here is not critical to the understanding of the project; however, it does complete the project development developing from one section to the next.

3. The terms "immersive environment" and "game world" are used interchangeably throughout this work too acknowledge the similarities between games and simulations as immersive environments. However a distinction in their context must be made, "game world" refers to an "immersive environment" with the addition of narrative.

4. The attached disk contains all relevant work. The root folder contains this text document and an excel spreadsheet which holds all questionnaire data. Two folders can also be seen, "Observation" which contains all videos, photos and log files collected; "UT2004" contains all the relevant maps, textures and code needed to reproduce the tests.

iii. Acknowledgements:

This work would not have been possible without the support of Dr. Ir. Colin Price, University of Worcester for his constant guidance throughout this project. To which great thanks must also be given for the code found within Appendix 4 allowing for the logging of player movement within Unreal Tournament.

I am also grateful to John Price, University of Worcester, for allowing research to be conducted with his students during the course of this work. Many thanks to Kim Sutherland for her constant support and encouragement throughout this project. A final thank you must be given to all participants who took part in this study, allowing for a wide range of data to be collected helping the creation of a theory regarding human movement in immersive environments.

v. Declaration:

I declare that this Independent Study is all my own work. All sources are carefully acknowledged and referenced appropriately. I confirm that this work has not been used in any other academic context.

"Every cultural pattern and every single act of social behaviour involves

communication in either an explicit or implicit sense"

(Sapire, E. In: Huhtamo, E., 2003).

1. Introduction:

A project aims and brief has been included, it is this which the following work shall be based upon although adjustments may be made to suit the projects aim during its development.[1]

This research project will explore the concept of semiotics and how semiotics can be used within the analysis of immersive environments (IEs). Semiotics is the theoretical construct for studying the world around us, everything which creates information, understanding or is understood by our preconditioned mind (e.g. red = stop). Chandler (2007) states that, "information or meaning is not 'contained' within books, computers or audio-visual media... ...we actively create it based upon a complex series of codes or conventions of which we are normally unaware" (codes being a framework under which semiotic signs make sense [Chandler, 2005]). Peirce (in Port, 2000) argues that in order to do this we respond to signs through the mental stimulus (codes) they create; these signs are then split into three subsets, the icon, the index and the symbol. **(1)** Icon, an icon physically resembles that which it stands for; an example of this could be the picture of two computers signifying network connections on a Windows computer user interface. **(2)** Index, an index implies something else; an example would be the earlier example of red = stop, red implies stop (Port, 2000). **(3)** Symbol, a symbol is a visual representation for something other than itself, in daily life

[1] A rough plan has been created to help focus the mind on both order and content of the project. This plan is subject to change however it can be found within its original form within Appendix 1.

the most common example would be the toilet signs we see on male and female toilets; representing a man but meaning male toilet (Hartley, 2007).

This individualistic process means that it is difficult to find a standardised, defined meaning for the term semiotics; with one common definition being the "science of signs" (Morris in Chandler, 2005). This work will endeavour to interpret these codes and conventions in order to gain a general awareness of human interaction with IEs. By doing this an attempt will be made to create a theory with which to influence the human player based upon the semiotics of the visual game world (GW). Semiotics has converged with many academic disciplines since its conception, primarily accredited to the Swiss linguist Ferdinand de Saussure. However the approach only began to infiltrate modern cultural studies within the 1960s and from within this field visual semiotics began to emerge (Chandler, 2005). Ferri (2009) argues that "semiotics has always managed to re-think itself, broadening its focus without losing coherence," here it will be attempted to broaden the horizons on visual semiotics without losing the focus governing its very nature.

In more recent times academics such as Ferri, Kucklich and Myers have began studies regarding the semiotics of computer games and IEs. There is yet to be a single coherent theory on the use of visual semiotics within the movement of human players throughout these virtual worlds. This project will seek to explore existing theory regarding visual semiotics, visual semiotics within computer games and computer game theory. The results of this exploration alongside first person research will help in the formulation of a theory of human interaction within IEs. In order to do this some of

the fundamental concepts of semiotics shall be explained, the concept of signs has been developed earlier. Harley (2007) explains that these signs are found within a semiotic text, the word text has developed from meaning a written work to anything that can be interpreted; texts include books, adverts, television and IEs.

The codes with which we use to understand these texts are constructed on a basis of social codes gained through cultural conditioning. Cultural conditioning supposes that culture is objective and can therefore be measured. This culture is then enforced onto the population creating a person that fits into the society's cultural norm, an example within Britain would be thinking of a burglar wearing a back and white striped jumper or thinking of paradise as a beach with white sand and sunshine. Next the narrative of a the text must be explored, narrative does not only refer to the plot, storyline and discourse it is also used to explain the ideology and presentation of the text as a whole, as such it is critical to understand the narrative of the IE prior to analysis. Discourse is the social process of making and reproducing sense, the creation of meaning through the abstraction of language. This may seem irrelevant to visual analysis of IEs, however, game players find themselves using discourse within their games. This may be semantic when a player types that they have "pwned" (meaning "owned" or beaten) their opponent; but it may also be in reference to the discourse of computer games themselves e.g. the generic appearance of in-game pickups (Harley, 2007).

2. Project Methodology:

From surrounding research and past knowledge it was decided that a single system development life cycle (SDLC) or rather in this case project development life cycle (PDLC) would not be sufficient to cover all the required areas. It would seem a combination of a traditional waterfall methodology with the use of structured systems analysis and design (methodology) (SSADM) for the research project and an iterative development for creating the IEs, required to test the projects research, would be necessary. The is due to the Waterfall SDLC's weakness in isolating problems during the feasibility stage, the iterative approach will allow for problems to be resolved later in the SDLC. (Gangolly, 1997) In order to ensure this project proceeds smoothly further research has been conducted into the two chosen approaches and construction of a project plan supporting these has been created.[2]

2.1. The Waterfall PDLC and SSADM:

See Appendix Two.

2.2. Iterative Approaches:

See Appendix Two.

[2] See Appendix One for Project Plan.

2.3. Combined Methodology:

The combination of the two chosen methodologies has been outlined in the above sections. In its final form the project methodology is viewable as:

Requirements	Waterfall
Analysis	Waterfall
Design	Waterfall
Coding (Creation of IE)	Iterative
Testing	Iterative
Acceptance/Implementation	Waterfall

Table 1: Project Methodology

Further attempts will be made to nullify the weaknesses outlined in the methodologies above, these include:

SDLC (Waterfall); **(1)** lack of control – Due to the estimated timeframes for each section of the project development there is always the chance that the project could fall behind schedule. (Avison and Fitzgerald, 2002) In an attempt to reduce the effects of this scenario a contingency of one week has been built into the projects timescale. **(2)** Emphasis on 'hard' thinking – Due to the rigid nature of the SDLC and the assumption that there is a technical solution to the problem at hand the SDLC can often be hard to construct among problematic and ambiguous situations. (Avison and Fitzgerald, 2002) This argument put forth by Avison and Fitzgerald supports the use of

an iterative approach used alongside the SDLC, the project predominant question is not of a technical nature but rather humanistic. In order to ensure the project does not purely rely on hard think the human core must never be forgotten, this can be seen through the videos that will be recorded as the human player explored the IEs.

Iterative, **(1)** lengthy review and analysis times – the amount of time spent reviewing and analysing iteration's of the project will be reduced through the use of the same analysis methods. This will provide the researching with a common set allowing the process to be completed smoothly and on time. **(2)** No overlap in development – as the current iteration relies on the completion of previous iterations there is no overlap in the projects development. Whilst this may pose a critical issue for a team of developers this is not an issue with only a single researcher as only a single iteration can be managed at any given time. **(3)** Lack of knowledge regarding the system requirements – using the iterative method can result in a lack of knowledge regarding system requirements. This is due to the process beginning before all necessary research has been completed, however this issue can be addressed for the purposes of the research at hand. This is accomplished through the blended waterfall and iterative methodology meaning all (available) research has been completed prior to building the IE. However this is not to say that additional information cannot be extracted during the iteration phase.

Lastly in order to ensure the combination of the chosen methodologies is effective single level feedback paths with be utilised. (Jayaswal and Patton, 2006) It is this that

allows the theoretical transfer of from one stage in the SLDC back to the prior stage, allowing the iteration needed to develop the IEs.

3. Literature Review: Visual Semiotics and Visual Understanding:

The purpose of the literature review is to understand current visual semiotic theory as well as the concepts of genre and context. In order to do this key authors and texts will be addressed and summarised, this is then combined with the literature review in section four to form a combined theory used with data analysis and map creation.

Moriarty (1994) proposes that semiotics is useful for analysing visual communication, something which is now (2010) generally seen as true. However, Moriarty expands this by explaining that the processes used to analyse a visual medium are directly parallel to those used to create the medium; meaning semiotics and visual communication are so intrinsically linked that they becomes “visemics”. In support of this Moriarty (1994) explains an advertisement of a car, here he states that the car stands for personal achievement, a status symbol, rather than just providing a method of transport. It is this level of uncertainty that concerns Dillion (1999) who argues that images, unlike the relative certainty of language, say nothing. These meaning have no clear syntax to articulate the artist’s meaning; instead they rely upon a series of arrangements which signify a meaning to the observer. This would suggest that it would be difficult to analyse the interactive art that is an IE, in order to understand the players behaviour it

is important to understand the effect the environment is having upon the player themselves.

Williams (2002) concerns himself with how we read film and television; here he states that watching television is commonly regarded as a passive activity, something we do in order to relax. However, this is not the opinion of Williams himself (2002), he believes that watching television is an active process of "interpretation and comprehension." It is the subconscious nature of this process which causes us to believe the act is passive, a process by which we formulate the information we have with the information that is presented to us. In order to begin this argument Williams (2002) takes us back to our childhood understanding, here we begin to learn how to interpret visual communication, body language, dress and visual signs (e.g. the gendered toilet icons); all of these things become semiotic signs which we assert meaning to within a particular context. To provide evidence for this an image of the sun within a film is used, this has an indexical relationship to heat, supported by the main character sweating. The viewer cannot feel this heat, however, whilst watching the film they are still sure of its existence due to our familiarity with these signs within the real world. For this research project we can assume that a player interaction with an IE is constructed in the same way as our interaction when watching a film or TV programme. The major difference being the subconscious development of our understanding is then broadcast through an in-game persona; as such, we must seek to understand if this has any major effect on our conscious mind.

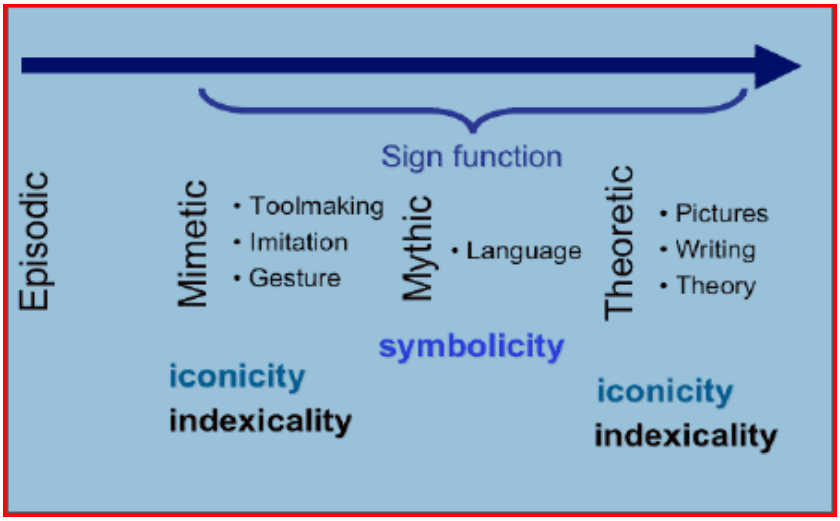

Figure 1: Level of semiotic reasoning (Donald, 2001. Cited in Soneson, 2007).

Sebeok (1999), in order to support his theory of global semiotics (the application of semiotics to any form of life), argues that by the thirteenth century the philosopher Thomas Aquinas had deduced that animals, as well as humans, make use of signs. (Aquinas cited in Sebeok, 1999) This idea presents an interesting concept in regard to the project; we must seek to understand the animalistic nature of the player's movement within the GW. Should the interpretation of this be ingrained into our animalistic unconsciousness the player may not realise the motivations behind their actions, instead these actions may be a second nature. Sonesson (2007) attempts to analyse Sebeok's global semiotic theory, in order to do this research regarding human evolution is used, suggesting that animals cannot make use of mimetic signs. This is evidenced through the work of Donald (1991) who states that the majority of mammals live in the present and are only capable of immediate memory, they are episodic meaning they cannot apply existing meaning to a situation. Humans apply theoretic information to the world around them allowing humanity to develop an advanced world view based upon indexical links, this would suggest that during game play the participant should not display any sign of animalistic behaviour. Due to the differing opinions raised by Sebeok and Donald attempts will be made to

analyse the behaviour of participants in order to understand the animalistic nature of their movements.

Taylor and Willis (1999) believe that different mediums require different analysis; they must not be reviewed as generic texts. To evidence this, the mediums of television and film are used. Here films are discrete texts whilst TV forms part of a 'flow' of images. This means that ideas are often formulated and created prior to watching the television whilst film places us into a new world with a clear pallet. However, it is worth noting that the difference in genre between films and television create different preconceptions prior to viewing. Pearson and Simpson (2001) argue the opposite of Taylor and Willis, suggesting that it is not until the observer comes part of the text that they then begin to see "the process by which a film or television show draws attention to itself," reflectivity. During this process the text asserts its presence as a construct of a medium through a series of methods, these include discontinuity and interruption. Within the context of an IE we may see these, respectively, as skipping from one character to another or waiting for the game to load.

Thwaites et al (2002) explain that genre is a cultural concept, providing a classification for analysis in terms of the texts social function. This presents relating texts within genre, meaning that "neither a text nor reading can be unique," forming part of a network of interconnected texts providing the viewer with a particular bias prior to reading. Whilst a film has a genre its discrete nature means this bias is reduced when compared to a TV programme's continual flow of images. In this sense the film has a resounding similarity to interactive computer games which belong as a discrete text

within a genre. In order to help understand the later analysis of player immersion the ways in which films are interpreted will be reviewed. Howells (2003) supports this by arguing that film semiotics is far more complicated to that of a stationary art; gaining importance resulting in a recognised branch of film theory, providing an extremely rich but difficult method of analysis. Howells (2003) believes this is because the signifier and the signified are almost indistinguishable within film, if this is indeed the case it would seem logical that IEs suffer from the same issue.

Harries (1996) argues that context is one of the most important factors regarding the semiotic analysis of film; any engagement with a film will take place under the conditions of the world around it. It is for this reason people argue that the cinema is the best way to watch a film, due to the context the human participant is watching it under, "within and around a text". However, Derrida (1992, cited in Harries 1996) continues that context is never "absolutely determinable" meaning that whilst the context must be observed to understand the participant's decoding of the text it can never be completely certifiable. Harries (1996), continues that contextual relevance can include the practices of the films producers, the advertisement used and even governmental laws and regulations. Whilst these factors are divorced from semiotic analysis they still affect the readers decoding. Harries (1996) continues to explain that early semioticians viewed film as an object in itself, whilst social semioticians view films as individual texts and summarising that it is only through "contextual awakening…that it can that it can encourage analyses which not only produce answers, but which also provoke further questions."

Gilmour (2008) looks into the role of gender with computers, in an attempt to dispel the cultural stereotypes of game developers which are listed as; **(1)** boys like action, shooting, running and jumping, girls like storytelling and characters. **(2)** Boys like measuring their skills, girls like getting credit for trying. **(3)** Boys play until they win, girls play until they are bored, etc. Gilmour views the computer as a platform for existing cultural beliefs rather than as a driving force in changing cultural beliefs, by doing this she can separate the cultural codes within new technologies and software (games) which, Gilmour argues, contains the age-old belief that women are more sociable than men. Based upon a series of observations at three private schools in Los Angeles Gilmour concludes that girls cannot be classified into a single user profile and that there is far more variety within girls than typically assumed. This issue is of critical importance for game developers, should this study's results suggest a theory for guiding human players it must be clear whether or not it is a general theory or gender specific.

3.1 Literature Review: Visual Semiotics in the Context of Immersive Environments and Computer Game Theory:

The purpose of the literature review is to understand current theory regarding semiotics within computer games as well as a general overview of relevant computer game theory. In order to do this key authors and texts will be addressed and

summarised, this is then combined with the literature review in section four to form a combined theory used with data analysis and map creation.

Ferri (2009) argues that a computer game is a complex matrix of possibilities. Although it exists before "ludic activity" is called upon, it produces a single text each time the player interacts with the environment. For this reason the game is a complex semiotic structure and can be analysed as such. However, Ferri believes that to complete said observation a dynamic approach must be taken as the game-play can vary between each session. The matrix is constructed using a set of procedures, and by analysing these procedures along with the game as a semiotic structure a thorough analysis of the way in which humans interact with the IE can be constructed. In addition to this it would also seem that the way in which the game is played will vary between each session due to the gamers' understanding of its context. Ferri also argues that the user is encouraged to continue their gaming experience through "procedural player evolvement;" the process of persuading the player to continue for varying purposes. Once again this could be analysed from a semiotic viewpoint, the player being encouraged to head towards certain signifiers within the game level.

Ferri argues this point by classifying people's attitudes towards the game into two separate entities, "this is not a game (TINAG)" and "this is a game (TIAG)". TINAG is broadly defined as users' acknowledging that gaming activities are fictional and as such they set aside their knowledge of the external world for the purpose of the GW; e.g. players are not surprised by the height of Super Mario's (Super Mario World, Super Nintendo) jumps within the GW, players believe that they are correct for the current

GW. Once the player enters the TIAG state they acknowledge the height of Mario's jump is unrealistic and begin to use this lack of realism to their advantage within the GW. Wade (2009) considers the IE as "space" theorising that all games begin and end within space, here he splits space into three classes. (1) Perceived space, the space that we comprehend and we perceive as our surroundings within the game; (2) Conceived space, the space that is represented for us (e.g. a graphical representation); (3) Lived space – the space in which we as humans "live," this is both the environment we become immersed in (using Wade's examples World of Warcraft) or the environment our person is in (the room in which we play World of Warcraft).

According to Wade it is the triad (see figure 2) of these spaces that creates the audience's definition of the game and its rules and due to this the creation of the game as a text. Once the user has entered all of the three defined spaces they find themselves within the centre of the space triad and are completely immersed within the virtual environment.

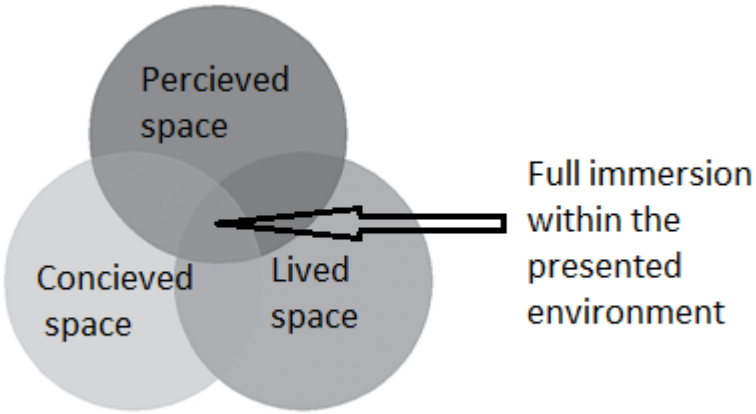

Figure 2: Venn Diagram

Bruno Latour states that "every human interaction is sociotechnical" (Cypher and Richardson, 2007). This suggests that coded details are placed into IEs to encourage an action from the human player. Cypher and Richardson (Ibid) then go on to argue that

Massively Multiplayer Online Role Playing Games (MMORPGs) can be seen as sociotechnical (in Latour's terms) meaning that codes interact with human players to effect their actions in the GW. However, due to the populated nature of MMORPGs human-human interaction is also a key aspect in the games analysis and any action performed by one player will affect the game of another, this can also be argued for single player games where non-player characters (NPCs) may change the narrative or development of a game. Cypher continues by arguing that playing a computer game can be a challenging process in which smaller objectives form part of a unified world goal (Ibid). Bell (2003) alludes to this in his work *Realism and Subjectivity in First-Person Shooter Video Games,* here he quotes the introduction to the First Person Shooter (FPS) Quake II:

> *"Shortly after landing on an alien surface, you learn that hundreds of your men have been reduced to just a few. Now you must fight your way through heavily fortified military installations, lower the city's defences and shut down the enemy's war machine. Only then will the fate of humanity be known."*

Bell argues that this paragraph defines the GW in which the human player is soon to be immersed and as such their actions within this GW are set within predefined constraints. This argument can be carried forward to state that any (relatively experienced) gamer would know what to expect from a computer game genre and predefine their actions before immersion has begun.

In the 2007 work by Cypher and Richardson it is argued that virtual spaces can be interpreted as aesthetic creations, which in the Western world is biased towards an ocularcentrism prioritising visual representation (2007). Ellis (1982) and Chesher (2004) point out that the way in which we observe our world (and as such GWs) is not innate but rather culturally formed, e.g. observation of a green addition symbol is representative of medical care, which can only be interpreted through an existing cultural knowledge of medical icons. Chesher (in Cypher and Richardson, 2007) continues by arguing that console games are "sticky," immersing the user through a 3D environment and kinetic interaction through a game controller (keyboard and mouse or gamepad.) This combination creates a "cybernetic suspension" (an immersion) far greater than any other form of visual media. This can be tied into Hall's theory of proxemics created in 1966; proxemics can be defined as "the semiotics of space" (University of California Berkeley, 2003). In Hall's theory four set categories of interpersonal distance for American culture (social codes) are presented these define the sphere of the person (c = close, f = far):

Intimate	Personal	Social	Public
0-6"c 6-18"f	18-30"c 30-48"f	4-7'c 7-12'f	12-25'c <25'f

Table 2: Personal spheres according to Hall.

These interpersonal distances are then split into three spatial constellations; fixed, semi-fixed and variable. Fixed space is formed by immoveable objects (walls, rock,

hills, territorial boundaries), semi-fixed by mobile elements (doors, curtains, furniture) and variable any space which does not conform to the first two constellations; usually open space. Hall argues that it is not until a spatial norm is broken that we realise the norm exists, this is due to our cultural conditioning. A common example of this would be holding a conversation with another person who is standing 'too close for comfort.' One member of the conversation is within their personal interpersonal distance (18-30") whilst the other feels the interpersonal distance is too close. The boundaries gamers developers place are usually marked by clear indexical markers such as "walls, fences and 'private-property signs;'" these signs hold meaning to both the addressor (sender) and the addressee (receiver) and are understood without explanation (University of California Berkeley, 2003). Harper et al continue Hall's work to establish differences between interpersonal distance in sex, age, personality and psychiatric conditions (Harper et al, 1978 cited in University of California Berkeley, 2003). These findings would seem to suggest that proxemics may play a role in player's interactions within IEs as well as real environments; and as such attention must be paid to player's behaviour in proxemically different space within the GW.

Cypher and Richardson (2007) regard computational space as progression, "forward and back, in and out, up and down," using constraints we are familiar with in the real world; this idea of computational space then presents itself inside of a GW with players looking to find their way around using set criteria (up, down etc.).[3] Cypher and Richardson argue that the game character becomes an embodiment of the human player, unable to separate one from another, "here we have a sociotechnical network;

[3] Computational space – the space we perceive with a graphical representation on a computer system, e.g. browning a file system through a series of layers.

a cluster of meanings and habits, and a collective of combined agencies, human and non-human (indeed, such a distinction barely makes sense in the context of an immersive virtual environment)," an intrinsic link between the player and computer through the meaning created by the game (2007).

Bell (2003) discusses the differences between film and video games, suggesting that within-games choices can be made allowing the text to be manipulated by the user to create a new realism. However he later goes on to explain that this realism is purely a function of the texts production and the end user has no control over its creation, only in its interpretation. This is supported by the work of Jarvinen (2001) "Games offer instant action, instant pleasure. The doses of pleasure are delivered according to a game mechanism. This is created by the designer, who allows/constructs things to happen in the game environment, but also by the player who achieves pleasure by successfully executing the action that the game requires in order for the game to continue." The realism and pleasure created for the GWs are both the product of a game developer and the game player, it is this pursuit of pleasure that causes a lapse within the game player's perception of reality resulting in immersion.

Hitchens (2007) argues that if we strive to understand a player's experience (which we do in this study) we must understand the player's relation to time within the game, is time progressing in a real world format or has it been sped up or slowed down? Should the player's perception of time be altered the state of immersion required would be consistent and deep. Examples of player's perceptions of time changing can be seen in-games such as *The Sims*, in which the gamer can run the game in real time or fast

forwarded. Due to the majority of in-game time spent with the “sim” out of the house or asleep the game is generally fast forwarded, perhaps to a state where real time becomes slowed due to the game time becoming a perceived reality.

Klastrup (2009) seeks to explain the fiction of a gameworld which she describes as, “a new form of invented universe, a next stage in the development of the entertaining fictional universes we know from films, novels and single-player adventure computer games.” It is argued that in order for the game player to become truly immersed they must willingly suspend their disbelief, for example; it would not be strange to find yourself in a world with zero gravity, as it is the standard attribute of that world. The creation of boundaries suggests the process of turning on a console or logging into a game acts as a concrete boundary for immersion, once this process has been achieved the human player is suspended within the rules of the GW.

Klastrup argues the use of narrative within computer games, the fictional concept is described by the imagery within the game, however, the games narrative describes this presentation and as such the complete world is projected. The presentation of the narrative within a computer game has already been defined by the developer; traditionally we interpret narrative and present our own visual construct. Therefore, the GW relies both on traditional narrative and the game’s visual creation. However the “worldness” is not completed prior to our experiences within the presented world, the player is required to have experienced and believe the world before their disbelief can be fully suspended and immersion can truly take over.

Wright et al (2002) seek to understand human behaviour within the context of computer games; in order to gain this understanding they seek to explain the player's discourse (in this case the game *Counter Strike: Source* is used). Myers (1992) argues that the human experience of a game is different depending on the player's skill level "Of course, the playing of the game also produces changes in one's own subjectivity making it a pleasurable experience if one is accomplished." This is also noted by Wright et al (2002) who state the most frequent type of discourse were related to "game performance or conflict." This included the use of insider language (discourse) which inexperienced players were yet to understand. An example of this can be seen in the in-game insult of "camper;" a player with little skill who hides and waits to shoot at passing enemies; however it is later explained that one is allowed to "camp" in certain situations such as defending a bomb site. Once the player has mastered the discourse they start to be accepted into the game's elite.

However Wright et al (2002) continue to note that immersion within the game is not complete due to exterior (non-game related) conversations, and that the real and the virtual worlds are combined. Player's names and sprays (small pictures which can be place onto in-game surfaces) are used to demonstrate this. A counter-terrorist player

Image 1: Player tag in Counter Strike: Source representing the real world.

places a picture of the destroyed World Trade Centre in the map to show their opposition to the terrorists both in-game and out of game (Image 1, left).

This is continued when a player named "Osama bin laggin" enters the game. Once again blurring the line between the real and immersive worlds, here "Osama bin laggin" refers both to the real world terrorist and the concept of "lagging" in which a players connection to the server is poor and the game play is 'jumpy'. Wright et al (2002) have clearly shown that immersion is not a complete concept in many games with players realising that they are playing a game within the real world and not being transported into another virtual world. This realisation would seem to suggest that human behaviour can be found whilst observing the play of any game and that true immersion is yet to be achieved.

Friedman (1999) argues the strength in human-computer interaction is down to a continuous feedback-loop created, the constant input-output cycle linking the two identities. Every time the human component reacts, the computer corresponds (e.g. move left – avatar moves left), this is unlike any other medium which relies on passive interaction.[4] Friedman states that this process creates a cybernetic circuit, however the immersion created by this circuit is dependant on the context of the human interaction; "word document is disengaged…web browsing incremental…computer game is full immersion" (Friedman, 1999). This engagement can cause the human time (rather than game time which may work at varying speeds) to become distorted with

[4] Passive interaction – an unchanging text understood by the active participant e.g. a book, moving through the words one sentence to the next. Unlike an active interaction in which an interaction reveals the next option/choice/sentence, etc.

little to no down-time. This is supported by Myers; (1991, cited in Friedman, 1999) "from personal experience and interviews with other players, I can say it is very common to play these games for eight or more hours without pause, usually through the entire first night of purchase."

Letho (2009) agrees with Ferri (2009) in that each time a game is called by the player a new text is created. However, he goes beyond Ferri's argument to the extent that the gamer needs the game as the game needs the gamer; alone the game as a text does not exist. If we follow this argument for the purpose of this work the analysis of game levels as texts can only be constructed during the game being played, for this reason real time observation should be carried out to ensure the analyse is of the players text rather than the researcher's text. Letho also continues Ferri's argument of TINAG/TIAG by stating that signifiers within-games are undetermined by the game's objective reality (the GW) rather that they are determined by the player's reality, "the player exceeds the code's phenomenological givenness" [*sic*]. For this reason Letho proposes that "text ≠ cinema ≠ games" (text is not equal to cinema which is not equal to a computer game), this he argues is due to the battle between interactivity and immersion found within advanced computer games; where the player is caught between ludic action and cinematic immersion, the process of actively playing the game whilst passively receiving information. Work undertaken by King and Krzywinska (2002 – cited in Letho, 2009) argues that this battle is created by the sense of immediacy created by the impression of presence during the inhabitation of a digitally produced landscape.

Letho continues to argue that within the game humans can behave in an unusual manner, “roaming freely or killing oneself for fun.” It is argued that the mathematics of the games options *(the states within the finite state machine)* is banal because of the need for freedom. However this introduction of freedom is still contained within the mathematical conditions of Ferri’s matrix of possibilities and can therefore still be analysed. Letho counters his own argument with the player response theory; within the ludic realm of the IE the player responds to the potential of the game itself. An example in context would be using the potential of the game by deliberately moving around the game level on a lift or walking down a staircase, it would still seem that the game level can be analysed as a semiotic text.

Meneghelli (2009) suggests that the advancement of semiotics into untraditional fields has caused a great debate surrounding the relationship between texts and practices creating theoretical issues. Meneghelli goes on to support the use of semiotics for the analysis of computer games arguing that games share similarities with traditional texts, however they do possess other more unusual factors; “interactivity, immersion and unpredictability.” This is a view supported by Pozzato, who argues that a text is any object which can be interpreted by the reader. (2001 – cited in Meneghelli, 2009) Scalisi (2001) notes that one of the basic assumptions of semiotics is that we cannot “not communicate.” This is the same for semiotic analysis of IEs, even when the player does not believe the GW is directly communicating with them, some form of communication will be received through the unconscious interpretation of visual codes. It is for this reason that care must be taken during the analysis.

The unpredictability of the game as a text is debatable if the text is only created once it is played; it is possible that the reader can predict its course of action. It seems that Meneghalli realises this to some extent as she states that a game is only meaningful to someone who has first-hand experience of the game and therefore contributes to the creation of the text (see Letho (2009), "the gamer needs the game as the game needs the gamer.") In order to support this and also support Meneghelli and Letho theories, Franschini's (2002 – cited in Meneghelli, 2009) argument that a game allows a person to perform actions within a world they do not "really" belong, the player becomes a "digital prothesis." It is this prothesis that Meneghelli argues allows us to interact with the digital environment created before us. It is the level of this prothesis that effects our immersion within the game (see Figure 3 below). From this table it can be seen that players are most influenced when they are placed into a computer game as themselves, this can be seen as any form of assumed identity that cannot be seen. Meneghelli provides the example of Doom, however the mask prothesis is also found within any FPS video game including Unreal Tournament. Because of this it would be expected, according to Meneghelli's theory that players would undergo a vast alteration of identity. Prothesis such as characterisation, any third person viewpoint or implementation (being placed into an object, Meneghelli provides a vehicle as an example) are less effective as the player assumes to role of a third party.

Digital Prothesis	Prothesis Characterization	Alteration of player's identity	Examples
TRANSPARENT	minimum	null	cursor in *The Secret of Monkey Island*
VEHICLE		minimum	car in *Gran Turismo*
MASK		maximum	point of view in *Doom*
CHARACTER	maximum	ambiguous	Lara Croft in *Tomb Raider*

Figure 3: A typology of digital prothesis (Fraschini, 2002 – in Meneghelli, 2009).

The table shows that the mask prothesis is the most effective for human immersion within a GW, gamers are not represented by another character (e.g. Lara Croft) nor are gamers seen to be within the game itself (to use Fraschini's example – inside the car in Gran Turismo, inside the game). The mask prothesis places players within the GW, Meneghelli states that several scholars (although she does not name any) have underlined that an effective first-person point of view is the most important element of immersion within computer games. However Fraile (2009) asks "how can we determine *internally* to the video game the actions that make sense and those that are not even seen as possibilities?" In order to understand this he argues that we must first understand people's preconceptions before they begin to play the game, this is something that must be understood before analysis can be undertaken and as such could be ascertained from a questionnaire. By doing this, the semiotic analysis of existing game levels could be completed within context.

According to Kucklich (2003) the basic similarity between games and texts is the interaction the human has with the signs they observe. Kucklich quotes Juul's (1991) thesis *A Clash Between Game and Narrative*; "the qualities of computer games are based on entirely different factors: in computer games the player is given a liberty to explore and understand the structure of the unreal GW, and to get better at handling it, rather than focus on narrative." As such, the semiosis within a computer game is perhaps even greater than within a traditional text.

Figure 4: Comparison of computers games to standard narrative.

Movies / Novels etc.	**Game**
Existent	Existent *or* Continuous production of existents (i.e. hordes of opponents)
Event	Event (cut-scene) *or* Simulation with multiple outcomes
Sequence of events	Selected events as events or simulations *or* Ideal sequence of events that the player has to actualise by mastering the simulations[5]
Character	Character (cut-scene) or Player position (game)

Juul continues to argue this theory in his 2001 work *Games Telling Stories,* the table above (Figure 4) shows Juul's comparison of game narrative with a standard text (movie, novel). Here we can see the game narrative also relies on the human

interaction, using an example from the character section they have a position within the game-word which is controlled by the human gamer; in a movie or novel the character exists in the scene because the author has placed them there.

Peirce (Chandler, 2007:13) defines a sign as something which can be interpreted infinitely, during which the sign gains in meaning allowing us to make sense of our world (or perhaps our IE). This process is traditionally accomplished through an alternate identity or avatar (linking into Meneghalli's digital prothesis), which through their own codes may then define the action of a player, for example one may drive far more violently in a tank than a go-kart due to the player's interpreted identity.

Lindley (2005) argues that the actions involved in playing a computer game are so unified that they become a gestalt, he argues that a "game-play gestalt" is a specific way of thinking about or understanding the state of a game. These game-play gestalts are often unique based upon an individual player's style or perhaps even mood; however, game genres generally hold some form of base gestalt. An example given is a FPS game, "*Action games*: shoot while being hit, strafe to hiding spot, take health, repeat" (Lindley, 2005).

This gestalt takes into account tactics and patterns (in movement for example), it is argued that these tactics are often consciously chosen in response to their in-game situation. In order to illustrate his theory Lindley provides figure 5 (below) which is constructed to show a semiotic form at each corner, once this has been created, objectives can be slotted into the triangle to display their "relative degree to which the

different levels of temporal structure are the intended focus of player engagement" (Lindley, 2005). According to the figure below we can place Unreal Tournament 2004 into it, but due to its lack of narrative we must place the game towards the left of the figure and due to its nature of "Unreal" Tournament it would seem to fit towards the Game rather than Simulation genre.

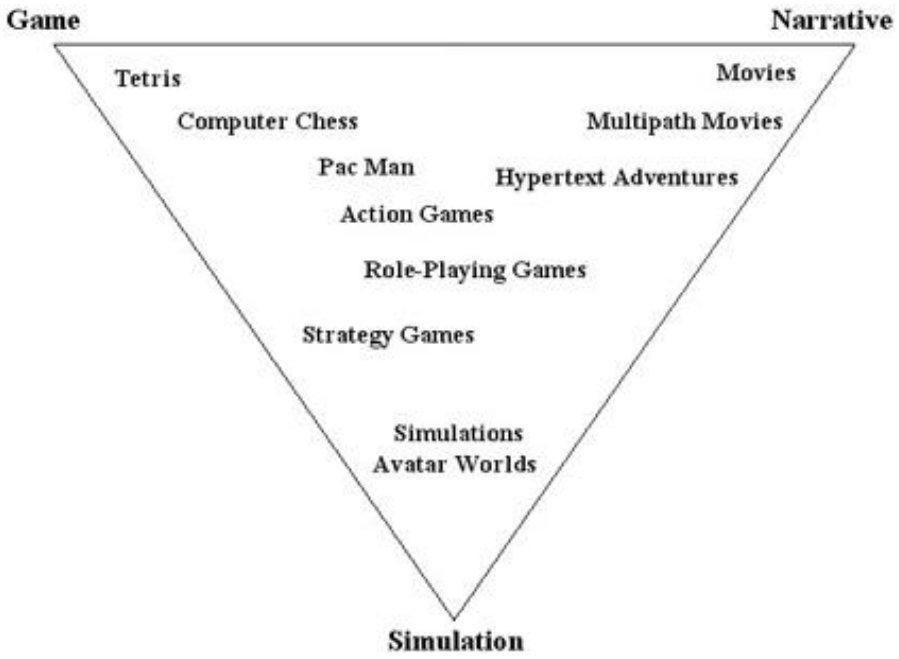

Figure 5: A classification plane based upon time form in ludic systems (Lindley, 2005).

However, a major disadvantage to this model is its reliance on opinion rather than quantifiable fact; some may consider Unreal Tournament to represent combat simulation rather than purely being a game.

The effects of lighting within IEs will be analysed within the primary research conducted as part of this study. El-Nasir et al (2007) seek to understand the effects of dynamic lighting within computer games, in order to do this dynamic lighting is

analysed in the more traditional medium of film and then tested using a dynamic-lighting prototype implemented into a modified Unreal Tournament 2004. El-Nasir et al (2007) identify the basic features of lighting, **(1)** brightness or luminance (which in real space can be measured in lux, lumens, foot candles, etc.); **(2)** colour (as expressed through it spectrum, measured through degrees Kelvin, or manipulated through filtration); **(3)** hard or soft shadow quality; **(4)** direction and **(5)** variation over time.

Using Giovanni Baglione's painting *Sacred Love versus Profane Love* El-Nasir et al (2007) identify the use of high brightness contrast, which, they explain, is a tried and tested method of increasing arousal in the viewer. The use of contrast between warm and cool colours is also explored; here we are informed that traditionally in movies low contrast scenes appear prior to high contrast scenes to create a turning point within a film. It should, in theory, be possible to place this method into an IE to illicit emotion.

The research is then continued into computer games, El-Nasir et al (2007) explain that by suspending a player in a state of incomplete knowledge through reduced lighting, the feeling of fear and vulnerability can be created. This process is used throughout the game Resident Evil, whilst the human player is controlling the character "Ashley," they enter the games darkest scenes, corresponding with Ashley being the most vulnerable player. Based upon a test of 100 participants in the Unreal Tournament 2004 modification player's responses to lighting was observed, many inexperienced game players noted how they were conveyed information about the game through the games lighting. However on the other hand more experienced players felt the dynamic lighting made the game too easy guiding them through the game quickly due to the

increased information. The work of El-Nasir et al (2007) would seem to suggest that lighting can be used effectively by game developers to guide a human player through a GW; however it could also be used for the reverse of this, intentionally guiding a player into danger.

Whilst individual opinions differ it has become clear is that it should be possible to analyse a computer game as a semiotic text. Using computer game theory it is understood that there are many aspects to consider whilst undertaking this analysis, these include the depth of a player's immersion, specifically their awareness of the differences between the GW and the real world. The relation of in-game time to real world time, play awareness of proxemics and how all visual codes (e.g. lighting and game icons) may be received by the player whilst immersed in-game environments will also be considered.

4. Research Methods:

Phillips and Pugh (2000) identify three key features of good research these will be outlined below along with actions that will be undertaken to ensure these hypothetical constants are maintained during the projects practical research. **(1)** Open minds: Here Philips and Pugh argue that all research should be approached without any dominant preconceptions of the subject. Although the focus of the work is on a human player's

interaction with an IE and as such it is assumed that each participant has some past experience with computer games or IEs. However this has been overcome through the questionnaire and observation processes, allowing a cross reference between past exposure to IEs and player behaviour.

(2) Critical analysis: An attempt must be made to analyse data critically, can the data be interpreted differently, what factors affected the results of the data and is the data correct are a few of Phillips and Pugh's criteria. In order to ensure that all data is critically analysed a set format for data collection has been creates passing through three distinct stages, questionnaire, observation, interview. During the questionnaire stage the research will not be present as the participant answers the questions, this was decided upon to reduce external influence and pressure. No participant identification will be made other than a unique identification number, this allows each participants data to be analysed without and preconceptions. In order to determine affecting factors participant data will be cross-references will be made between the questionnaires and interview/observation.

(3) Generalisations: It is argued that all research will require some generalisations based upon knowledge to facilitate analysis however it is the nature of these generalisations that concerns Phillips and Pugh. Here we must interpret and explain our generalisations against the topic and data in question whilst also specifying believed weakness so work can be interpreted critically. Any generalisation made

during the research will be stated and clarified including reasoning as to why the generalisation was made; this process should help to remove any generalisations which cannot be verified.

The below methods will be used in conjunction with each other to produce a data set based upon the concept of triangulation, the combination of multiple research methods to support one another's findings (Stokes, 2008). This process will allow data gathered from the questionnaire phase to be cross-checked against the videos recorded of the player's movement within the IE.

4.1. Questionnaires:

Dawson (2005) explains the use of questionnaires is their ability to collected data from a large number, as such most probably a cross section, of people. The process of creating a non-leading effective questionnaire is lengthy, however once this has been done a vast amount of information can be ascertained during a short space of time. Attention must be focused on the questionnaires target audience, medium, response rate and question type (Dawson, 2005). The questionnaires can be seen in appendices 3-3.2 and a few examples of completed questionnaires can be found in appendix 3.3. In order to meet these criteria a short introduction is presented to the participants explaining the format of the participants, in this an explanation of the various question types is given although the data should then be relatively easy to analyse due to its

numerical, *in general,* nature providing detailed results from a wide range of participants. The target audience of the questionnaire is reasonably wide however as state previously a presumption that participants have had some minor experience with computer games or IEs is upheld, although participants with no experience are fully welcomed into the study. Whilst they may be unable to answer the questionnaire section results from the observation and interview sections may provide and interesting counter to the results of experiences game players.

It is believed that response rates will be relatively high due to the questionnaires being given out during classes at the University of Worcester and collected upon their completion. For these questionnaires further analysis can be conducted as participants that are also completing the IE observation task can be cross referenced to their questionnaires through and identification number. This will allow links to be made between the two and hopefully conclusions can be drawn surrounding the player's movement in context to questionnaire answers, e.g. the behaviour of a regular game play is different to that of a casual game player for X reason.

4.1.1. Developing the Questionnaires:

See Appendix 3.1

4.1.2. The Final Questionnaire:

See Appendix 3.2

4.2. Observation:

The reason observation has been chosen as a research methods is its unique ability to collect data from a situation with minimal interference and interruption (Jorgensen in Casey, 2006). Observation would seem to be an effective research method for the project in question, as we require the participant to interact with the IE without the research effecting their decisions. Data can then be taken from this observation using the locator method described above.

One foreseen problem with observation method is that the observer cannot be certain of the reasons for the participant's movement within the IE. In order to help rectify this issue a video of the participant's interaction with the IE will be shown to both the participant and the researcher, here a small informal interview will be conducted to gain an understanding into the participant's actions.

The primary method for gathering data during the observation phase will be by using a 'locator' within an Unreal game level, this locator will write to a log file

(C:\UT2004\UserLogs) stating the human player has walked through it. Once the level has been fully played this log will allow us to see the players chosen path, this data can then be analysed to look for semiotic hints as to why the player took the path they did. The code used to do this can be found within appendix 4. Whilst compiling the code needed to make the locator work an error message was displayed stating that the unreal class "player" could not be found, as such the compiler program (WOTgreal) could not implement the code needed for my research. This problem was easily solved by entering the Unreal.ini file and moving the CBP22 package to the bottom of the packages list. As unreal had placed it before its standard packages WOTgreal was looking for code that had not been compiled yet.

4.2.1. Analysis of Existing Unreal levels:

It was decided that the process of analysing existing Unreal levels that are suitable for effective observation should be undertaken before the construction of any game levels for this project, as existing unreal levels could be useful in attaining information about player movement. The process to decide upon the existing UT2K4 maps required separating the maps into lists of their game type and excluding them by various means.[5] The Unreal game types (Assault, Bombing Run, Capture the Flag, Death Match, Double Domination and Onslaught) were all played through, it was decided that Death Match maps would be used for observation as they did not include any primary target, as previously stated Death Match is also the most popular of the Unreal game types.

[5] See Appendix Six for a full list of Unreal Tournament 2004 maps separated by game type.

This mean the player's movement could be seen as impartial to Unreal Tournament, representing all IEs. Movement would be based purely on the appearance of the game level and the conditions human players brought into this virtual world.

Bombing Run and Capture the Flag both relied heavily on team colour coding to guide the human player towards the enemy base, on top of this, along with Double Domination; they also relied on compass styled pointers guiding the player towards their goal. The nature of the Assault and Onslaught game types meant the levels were very large and structure meaning it would not be feasible to observe a large number of participants playing these levels. Assault was also a liner game type meaning player's freedom to move in various ways around the GW was severely limited and therefore an accurate reading of player's decisions could not be made. Onslaught was the only Unreal game type to make use of a mini-map, for this reason it was discredited as players may base their movement on this rather than the composition of the IE. All that remained was to decide upon which Death Match maps to use for player observation.

4.2.2. DM-Rankin:

See Appendix 7

4.2.3. DM-Antalus:

See Appendix 7.1

4.3. Interview:

Interviews will be used due to the nature of the research, the desire to understand the participant's actions within the IE. The interview should provide a large amount of qualitative data allowing the quantitative data to be analysed within context to its participant and their beliefs. Bennet et al argue that interviews should be constructed to suit the needs of the participant; this approach will be taken to a degree as interviews will be unstructured in general. (Bennet, McRobb, Farmer, 2002: 123) The reason for using an unstructured technique is to limit influence over the participant whilst hoping to attain information regarding their movement by asking flowing open ended questions. However there is a chance that the qualitative information gathered through the unstructured interview will be unwieldy to consolidate into useful data; it may also be impractical to compare information from different participants. (Key, J. P., 1997)

In order to help resolve this issue the interview process will be explained to the participant in a structured format. Here they will be told to highlight any in-game

features that effected their movement and asked to attempt an explanation of their movement around the environment. This process should help to focus the participant's interviews as they watch the recording of their movement. Unfortunately there is a chance the participant will be unable to remember the reasons for the actions in the game; perhaps due to the movement's subconscious nature. In situations such as this an informed generalisation (based upon the rules of Phillips and Pugh (2000)) will be made.

5. Data gathering results - Analysis and Interpretations:

In the following sections the results of the interviews, questionnaires and observation (videos and pictures) carried out throughout the study will be analysed.

5.1 Interviews results and analysis:

During the first research session (25/11/09) interviews were used in an attempt to learn about the understanding players had of their own movements. Originally an unstructured approach was taken simply explaining what was needed of the participant prior to them watching the video of their movement within the IE. Unfortunately this approach was unsuccessful, the majority of participants were uncomfortable explaining their actions in their own words, many expressing that they did not know why each choice was made. This would seem to support Sebeok's (1999)

theory of an animalistic subconscious controlling out actions and provide example of the theory in the context of IEs.

In order to resolve this issue a structured approach was taken. This was conducted by stopping the video whenever the player took an action or paused in-game, the research can then ask the participant to explain why they took the action or decision they did. Whilst this approach led to a greater number of results the vast majority of participants were unsure why they took their actions, describing them as “instinct” or “sub-conscious.” However, one particularly vocal participant (5) provided a useful description of their movements, whilst being only one individual the uses of this are critical when combined with the observation and numerical data gained. The participant, explained that they had a preference to head left when the choice was given and that high-ground was explored first, movement was also based on the location of pickups.

5.2. Questionnaire results and analysis:

In total 41 participants were used for data analyses, the results gained will be analysed below. Data analysis has been split into the two sections found on the questionnaire, firstly game questions and secondly personal questions. To begin with the four major functions have been used: mean, median, mode and range. This information can be found on the attached disk in the “Qresults” excel file and in Appendix 8.2.

Below is a very brief description of the four major data interrogation methods, each tool cannot be used to gain effective data from every question however, their use in relation to specific questions will be explained later.

- Mean = the sum of the values divided by the number of values needed.
- Median = the middle value (0, 3, 5, 6, 7 (5 = median)).
- Mode = the most common number with the list.
- Range = the difference between the smallest and largest values within a data set.

Any question that provides a mean result of 4 or above will be considered to be relatively definitive, as the average result was far above the middle value of 3.0. The analysis of the questionnaires on a question by question basis can be found within Appendix 8, overall questionnaires provided a useful data collection technique producing a large amount of quantitative data that can be analysed alongside the player video recordings.

5.2.1. Questionnaire Section One:

See Appendix 8.

5.2.2. Questionnaire Section Two:

See Appendix 8.1.

5.3 Observation results and analysis:

Observation proved to be a critical data analysis technique, allowing the researcher to pick out key focuses from the player's movements. Due to the number of videos (66) and pictures (100s) recorded during the observation research phase five key videos have been chosen for each map. The first two of these players provide the highest number of locator hits within the GW, therefore the highest amount of observable movement. The final three are selected from players with vastly different criteria; following this a generalised conclusion based upon all of the videos for each map that will be constructed. The videos chosen represent a cross-section of the research participants and details about the participant will be presented prior to analysis.

5.3.1 Observation Antalus:

See Appendix 9.

5.3.2 Observation Rankin:

See Appendix 9.1.

5.4 Conclusions:

When a human player enters an IE the player does not stand still for an extended length of time, instead they will always move, be it left, right or straight ahead. This movement can be based on a multitude of things and in the majority of cases comes from a subconscious urge; a player may decide to move left due to preconditioning from their culture (Thwaithes et al, 2002). A British player may well be conditioned to move to the left due to exposure to the left hand drive road network within the UK, however a player from mainland Europe may move right for the same reason. Within the questionnaire a right hand bias was found however this was not evident in the observation, instead there was a slight left hand bias. This will be tested within the created game levels.

The player often moves because of a signifier within the IE, the signifieds of said signifiers provokes meaning to the human player and as such the player moves. A semiotic analysis of these signifiers can then be carried out and the effects of certain purposely placed signifiers within IEs can be ascertained. These signifiers could be controlled by the IE developer during the creation of the environment and as such the player may be influenced to move towards certain sections of the environment; this will be tested in the created maps. Although in practise this method of analysis seems simple, Sausserian semiotics argues that there are no inevitable relationships between signifiers and the signified (Chandler, 2007). Therefore the development of a theory in which players can be influenced around an environment must rely on multiple signifiers as well as cultural constraints and appeal to the interest of a player.

Myers (2003) argues that analysis of play is a paradoxical by its very nature and that electronic play has the ability to sap time whilst creating excitement from repetition. It would seem that Myers argument is correct the majority of electronic games require simple actions to be performed multiple times. The online gameplay within Unreal Tournament 2004 (UT2K4) Death Match can be quantified down to the level of finding a weapon and then killing all opponents. However, human players have spent a total of nearly 1.5 milliondays (or the equivalent of 162+ years). From the day of the games release (18th of March 2004) until the 11th of November 2009 in which time 303,992,732 kills have been achieved (see appendix 5) (Epic Games, 2009). The vast popularity of the game serves to prove that repetition, along with other factors, makes obvious demand on player's time whilst also providing vast amounts of enjoyment.

An attempt has been made to reduce the strength of this paradox when analysing computer games by observing them as IEs rather than game levels. By doing this it is hoped that analysis can be derived based upon semiotic factions involving movement around a set area (real or simulated). However, whilst interviewing participants this bias was removed as the nature of their movement may have been based upon their realisation that it was in fact a game level. An example of this could be participants' desire to move into danger rather than away from it, however it was found that players generally attempted to move to higher ground and as such away from danger.

Ferri (2009) argues that a new text is created each time the game is played, this would mean that any behaviour generated by a game level should be different the next time

it is played, perhaps due to context and the cultural conditioning of the gamer. Should the gamer be the same then the text is different due to the players experience of the prior text, in this case their actions may well be different than the last time. Attempts have been made to counter this by observing players with different levels of experience, some of which conceded that they had played the game levels (Antalus and Rankin) before; as such the behavioural patterns noted should be seen in the majority of humans interacting with an IE. The major observations shall now be noted:

(1) It seems that the vast majority of players pause to observe their local surroundings, the length of pause seems to be related to the player's experience with computer games with the least experience players pausing for a longer period of time. Whilst this theorem is not wholly applicable to all players, it does provide a generic overview - the reason for this pause is most likely to understand the context they find themselves in and ascertain what the correct action would be. **(2)** The simplest way to affect a player's movement seems to be through the placement of pickups, players will go out of their way to collect pickups providing they are clearly visible from a distance. **(3)** Players tend to follow obvious paths rather than walking into dense ground or attempt to walk up something that seems visually difficult e.g. mountainous terrain. This appears to be clear and methodical way to guide a player around an IE. Developers can place objects or terrain alongside paths to create an impromptu boundary for the player. This theorem is related to proxemics, it would be suggested that developers make use of a combination of both fixed and semi-fixed space in order to create boundaries that do not constrict the player to the extent that they feel uncomfortable. **(4)** Combining these ideas, pickups can be used to suggest the correct path for the

player to head down, it is known that players observe local surroundings upon start-up, and as such pickups could be used to lure players down one of any number of available paths as soon as the game begins. **(5)** From observation in Antalus, players have been seen to use the tall stone structures to provide both movement boundaries and visual markers for placing oneself on a map of the IE. This method was not seen within Rankin perhaps due to the map's construction (small interior rooms and corridors) and so must be used to combination with other theorems to create an effective result.

(6) It would seem that players have a desire to explore areas that are visually different to the area they are currently in; this has been seen in Antalus where players head into the small underground room, the only area of the map that is inside. **(7)** Moving objects are of interest to players, they do not always move towards the object but often stop to observe its movement, understand what it is. This can be seen in both moving pickups and emitters located around the IE. The following theorems relate to the safety of the human players digital prothesis. **(8)** Players generally like to keep to high ground, only diverting when they see something of interest on lower ground. This could be due to an inherent defensive human mechanism. **(9)** The more experienced game players move constantly, this may be because it is harder for enemies to attack when the player is not stationary. **(10)** The most experienced gamers keep their backs to the walls, allowing them a field of vision that contains the majority of positions that the opponent may be in; reducing the risk of being attacked from behind.

All of the above theorems will be tested within the created maps (which will be in a non-linear format as per the preference found in questionnaire question number 7iv), the following will outline a series of ideas that have not be resolved from the observation conduced - tests for these will be built into constructed game levels. **(1)** No clear distinction has been made as to the effects of lighting; as such lighting tests must be built into the constructed levels. **(2)** The effects of the colour red and green have been used as semiotic examples throughout this project; their effects within an IE will also be tested. **(3)** Observation showed that the majority of participants favour a left hand turn but when quizzed said they would turn right in principle. A room showing a clear definitive answer to this question shall be created as detailed later. **(4)** The questionnaire showed a bias towards NPCs, a NPC will be placed into the IE to observe how players react to its presence.

6. Immersive Environment Construction and Analysis:

The maps created here are based upon the research done throughout this project, section 6.3.3 Observation Conclusions contains the ascertained information used for their development.

As previously stated, map constructions will be completed using a three-stage iteration model of design and the analysis; the first stage will be the maps basic construct, testing the conclusions of section 6.3.3. Following the maps' analysis the second stage

will commence, here any unsuccessful tests from stage one will be adjusted in an attempt to find a workable solution to the problem. This will then be analysed and the final stage may commence, here the map will be edited to create an effective, atmospheric IE; a map which is visually pleasing, looking full and complete. This map will then be analysed to see if the detail added nullifies the attempts to guide the player, perhaps suggesting if game developers can create professional looking IEs that produce desired player actions.

To test the created maps players have been asked to collect five designated items from within the IE, a brief explanation of the map is given to each participant prior to game play, these can be found at the end of each map creation section. The idea behind having each participant search for five items was that it would allow them to continually move around the whole level meaning all participants should see each section of the IE.

6.1 Stage One:

See Appendix 10

6.1.1 Stage One Map Test Instructions:

See Appendix 10.1.

6.1.2 Stage One Analysis:

See Appendix 10.2.

6.2 Stage Two:

See Appendix 11.

6.2.1 Stage Two Map Test Instructions:

See Appendix 11.1.

6.2.2. Stage Two Analysis:

See Appendix 11.2.

6.3 Stage Three:

The purpose of stage three was to add additional detail to the map to see if this reduces the findings of maps two and three; this process was done through the addition of static meshes, emitters and improved lighting. The only experimental adjustment made to the IE was to add a row of mini health picks to the right hand exit of the spawn room, this was done in an attempt to change the left exit bias seen in the first map and to increase the right hand bias (due to lighting) found in the second map.

It is hoped that this process well demonstrate the effects of using two separate visual influences to increase the likelihood of a player moving as the developer wishes.

6.3.1 Stage Three Map Test Instructions:

See Appendix 12.

6.3.2 Stage Three Analysis and Conclusions:

In general the results for the stage three map test were very similar to that of stage two, however, due to the addition of detail within the game level the effects of some visual influencers was reduced. The similarities between the game levels are primarily highlighted in Section 7.2.2 points, 2, 3, 4 and 6. **(1)** In stage two all but one participant moved right at spawn, due to the reduced light to the left, with the addition of pickups this result improved to 100% of participants turning right. This helps to prove the effects of both lighting and pickups as a method of guiding a human player around a game level. **(2)** Another effect of lighting can be found in the basement room, a path was created by shining lights through a series of floor grates. This attracted player movement with players walking along the path to reach other sections. **(3)** The effects of movers and emitters was highlighted in stage three with players moving to view items such as the fire emitter and moving fans. **(4)** The addition of static meshes to the jetty directly in front of the main doorway meant that the right hand camber of the jetty could not be seen; this reduced a player bias to turn right at the doorway.

(5) In this test 63% of participants chose the health pickup suggesting they were not anxious about falling a great distance with their digital prothesis. Comparing this to the 85% which took the adrenaline in the stage two test the contrast is rather large, this is supported by the fact that players again were violent towards the NPC with 54% of players killing it. From this a generalisation can be taken that players do leave behind their real world morals and cultures when entering the GW. **(6)** In the basement room of the GW the fake door attracted a lot of attention, nine out of the 11 players attempted to get through this door. This level of interest was expected in the first two map tests with regards to the doorway to the outside wall, it is believed that there is a general player interest to explore and this can be used to the advantages of games developers. Based upon these theorems it does indeed seem possible to guide a human player around a GW.

The above theorems and the theorems found within Sections 7.1.2 and 7.2.2 will be combined to create a theory of influencing player movement within the following section (7, Conclusion).

7. Recommendations:

Whilst the study conducted has been as thorough as possible in all events a series of recommendations shall be presented for both further study and improvement. **(1)** The

pilot studies should be replicated with an increased number of participants from more varied gaming backgrounds to ensure results are maintained. **(2)** The theory presented in section 7 has been tested using the game Unreal Tournament 2004; in order to be sure that the theory applies to all game types and genres a series of studies must be undertaken using different games. **(3)** The study does not take into account the effects of sound as an influence to movement, this must also be explored.

7.1. Final Conclusions and the Creation of a Theory for Guiding Player Movement:

In conclusion the project progressed on target and managed to develop a series of workable theorems for the creation of theory to guide player movement. The use of questionnaires and observation as data gathering methods were highly effective, although, unfortunately the interview process was not as effective and no useful data could be extracted from the participants. The literature reviews provided useful background and context to the study through the theories of proxemics, use of lighting and cultural conditioning of participants as a few examples. The analysis of player movement and the attempted use of interviews showed that player movement is generally a subconscious process, however, some actions are calculated through logic and experience (generally in more experienced gamers). Due to this processes' subconscious nature it has been observed that players do indeed react to visual influenced within IEs; it is the effect of these reactions that defines whether a player can be conditioned to move around an IE. These reactions cannot be guaranteed and as such the presented theory is a theory for guiding human players rather than

controlling the human player, although pilot studies have shown the results to be promising.

A Theory for Guiding Player Movement:

Before environment-specific influences are placed there are a few human related aspects which can be used to guide a player around an IE. Through observation it was found that in general, players display a bias towards turning left around the environment. Another observation was that players generally explore high ground first, it is theorised that, subconsciously, the high ground is associated with safety. This is supported by players' general unwillingness to move down a level to explore the low ground within the map. Player also pause to view their surroundings in an attempt to conceptualise the game environment, this behaviour is also noted when players reach a point of extreme high ground.

When a combination of results are taken from the questionnaire through to the stage three pilot it can be seen that, in general, players leave behind their real world preconceptions when entering an IE, although an exception to this rule was found in the stage two pilot studies. This would suggest that players will react differently to a situation within the game world to the real world, for this reason the effects of an event cannot be predicted by the game developer. In order to ensure the expected action is created a series of methods can be implemented, primarily and most simply the placement of pickups within an IE presents visual signs for the place to move towards them item. By doing this the developer can then encourage the player to

move around the IE in the desired manner, however, it has been seen that this approach alone does not provide guaranteed results (players have been observed ignoring pickups in both the official and created maps).

For this reason additional methods must be applied to entice a player to complete a desired action; lighting provides an effective method for enticing a player to move in a certain way. This has been observed in two separate instances **(1)** the negative use of light, in which an area of the map is dimly lit to reduce a player's perception of the area and thus the likely it will be chosen as a destination. **(2)** The positive use of light has been observed as a method to create imaginary walkways either by shining a bright light through an area to create a path surrounded by shadow; or by under floor lighting attracting player attention from below. Lighting presents another useful method for enticing required player actions. The affects of colour have been seen in the pilot studies in which a majority of players move towards the green light and away from the red. This highlights both the usefulness of lighting and colour for a game developer, creating an atmosphere that is either enticing or repelling. A final use of lighting is to highlight areas of interest within the GW; examples of this within the pilot study are the sunlight coming through the main entrance or the light above the lift.

Another method of enticing player interest was first found through analysis of the map DM-Antalus, here it was seen that players have a desire to entire areas that are visual different from the rest of the map. This was also found in the pilot studies in which players stopped to look outside and in pilot study three where players attempted open the fake door in the basement of the GW. This desire to explore can be utilised by

game developers, drawing players into sections of the map they wish to highlight e.g. place a key objective or pickup.

Player interest can also be gained through moving objects; the majority of the game world is a stationary creation in which the player moves around. The addition of moving objects have been seen to cause players to pause in order to view the mover, in some cases player even move their in game character closer to these moving objects. This effect had also been found by using emitters within the pilot study to create fire and rain, this focus on movement seems to stem from a subconscious behaviour to defend oneself and in order to do this focus on any moving, possibly attacking objects.

Whilst all of the above ideas are effective in guiding a human player around an IE they are most successful when implemented together. Examples of this can be within pilot study three, the 100% right hand turn due to both lighting and pickups or the increase in players taking the shelf path due to pickups and the positioning of static meshes (proxemics). Examples can also be seen of reducing the guiding abilities of an IE, such as positioning static meshes on the jetty in front of the main building. This process reduced the amount of players which took a right turn from the doorway. In order to successfully guide a human player around an immersive environment the environment must be planned and built around a desired movement pattern. Techniques to guide this movement should be placed in the appropriate locations and a small scale test ran to ensure the desire results are ascertained, if not additional methods can be implemented to ensure the developers aims are realised.

Appendix 1 - Original Project Brief:

Title: An Exploration into the use of Visual Semiotics in Immersive Environments and Computer Games: How to guide the mind.

Aims:

- To investigate how the visual semiotics of computer games and immersive environments guide the player through the environment and inform the choice of the player's actions.

- To investigate how the use of visual semiotics can be exported into saleable computer games by understanding its use within current games.

Project Brief:

The project will attempt to help develop strategies that can be implemented into saleable computer games and influence the ways in which they are played. The development of these strategies would seem to be feasible; Myers (2003:151) argues interactive media conforms to human semiosis.

The project will make use of existing computer games, and IEs produced for this research. Data collection may involve both in-game logging of player activities (allowing quantitative analysis) and qualitative techniques such as questionnaires, interviews and observations. Analysis of the data (eg t-tests) will lead to the suggestion of design principles to inform the use of visual semiotics in IEs. The waterfall methodology will be used however it will be customised to suit the project at hand; aspects will be taken from the incremental model.

Appendix 1.1 - Rough study plan.

Italics note 'spur of the moment' research ideas.

- Research/reading of existing visual semiotics information
- Construction of an explanation of visual semiotics in the context of IEs.
- Construction of my ideas in regard to this theory.
- Development of a questionnaire regarding the theory and IE level design.
- Quantitative analysis of the questionnaire.

- Qualitative analysis of the questionnaire results against the theory and theory development.

- Observation/interview of players within IEs making note of their play as a form of semiosis. *Other games than Unreal 2004?*
- Development of a game level in several steps with interview/observation and semiotic analysis at each stage of development.

- *Does the addition of unreal bots effect the way in which the player moves around the game level – the addition of fear.*
- In-game logging data from final game level – does this data support observational data in regards to level movement.
- Final analysis of all the data gathered about a final game level against the original theory.
- Expansion/review of said theory and final theory creation.
- Can the new theory be implemented into the development of saleable computer games? Why?

Appendix 2: Waterfall and Iterative Approaches:

2.1. The Waterfall PDLC and SSADM:

Although the Waterfall SDLC is based upon the construction of an Information System we can use it as a basis for the research project as it would seem to suit the liner nature of the research project; the liner nature of the project can be seen within the plan in appendix 1. To the left we can see a graphical representation of the SDLC split into six stages. The last of these, acceptance can be removed from the PDLC that will be used for this project as the work is purely researched based no client can accept the projects final form.

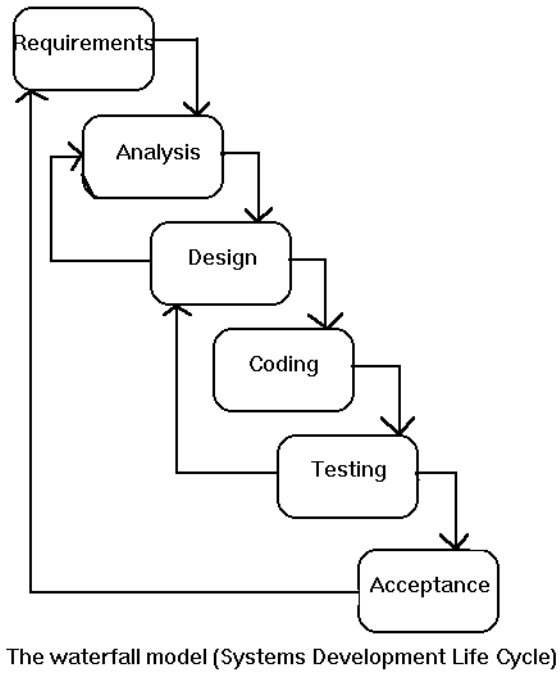

Figure 3: The Waterfall Model (Gangolly, 1997)

Firstly we have the requirements elicitation/feasibility stage in regards to this project this stage can be interpreted as the literature review that must be conducted prior to the construction and analysis of game levels. This is then continued into the analysis stage, in our case the research that will be conducted into existing Unreal game levels. In the first two stages the SSADM method of breaking the system down into smaller sections will be employed, here we will take individual sections of the game for analysis, e.g. lighting. (University of North Carolina, 2006)The analysis stage will also include the data analysis that results from these play tests and the creation of a theory based upon this data. Based upon this analysis an IE will be designed the design phase of the project, this will then be constructed in the coding phase.

Finally the testing/implementation phase of the project will be used to analyse the results found from the creation of the IE against the theory created in the analysis stage. Although its liner nature may support the format of the project there are some key weaknesses that need to be addressed. Firstly Avison and Fitzgerald argue the inflexibility of the SDLC method, this has already be countered with the use of an iterative approach for the creation of the IE (2006). Further weakness of the approach include the assumption of “green field development,” “lack of control” and its “emphasis on ‘hard’ thinking.” (Avison and Fitzgerald, 2006) Attempts will be made to resolve these issues with section 2.3.

2.2. Iterative Approaches:

A key advantage of an iterative approach is that it allows a system to be built up over a series of stages and it is for this reason an iterative approach has been chosen (Landay, 2001). The IE used to test the created theory will be constructed using three iterations (prototyping), here we can see if factors and which factors do indeed effect the player's movement. Allowing the researcher to ascertain useful information from the system before its construction is finalised, this means issues can be discovered earlier in the SDLC reducing costs and ensuring time constraints are met. (Avison and Fitzgerald, 2002) However all approaches have inherent weaknesses these will be analysed to see if improvements can be made.

A further advantage of the iterative approach is outlined in the Rapid Application Development Methodology (RAD) which states that not all of a system's requirements are known prior to development commencing. (Avison and Fitzgerald, 2002) In context this means that during the development of IEs additional information can be derived allowing the developer to make tactical changes to the project, this will allow the IE to act upon any new information that is found

Due to the nature of the project the iterative approaches main weakness can be avoided, this is that the client and team do not embrace the project as a whole instead focusing on their individual section. (Cardozo, 2002) This is avoided as the iteration process is set to be completed by a singular individual meaning each of the iterations in the IE construction is consistent with both past and future incarnations. There are however a series of other disadvantages to an iterative approach, these include,

lengthy review and analysis times, no overlap in development, lack of knowledge regarding the system requirements. (ASPAlliance, 2010)

Appendix 3 - Questionnaire (1st draft):

Questionnaire: An Exploration into the use of Visual Semiotics in Immersive Environments and Computer Games: How to guide the mind.

Introduction:

All responses are to this questionnaire are strictly confidential and will be used for research purposes only. At no point during this questionnaire will your name be requested. You may withdraw from this research at any time (simply destroy this document).

Questions will be graded on a scale of 1-5. 1 being little or negative, 5 being lots or positive; 2-4 are for answers between these boundaries. Please circle the response that most accurately represents your opinions. Other questions may require a simple

negative/no or positive/yes response, please circle the response that most accurately represents your opinions and some questions will require a written answer. A few questions will require you to choose the option that represents you e.g. age, sex.

Question 1: Rate your exposure of to computer games or immersive environments.

1. 2. 3. 4. 5.

Question 2: How many hours per week do you spend playing computer games?

0-2 3-5 6-8 9-11 11+

Question 3: For the time you spend playing, how much is single player?

1-15% 16-30% 31-45% 46-60% 61-75% 76%+

Question 4: Do you think it is important for games to be open and free flowing (5), or is it important that games have a set path (1)?

1. 2. 3. 4. 5.

Expand if you wish:

_____

_____

_____

Question 5: On average how long do you spend playing a new game in hours before you move on to another game?

0-5 6-10 11-15 16-20 21-25 26-30 31+

Question 6: Is this playing time affected by the size of the game world?

1. 2. 3. 4. 5.

Question 7: How do you find your way around the game world? Rate the importance of the following:

i. Visible paths e.g. Roads/walkways.

1. 2. 3. 4. 5.

ii. Standout objects e.g. Towers/trees.

1. 2. 3. 4. 5.

iii. Terrain e.g. Rivers/mountains.

1. 2. 3. 4. 5.

What else do you look for to help you around the game world? _____

_____

_____

Question 8: Do you leave behind real world perceptions when you enter the game world? E.g. walk towards danger/fight instead of run?

1. 2. 3. 4. 5.

About You:

Please note: this information is strictly confidential

Question 1: Gender?

Male Female

Question 2: Age?

16-18 19-21 22-24 25-27 27-29 30-32 32+

Question 3: What is your preferred gaming genre?

FPS RTS Driving Sport RPG

If other please state: _____

Question 4: Do you have any comments or questions that could be used to improve this questionnaire?

_____

_____

_____

Appendix 3.1 - Questionnaire (2nd draft):

4.1.1 Developing the Questionnaires:

Once the basic structure of the questionnaire had been created further questions based were added to help ascertain the data needed. Question eight can be argued as the most important as here the questionnaire attempts to discover exactly what factors effect a human players movement around a GW; in order to improve the data here an additional five options were added.

At the end of the eight original questions a further two were added. In question an attempt is made to understand if the presence of a map is important for gamers, an increasing common occurrence due to improved computer performance and as such larger game levels. The reasoning behind this was that if a map is of importance to a gamer perhaps the importance of visual objects suggested in question eight would be seen as less so; data will be analysed to either confirm or deny this assumption. In question ten the participant is asked:

Question 10: You are standing in a plain white room; there is nothing around you except two wooden doors. One is to your left, the other to your right. Which way will you turn?

Left Right

The question seeks to understand if there is a relationship between a person's basic instinct and their decisions within the GW. Does a player that prefers left favour a left turn in the GW, are we in the United Kingdom conditioned to turn left first perhaps because of our road infrastructure.

Questionnaire: An Exploration into the use of Visual Semiotics in Immersive Environments and Computer Games: How to guide the mind.

Introduction:

All responses are to this questionnaire are strictly confidential and will be used for research purposes only. At no point during this questionnaire will your name be requested. You may withdraw from this research at any time (simply destroy this document).

Questions will be graded on a scale of 1-5. 1 being little or negative, 5 being lots or positive; 2-4 are for answers between these boundaries. Please circle the response that most accurately represents your opinions. Other questions may require a simple

negative/no or positive/yes response, please circle the response that most accurately represents your opinions and some questions will require a written answer. A few questions will require you to choose the option that represents you e.g. age, sex.

Question 1: Rate your exposure of to computer games or immersive environments.

1. 2. 3. 4. 5.

Question 2: How many hours per week do you spend playing computer games?

0-2 3-5 6-8 9-11 11+

Question 3: For the time you spend playing, how much it is single player?

1-15% 16-30% 31-45% 46-60% 61-75% 76%+

Question 4: Do you think it is important for games to be open and free flowing (5), or is it important that games have a set path (1)?

1. 2. 3. 4. 5.

Expand if you wish:

_____

_____

_____

Question 5: On average how long do you spend playing a new game in hours before you move on to another game?

0-5 6-10 11-15 16-20 21-25 26-30 31+

Question 6: Is this playing time affected by the size of the game world?

1. 2. 3. 4. 5.

Question 7: How do you find your way around the game world? Rate the importance of the following:

i. Visible paths e.g. Roads/walkways.

1. 2. 3. 4. 5.

ii. Standout objects e.g. Towers/trees.

1. 2. 3. 4. 5.

iii. Terrain e.g. Rivers/mountains.

1. 2. 3. 4. 5.

iv. Open buildings.

1. 2. 3. 4. 5.

v. Moving objects e.g. Fire/water.

1. 2. 3. 4. 5.

vi. In-game pickups e.g. Weapons/ammo/armour.

1. 2. 3. 4. 5.

vii. Lighting.

1. 2. 3. 4. 5.

viii. The location of Non player characters.

1. 2. 3. 4. 5.

What else do you look for to help you around the game world? _____

_____

_____

Question 8: Do you leave behind real world perceptions when you enter the game world? E.g. walk towards danger/fight instead of run?

1. 2. 3. 4. 5.

Question 9: Should games have maps advising you on the path to take?

Yes No

Question 10: You are standing in a plain white room; there is nothing around you except two wooden doors. One is to your left, the other to your right. Which way will you turn?

Left Right

About You:

Please note: this information is strictly confidential.

Question 1: Gender?

Male Female

Question 2: Age?

16-18 19-21 22-24 25-27 27-29 30-32 32+

Question 3: What is your preferred gaming genre?

First Person Shooter Real Time Strategy Driving

Sport Role Playing Game Third Person Action

If other please state: _____

Question 4: Do you have any comments or questions that could be used to improve this questionnaire?

_____

_____

_____

Appendix 3.2 - Questionnaire (Final):

4.1.2. The Final Questionnaire:

Following the first twenty five questionnaire results some minor issues had arisen and some appropriate improvements could be made. The majority of these came through the last section on the questionnaire given out to research participants which asks, "Do you have any comments or questions that could be used to improve this questionnaire?" The following section will outline these comments and seek to improve the structure and wording of the questionnaire in general.

Participant two – "Q9. Have answers swapped to be consistent with left = negative, right = positive."

This suggestion has lead to the restructuring of question nine, the suggested format is the correct method and question nine now reads:

Question 9: Should games have maps advising you on the path to take?

No Yes

Participant seven – "With gaming genres it should be a rating because games now are very often mixtures of the above categories e.g. Fallout 3 RPG but has first person shooter elements."

Participant seven is correct, as hardware and game theory have developed many games now fit into multiple categories. However by rating the amount of time spent playing each genre of game would complicate the nature of the question, its purpose is purely to determine if the participants main-game type.

Participant eight – "Second into paragraph to be clear on the ratings or spread to be clear and easy to read."

It was decided that this paragraph would be edited to improve upon the over complicated sentence structures it included. The primary reason for this was the fact that a reasonable proportion of the participants taking the questionnaire did not speak English as a first language. During the creation of the questionnaire this had been presumed, the new introduction reads as follows:

All questions require you to circle the answer which fits yourself or your opinions. Some of these questions will be graded on a scale of 1-5. 1 being little or negative, 5 being many or positive; 2-4 are for answers in between these boundaries.

Other questions require you to circle the response that most accurately represents your opinions. A few questions may require a simple negative/no or positive/yes response, please circle the response that most accurately represents your opinions. At

the end of the questionnaire there are several questions which will require you to choose the option that represents yourself e.g. age, sex.

Participant 17 – "0% answer for question three would be useful, I don't play offline games."

Although changing this question has no practical benefits, it would be good practise to start counting for zero as opposed to one. For this reason question three now reads as follows:

Question 3: For the time you spend playing, how much it is single player?

0-15% 16-30% 31-45% 46-60% 61-75% 76%+

In section two of the questionnaire the fourth question which was used to ascertain the quality of the questionnaire and lead to the changes made above has also now been removed. This is because the questionnaire now stands in its final form, no more adjustments will be made so the data can be analysed without any changes to the questionnaire effecting results. This final edition can be found in appendix 3.2.

Questionnaire: An Exploration into the use of Visual Semiotics in Immersive Environments and Computer Games: How to guide the mind.

Introduction:

All responses are to this questionnaire are strictly confidential and will be used for research purposes only. At no point during this questionnaire will your name be requested. You may withdraw from this research at any time (simply destroy this document).

All questions require you to circle the answer which fits yourself or your opinions. Some of these questions will be graded on a scale of 1-5. 1 being little or negative, 5 being many or positive; 2-4 are for answers in between these boundaries.

Other questions require you to circle the response that most accurately represents your opinions. A few questions may require a simple negative/no or positive/yes response, please circle the response that most accurately represents your opinions. At the end of the questionnaire there are several questions which will require you to choose the option that represents yourself e.g. age, sex.

Question 1: Rate your exposure of to computer games or immersive environments.

1. 2. 3. 4. 5.

Question 2: How many hours per week do you spend playing computer games?

0-2 3-5 6-8 9-11 11+

Question 3: For the time you spend playing, how much it is single player?

0-15% 16-30% 31-45% 46-60% 61-75% 76%+

Question 4: Do you think it is important for games to be open and free flowing (5), or is it important that games have a set path (1)?

1. 2. 3. 4. 5.

Expand if you wish:

_____

_____

_____

Question 5: On average how long do you spend playing a new game in hours before you move on to another game?

0-5 6-10 11-15 16-20 21-25 26-30 31+

Question 6: Is this playing time affected by the size of the game world?

1. 2. 3. 4. 5.

Question 7: How do you find your way around the game world? Rate the importance of the following:

i. Visible paths e.g. Roads/walkways.

1. 2. 3. 4. 5.

ii. Standout objects e.g. Towers/trees.

1. 2. 3. 4. 5.

iii. Terrain e.g. Rivers/mountains.

1. 2. 3. 4. 5.

iv. Open buildings.

1. 2. 3. 4. 5.

v. Moving objects e.g. Fire/water.

1. 2. 3. 4. 5.

vi. In-game pickups e.g. Weapons/ammo/armour.

1. 2. 3. 4. 5.

vii. Lighting.

1. 2. 3. 4. 5.

viii. The location of Non player characters.

1. 2. 3. 4. 5.

What else do you look for to help you around the game world?

_____

_____

_____

Question 8: Do you leave behind real world perceptions when you enter the game world? E.g. walk towards danger/fight instead of run?

1. 2. 3. 4. 5.

Question 9: Should games have maps advising you on the path to take?

No Yes

Question 10: You are standing in a plain white room; there is nothing around you except two wooden doors. One is to your left, the other to your right. Which way will you turn?

Left Right

About You:

Please note: this information is strictly confidential.

Question 1: Gender?

Male Female

Question 2: Age?

16-18 19-21 22-24 25-27 27-29 30-32 32+

Question 3: What is your preferred gaming genre?

First Person Shooter Real Time Strategy Driving

Sport Role Playing Game Third Person Action

If other please state: _____

Appendix 3.3 - Examples of the Questionnaire completed:

Here are three completed questionnaires from participants one, twenty and an unobserved participant X. They show the first (one), edited (twenty) and final versions of the questionnaires (X).

1

Questionnaire: An Exploration into the use of Visual Semiotics in Immersive Environments and Computer Games: How to guide the mind.

Introduction:

All responses are to this questionnaire are strictly confidential and will be used for research purposes only. At no point during this questionnaire will your name be requested. You may withdraw from this research at any time (simply destroy this document).

Questions will be graded on a scale of 1-5. 1 being little or negative, 5 being lots or positive; 2-4 are for answers between these boundaries. Please circle the response that most accurately represents your opinions. Other questions may require a simple negative/no or positive/yes response, please circle the response that most accurately represents your opinions and some questions will require a written answer. A few questions will require you to choose the option that represents you e.g. age, sex.

Question 1: Rate your exposure of to computer games or immersive environments.

1. 2. 3. 4. 5.

Question 2: How many hours per week do you spend playing computer games?

0-2 3-5 6-8 9-11 11+

Question 3: For the time you spend playing, how much it is single player?

1-15% 16-30% 31-45% 46-60% 61-75% 76%+

Page | 1

Question 4: Do you think it is important for games to be open and free flowing (5), or is it important that games have a set path (1)?

1. 2. (3) 4. 5.

Expand if you wish:

Everything depends on the genres game.

Question 5: On average how long do you spend playing a new game in hours before you move on to another game?

0-5 6-10 (11-15) 16-20 21-25 26-30 31+

Question 6: Is this playing time affected by the size of the game world?

1. 2. (3) 4. 5.

Question 7: How do you find your way around the game world? Rate the importance of the following:

i. Visible paths e.g. Roads/walkways.

1. 2. 3. 4. (5)

ii. Standout objects e.g. Towers/trees.

(1) 2. 3. 4. 5.

iii. Terrain e.g. Rivers/mountains.

1. 2. 3. 4. (5)

Page | 2

iv. Open buildings.

1. 2. (3.) 4. 5.

v. Moving objects e.g. Fire/water.

1. 2. 3. 4. (5)

vi. In game pickups e.g. Weapons/ammo/armour.

1. 2. (3) 4. 5.

vii. Lighting.

1. 2. (3.) 4. 5.

viii. The location of Non player characters.

1. 2. 3. (4) 5.

What else do you look for to help you around the game world?

Probably reading the help or playing the tutorial.

Question 8: Do you leave behind real world perceptions when you enter the game world? E.g. walk towards danger/fight instead of run?

1. 2. (3.) 4. 5.

Question 9: Should games have maps advising you on the path to take?

Yes (No)

Question 10: You are standing in a plain white room; there is nothing around you except two wooden doors. One is to your left, the other to your right. Which way will you turn?

Left (Right)

Page | 3

About You:

Please note: this information is strictly confidential.

Question 1: Gender?

Male Female

Question 2: Age?

16-18 19-21 22-24 25-27 27-29 30-32 32+

Question 3: What is your preferred gaming genre?

First Person Shooter Real Time Strategy Driving

Sport Role Playing Game Third Person Action

If other please state: _____

Question 4: Do you have any comments or questions that could be used to improve this questionnaire?

_____

_____

Page | 4

20

Questionnaire: An Exploration into the use of Visual Semiotics in Immersive Environments and Computer Games: How to guide the mind.

Introduction:

All responses are to this questionnaire are strictly confidential and will be used for research purposes only. At no point during this questionnaire will your name be requested. You may withdraw from this research at any time (simply destroy this document).

Questions will be graded on a scale of 1-5. 1 being little or negative, 5 being lots or positive; 2-4 are for answers between these boundaries. Please circle the response that most accurately represents your opinions. Other questions may require a simple negative/no or positive/yes response, please circle the response that most accurately represents your opinions and some questions will require a written answer. A few questions will require you to choose the option that represents you e.g. age, sex.

Question 1: Rate your exposure of to computer games or immersive environments.

1. 2. 3. 4. 5.

Question 2: How many hours per week do you spend playing computer games?

0-2 3-5 6-8 9-11 11+

Question 3: For the time you spend playing, how much it is single player?

1-15% 16-30% 31-45% 46-60% 61-75% 76%+

Page | 1

20

Question 4: Do you think it is important for games to be open and free flowing (5), or is it important that games have a set path (1)?

1. 2. 3. 4. 5.

Expand if you wish:

_____

_____

Question 5: On average how long do you spend playing a new game in hours before you move on to another game?

0-5 6-10 11-15 16-20 21-25 26-30 31+

Question 6: Is this playing time affected by the size of the game world?

1. 2. 3. 4. 5.

Question 7: How do you find your way around the game world? Rate the importance of the following:

i. Visible paths e.g. Roads/walkways.

1. 2. 3. 4. 5.

ii. Standout objects e.g. Towers/trees.

1. 2. 3. 4. 5.

iii. Terrain e.g. Rivers/mountains.

1. 2. 3. 4. 5.

Page | 2

20

iv. Open buildings.

1. 2. 3. 4. 5.

v. Moving objects e.g. Fire/water.

1. 2. 3. 4. 5.

vi. In game pickups e.g. Weapons/ammo/armour.

1. 2. 3. 4. 5.

vii. Lighting.

1. 2. 3. 4. 5.

viii. The location of Non player characters.

1. 2. 3. 4. 5.

What else do you look for to help you around the game world?

Alternate routes.

Question 8: Do you leave behind real world perceptions when you enter the game world? E.g. walk towards danger/fight instead of run?

1. 2. 3. 4. 5.

Question 9: Should games have maps advising you on the path to take?

Yes No

Question 10: You are standing in a plain white room; there is nothing around you except two wooden doors. One is to your left, the other to your right. Which way will you turn?

Left Right

Page | 3

20

About You:

Please note: this information is strictly confidential.

Question 1: Gender?

Male Female

Question 2: Age?

16-18 19-21 22-24 25-27 27-29 30-32 32+

Question 3: What is your preferred gaming genre?

First Person Shooter Real Time Strategy Driving

Sport Role Playing Game Third Person Action

If other please state: _____

Question 4: Do you have any comments or questions that could be used to improve this questionnaire?

_____

_____

Page | 4

Questionnaire: An Exploration into the use of Visual Semiotics in Immersive Environments and Computer Games: How to guide the mind.

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All questions require you to circle the answer which fits yourself or your opinions. Some of these questions will be graded on a scale of 1-5. 1 being little or negative, 5 being many or positive; 2-4 are for answers in between these boundaries.

Other questions require you to circle the response that most accurately represents your opinions. A few questions may require a simple negative/no or positive/yes response, please circle the response that most accurately represents your opinions. At the end of the questionnaire there are several questions which will require you to choose the option that represents yourself e.g. age, sex.

Question 1: Rate your exposure of to computer games or immersive environments.

1. 2. 3. 4. 5.

Question 2: How many hours per week do you spend playing computer games?

0-2 3-5 6-8 9-11 11+

Question 3: For the time you spend playing, how much it is single player?

0-15% 16-30% 31-45% 46-60% 61-75% 76%+

Question 4: Do you think it is important for games to be open and free flowing (5), or is it important that games have a set path (1)?

1. 2. 3. 4. 5.

Expand if you wish:

_____

_____

Question 5: On average how long do you spend playing a new game in hours before you move on to another game?

0-5 6-10 11-15 16-20 21-25 26-30 31+

Question 6: Is this playing time affected by the size of the game world?

1. 2. 3. 4. 5.

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i. Visible paths e.g. Roads/walkways.

1. 2. 3. 4. 5.

ii. Standout objects e.g. Towers/trees.

1. 2. 3. 4. 5.

iii. Terrain e.g. Rivers/mountains.

1. 2. 3. 4. 5.

iv. Open buildings.

1. 2. 3. 4. 5.

v. Moving objects e.g. Fire/water.

1. 2. 3. 4. 5.

vi. In game pickups e.g. Weapons/ammo/armour.

1. 2. 3. 4. 5.

vii. Lighting.

1. 2. 3. 4. 5.

viii. The location of Non player characters.

1. 2. 3. 4. 5.

What else do you look for to help you around the game world?

_____

_____

Question 8: Do you leave behind real world perceptions when you enter the game world? E.g. walk towards danger/fight instead of run?

1. 2. 3. 4. 5.

Question 9: Should games have maps advising you on the path to take?

No Yes

Question 10: You are standing in a plain white room; there is nothing around you except two wooden doors. One is to your left, the other to your right. Which way will you turn?

Left Right

About You:

Please note: this information is strictly confidential.

Question 1: Gender?

Male Female

Question 2: Age?

16-18 19-21 22-24 25-27 27-29 30-32 32+

Question 3: What is your preferred gaming genre?

First Person Shooter Real Time Strategy Driving

Sport Role Playing Game Third Person Action

If other please state: None

Appendix 4: Code for logging users movement:

I would like to stress that the author of this code is Dr C. Price from the University of Worcester; it is used within this project with full permission and with great thanks.

xCBPDeathMatch.uc:

The class below is set as the default game type for the levels used within this project, this process is done by entering a level and selecting, view\level properties\level info\DefaultGameType. The type is then changed from xDeathMatch to xCBPDeathMatch, this game type uses the parameters of the original xDeathMatch.

```
//=================================================================
========
// xDeathMatch.
//=================================================================
========
class xCBPDeathMatch extends CBPDeathMatch;


#exec OBJ LOAD FILE=WeaponSkins.utx
#exec OBJ LOAD FILE=UT2004Weapons.utx
#exec OBJ LOAD FILE=XEffectMat.utx
#exec OBJ LOAD FILE=WeaponStaticMesh.usx
```

```
#exec OBJ LOAD FILE=NewWeaponPickups.usx

#exec OBJ LOAD FILE="..\Textures\AW-2004Particles.utx"

#exec OBJ LOAD FILE=intro_characters.utx

#exec OBJ LOAD FILE=DemoPlayerSkins.utx

#exec OBJ LOAD FILE=PlayerSkins.utx

#exec OBJ LOAD FILE=InterfaceContent.utx

#exec OBJ LOAD FILE=LastManStanding.utx

#exec OBJ LOAD FILE=HUDContent.utx


var globalconfig bool bCustomPreload; // if true, precache non-
Epic characters as well


static function PrecacheGameTextures(LevelInfo myLevel)
{
	local int i;
	local array<xUtil.PlayerRecord> AllPlayerList, PlayerList;
	local bool bIsTeamGame;
	local class<GameInfo> GameClass;
	local Texture LoadedSkin, LoadedSkinBlue, LoadedFace, LoadedFaceBlue;


	myLevel.AddPrecacheMaterial(Material'UT2004Weapons.AssaultRifleTex0');
	myLevel.AddPrecacheMaterial(Material'XEffects.bulletpock');
	myLevel.AddPrecacheMaterial(Material'WeaponSkins.GrenadeTex');
	myLevel.AddPrecacheMaterial(Material'WeaponSkins.ShieldTex0');
```

```
myLevel.AddPrecacheMaterial(Material'XGameShaders.Minigun_burst');
myLevel.AddPrecacheMaterial(Material'XEffects.pcl_Spark');
myLevel.AddPrecacheMaterial(Material'XEffects.EmitSmoke_t');
myLevel.AddPrecacheMaterial(Material'XEffects.SmokeTex');
myLevel.AddPrecacheMaterial(Material'XEffects.rocketblastmark');
myLevel.AddPrecacheMaterial(Texture'XEffects.FlakTrailTex');
myLevel.AddPrecacheMaterial(Texture'ExplosionTex.we1_frames');
myLevel.AddPrecacheMaterial(Texture'ExplosionTex.exp2_frames');
myLevel.AddPrecacheMaterial(Texture'ExplosionTex.SmokeReOrdered');
myLevel.AddPrecacheMaterial(Texture'ExplosionTex.exp1_frames');
myLevel.AddPrecacheMaterial(Material'XEffects.Rexpt');
myLevel.AddPrecacheMaterial(Material'XEffects.SmokeAlphab_t');
myLevel.AddPrecacheMaterial(Material'XEffectMat.shock_ring_b');
myLevel.AddPrecacheMaterial(Material'XEffectMat.Shield.ShieldSpark');
myLevel.AddPrecacheMaterial(Material'XEffectMat.SlimeSkin');
myLevel.AddPrecacheMaterial(Material'XEffectMat.goop_green_a');
myLevel.AddPrecacheMaterial(Material'XGameShaders.PlayerShield');
myLevel.AddPrecacheMaterial(Material'XEffectMat.Shield3rdFB');
myLevel.AddPrecacheMaterial(Material'XEffectMat.ShieldRip3rdFB');
myLevel.AddPrecacheMaterial(Material'XGameShaders.LinkGunShell');
myLevel.AddPrecacheMaterial(Material'Engine.BlobTexture');
myLevel.AddPrecacheMaterial(Material'XGameShaders.LEnergy');
myLevel.AddPrecacheMaterial(class'NewTransDeresBlue'.Default.Texture);
myLevel.AddPrecacheMaterial(Material'intro_characters.BRface1');
```

```
myLevel.AddPrecacheMaterial(Material'AW-2004Particles.Fire.BlastMark');

myLevel.AddPrecacheMaterial(Material'gradient_FADE');

myLevel.AddPrecacheMaterial(Material'AW-2004Particles.plasmastar');

myLevel.AddPrecacheMaterial(Material'XEffects.BotSpark');

myLevel.AddPrecacheMaterial(Material'InterfaceContent.SquareBoxA');

myLevel.AddPrecacheMaterial(Material'LastManStanding.LMSLogoSmall');

myLevel.AddPrecacheMaterial(Material'XEffectMat.redbolt');

myLevel.AddPrecacheMaterial(Material'XEffects.SpeedTrailTex');

myLevel.AddPrecacheMaterial(Material'XEffects.pcl_ball');

myLevel.AddPrecacheMaterial(Texture'XGameShaders.MinigunFlash');


myLevel.AddPrecacheMaterial(Texture'XEffects.BloodSplat1');

myLevel.AddPrecacheMaterial(Texture'XEffects.BloodSplat2');

myLevel.AddPrecacheMaterial(Texture'XEffects.BloodSplat3');

myLevel.AddPrecacheMaterial(Texture'XEffects.BloodSplat1P');

myLevel.AddPrecacheMaterial(Texture'XEffects.BloodSplat2P');

myLevel.AddPrecacheMaterial(Texture'XEffects.BloodSplat3P');

myLevel.AddPrecacheMaterial(Texture'XEffects.xBioSplat');

myLevel.AddPrecacheMaterial(Texture'XEffects.xBioSplat2');

myLevel.AddPrecacheMaterial(Texture'XGameShadersB.BloodJetc');

myLevel.AddPrecacheMaterial(Texture'XGameShadersB.BloodPuffA');

myLevel.AddPrecacheMaterial(Texture'XGameShadersB.AlienBloodJet');

myLevel.AddPrecacheMaterial(Texture'XGameShadersB.BloodPuffGreen');

myLevel.AddPrecacheMaterial(Texture'XGameShadersB.BloodPuffOil');
```

```
        myLevel.AddPrecacheMaterial(Texture'XEffects.GibOrganicGreen');
        myLevel.AddPrecacheMaterial(Texture'XEffects.GibOrganicRed');
        myLevel.AddPrecacheMaterial(Texture'XEffects.GibBot');

    myLevel.AddPrecacheMaterial(Texture'EpicParticles.FlickerFlare2');

        if ( myLevel.IsDemoBuild() )

        myLevel.AddPrecacheMaterial(Material'DemoPlayerSkins.DemoSkeleton');
        else

        myLevel.AddPrecacheMaterial(Texture(DynamicLoadObject("PlayerSkins.Huma
n_Skeleton", class'Material')));

        if ( !Static.NeverAllowTransloc() )
        {
                myLevel.AddPrecacheMaterial(Material'XEffects.TransTrailT');

        myLevel.AddPrecacheMaterial(Material'XGameShaders.TransPlayerCell');

        myLevel.AddPrecacheMaterial(Material'XGameShaders.TransPlayerCellRed');

        myLevel.AddPrecacheMaterial(Material'WeaponSkins.NEWTranslocatorTEX');
```

```
myLevel.AddPrecacheMaterial(Material'WeaponSkins.NEWTranslocatorBlue');

myLevel.AddPrecacheMaterial(Material'WeaponSkins.NEWTranslocatorPUCK');

myLevel.AddPrecacheMaterial(Material'WeaponSkins.NEWtranslocatorGlass');
}

if ( Default.bAllowVehicles )
{
        myLevel.AddPrecacheMaterial(Material'HUDContent.NoEntry');
}
        myLevel.AddPrecacheMaterial(Material'EpicParticles.BurnFlare1');
        myLevel.AddPrecacheMaterial(Material'DeRez.DeRezSkin');
        myLevel.AddPrecacheMaterial(Material'DeRez.RezTest4');

// water effects
        myLevel.AddPrecacheMaterial(Material'xGame.xCausticRing2');
        myLevel.AddPrecacheMaterial(Material'AW-
2004Particles.Energy.SparkHead');
        myLevel.AddPrecacheMaterial(Material'xGame.xSplashBase');
        myLevel.AddPrecacheMaterial(Material'xGame.xWaterdrops2');
```

```
if ( ((myLevel.NetMode == NM_ListenServer) || (myLevel.NetMode ==
NM_Client))
        && !myLevel.bSkinsPreloaded &&
        ((myLevel.bShouldPreload && myLevel.bDesireSkinPreload &&
        !Default.bForceDefaultCharacter) || myLevel.IsDemoBuild()) )
{
        class'xUtil'.static.GetPlayerList(AllPlayerList);
        if ( !myLevel.IsDemoBuild() )
        {

myLevel.ForceLoadTexture(Texture(DynamicLoadObject("UT2004PlayerSkins.X
anMk3V2_abdomen", class'Material')));
myLevel.ForceLoadTexture(Texture(DynamicLoadObject("UT2004PlayerSkins.Sk
aarj_Skeleton_Body", class'Material')));
        }
        // Filter out 'duplicate' characters - only used in single player
        // also filter out characters that aren't useable by bots (probably not
meant for DM)
        for(i=0; i<AllPlayerList.Length; i++)
        {
                if ( (AllPlayerList[i].Menu != "DUP") && (AllPlayerList[i].BotUse >
0) )
                {
```

```
                    // if no custom preloading, only preload Epic characters -
PlayerSkins, UT2004PlayerSkins, MechaSkaarjSkins, NecrisSkins, MetalSkins
                    if ( Default.bCustomPreload
                        || (Left(AllPlayerList[i].BodySkinName,12) ~=
"PlayerSkins.")
                        || (Left(AllPlayerList[i].BodySkinName,18) ~=
"UT2004PlayerSkins.")
                        || (Left(AllPlayerList[i].BodySkinName,21) ~=
"UT2004ECEPlayerSkins.")
                        || (Left(AllPlayerList[i].BodySkinName,16) ~=
"DemoPlayerSkins.") )
                    {
                        PlayerList[PlayerList.Length] = AllPlayerList[i];
                    }
                }
            }
            GameClass = myLevel.GetGameClass();
            bIsTeamGame = (GameClass != None) &&
GameClass.Default.bTeamGame;
            for (i=0; i<PlayerList.Length; i++ )
            {
                DynamicLoadObject(PlayerList[i].MeshName,Class'Mesh');
                if ( !bIsTeamGame )
                {
```

```
if ( (MyLevel.GRI != None) &&
MyLevel.GRI.bForceTeamSkins )
{
    if ( class'DMMutator'.Default.bBrightSkins &&
(Left(PlayerList[i].BodySkinName,12) ~= "PlayerSkins.") )
        LoadedSkin =
Texture(DynamicLoadObject("Bright"$PlayerList[i].BodySkinName$"_0B",
class'Material',true));
    else
        LoadedSkin =
Texture(DynamicLoadObject(PlayerList[i].BodySkinName$"_0", class'Material'));
}
else
    LoadedSkin =
Texture(DynamicLoadObject(PlayerList[i].BodySkinName,Class'Material'));
myLevel.ForceLoadTexture(LoadedSkin);
}
else
{
// preload team skins
if ( class'DMMutator'.Default.bBrightSkins &&
(Left(PlayerList[i].BodySkinName,12) ~= "PlayerSkins.") )
{
```

```
                    LoadedSkin =
Texture(DynamicLoadObject("Bright"$PlayerList[i].BodySkinName$"_0B",Class'Materia
l',true));
                    LoadedSkinBlue =
Texture(DynamicLoadObject("Bright"$PlayerList[i].BodySkinName$"_1B",Class'Materia
l',true));
            }
            else
            {
                    LoadedSkin =
Texture(DynamicLoadObject(PlayerList[i].BodySkinName$"_0",Class'Material'));
                    LoadedSkinBlue =
Texture(DynamicLoadObject(PlayerList[i].BodySkinName$"_1",Class'Material'));
                    if ( PlayerList[i].TeamFace )
                    {
                            LoadedFace =
Texture(DynamicLoadObject(PlayerList[i].FaceSkinName$"_0", class'Material'));
                            LoadedFaceBlue =
Texture(DynamicLoadObject(PlayerList[i].FaceSkinName$"_1", class'Material'));
                            myLevel.ForceLoadTexture(LoadedFace);

        myLevel.ForceLoadTexture(LoadedFaceBlue);
                    }
            }
```

```
                    myLevel.ForceLoadTexture(LoadedSkin);

                    myLevel.ForceLoadTexture(LoadedSkinBlue);

                }

                if ( !PlayerList[i].TeamFace )

                {

                    LoadedFace                                                  =

Texture(DynamicLoadObject(PlayerList[i].FaceSkinName,Class'Material'));

                    myLevel.ForceLoadTexture(LoadedFace);

                }

                if ( PlayerList[i].VoiceClassName != "" )


        DynamicLoadObject(PlayerList[i].VoiceClassName,Class'Class');

            }

        }

}


static function PrecacheGameStaticMeshes(LevelInfo myLevel)

{

        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibBotCalf');

        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibBotForearm');

        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibBotHand');

        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibBotHead');

        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibBotTorso');

        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibBotUpperarm');
```

```
        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibOrganicCalf');
        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibOrganicForearm');
        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibOrganicHand');
        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibOrganicHead');
        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibOrganicTorso');
        myLevel.AddPrecacheStaticMesh(StaticMesh'XEffects.GibOrganicUpperarm');

        myLevel.AddPrecacheStaticMesh(StaticMesh'WeaponStaticMesh.shield');
        myLevel.AddPrecacheStaticMesh(StaticMesh'WeaponStaticMesh.grenademesh
');
        myLevel.AddPrecacheStaticMesh(StaticMesh'NewWeaponPickups.AssaultPicku
pSM');
        if ( !Static.NeverAllowTransloc() )

        myLevel.AddPrecacheStaticMesh(StaticMesh'WeaponStaticMesh.NEWTransloc
atorPUCK');
}

defaultproperties
{
    DefaultEnemyRosterClass="XGame.xDMRoster"
    DeathMessageClass=Class'XGame.xDeathMessage'
    GameName="DeathMatch"
```

```
    ScreenShotName="UT2004Thumbnails.DMShots"

    DecoTextName="XGame.Deathmatch"

    Acronym="DM"

}
```

Locator.uc:

The locator class bellow is used to note a players position within the game level and then save that position to a log file. One minor adjustment was made to this code, in default properties bHidden was set to true as the human players decisions may be swayed by observing the position of the locator within the game world.

```
//-----------------------------------------------------------------------------

//

// Can be set hidden or not hidden by the player code.

//

// CBP 06-05-09.

//

//-----------------------------------------------------------------------------


class Locator extends Actor placeable;




var bool DEBUG;
```

```
var PlayerController PC;

var Pawn player;


function BeginPlay() {


  if(DEBUG) log(">>>>>");


}

function PostBeginPlay() {


  DEBUG = true;

//  DEBUG = false;


}


 function MatchCommencing() {


    log(">>>>>");

    log(">>>>> "$self$" matchCommencing() called");

    pc = Level.getLocalPlayerController();

    player = pc.Pawn;

    log(">>>>> "$self$"  player = "$player);
```

```
  }

  function MatchStarting() {

    log(">>>>>");
    log(">>>>> "$self$" matchStarting() called");
    pc = Level.getLocalPlayerController();
    player = pc.Pawn;
    log(">>>>> "$self$"  player = "$player);

  }

//--------------- show and hide the locator -----------------------------------

function show() {

    bHidden = false;

}

function hide() {

    bHidden = true;
}
```

```
function touch(Actor other) {

    pc = Level.getLocalPlayerController();
    player=pc.pawn;

  log(">>>>> "$self$" touched by player "$player);

}

defaultproperties {

  // Draw a default blank Static Mesh for this actor for the Editor.

  DrawType=DT_StaticMesh;
  StaticMesh=StaticMesh'CBP_SM_Semiotics.Bar384'

  bHidden=false
  //bStatic = false;
  bAlwaysRelevant=true
  //bNoDelete=true

  // need to set the below otherwise player will move through the actor .
```

```
 bCollideActors=True

// bBlockActors=True

// bBlockPlayers=False

// collisionRadius=64



}
```

Appendix 5: Epic games dataset:

Game play times:

Game Type	Score	Frags	Kills	Suicides	Team Kills	Avg FPH	Avg TTL	Matches	Hours
Deathmatch	952,927,594	277,847,706	303,992,732	26,145,026	0	196.3	15.4	4,814,692	1,415,755.20
Capture the Flag	282,087,450	74,589,927	88,975,045	14,385,118	634,065	221.5	11.7	1,084,540	336,725.90
Bombing Run	35,398,573	9,609,624	11,762,699	2,153,075	43,013	210.5	11.8	166,090	45,645.80
Team Deathmatch	193,870,107	135,075,239	147,756,395	12,681,156	1,815,583	263.4	11.5	1,496,871	512,780.30
Assault	177,707,236	33,525,882	96,484,901	62,959,019	1,944,064	60.6	12.5	996,869	553,629.60
Onslaught	1,061,474,122	303,402,699	349,619,285	46,216,586	1,195,533	237.1	11.6	2,897,123	1,279,778.00
Double Domination	1,806,434	0	576,730	0	1,802	205.1	13.7	11,567	2,465.00
Mutant	223,922	105,634	141,682	36,048	0	40.3	53.1	16,185	2,622.70
Invasion	-1,344,302	-13,583,039	9,422	13,592,461	250,046	-26	138.4	936,374	522,915.80
Last Man Standing	7,303,394	7,178,960	7,770,420	591,460	0	204.2	15.1	257,777	35,151.20
InstaGib Deathmatch	89,056,639	84,313,797	85,190,200	876,403	0	553.7	6.4	914,652	152,286.80
InstaGib CTF	863,499,472	357,976,143	362,528,437	4,552,294	132,943	907	3.9	1,390,729	394,683.50
InstaGib Bombing Run	57,205,325	26,242,759	26,895,249	652,490	20,411	525.2	6.5	184,876	49,966.70
InstaGib Team Deathmatch	31,787,459	30,613,908	30,964,982	351,074	51,691	685.5	5.1	179,291	44,656.40
InstaGib Assault	134,203	49,018	67,031	18,013	1,604	224.6	9.2	544	218.2
InstaGib Onslaught	194,087	45,760	51,851	6,091	93	86.9	32.7	1,033	526.5
InstaGib Double Domination	1,758,968	696,143	711,807	15,664	931	612.7	5.6	5,596	1,136.20
InstaGib Mutant	536,766	272,290	293,773	21,483	0	101.6	30.6	10,660	2,678.80
InstaGib Invasion	-158,497	-2,065,273	0	2,065,273	20,531	-30.3	118.7	137,287	68,099.00
InstaGib Last Man Standing	2,570,236	2,534,756	2,562,422	27,666	0	574.6	6.1	45,339	4,411.30
Vehicle CTF	295,671,146	75,890,763	89,669,529	13,778,766	457,663	231.8	11.4	1,054,778	327,461.70
InstaGib Vehicle CTF	783,709	236,366	261,782	25,416	1,293	167.6	17.7	4,172	1,409.90
	4,054,494,043	1,404,559,062	1,606,286,374	201,150,582	6,571,266	6,254	549	16,607,045	5,755,004.50

Most popular maps:

Map ID	Map Name	Matches	Score	Time	Last Match
1	DM-Rankin	1,829,111	194,230,244	34,338,845.30	11/11/2009 04:38
62	CTF-FaceClassic	992,710	309,357,807	20,125,275.10	11/11/2009 04:30
5	ONS-Torlan	966,066	264,185,523	23,761,380.40	11/11/2009 00:33
32	DM-DE-Grendelkeep	571,220	68,969,800	9,733,167.90	11/11/2009 04:41
118	DM-Campgrounds2004-G1E	462,346	62,133,458	9,126,117.90	11/11/2009 04:25
26	DM-Deck17	455,710	40,568,728	7,922,089.60	11/11/2009 04:14
158	ONS-Primeval	307,085	89,375,749	7,324,854.20	11/11/2009 04:16
24219	DM-Rankin-FE	302,583	23,283,171	10,015,628.80	11/11/2009 04:35
2	CTF-BridgeOfFate	295,694	64,056,538	6,712,859.60	11/11/2009 04:29
127	DM-Morpheus3	218,300	15,211,909	3,873,087.50	11/11/2009 02:56
91	DM-1on1-Idoma	203,992	18,815,762	2,840,147.60	10/11/2009 20:46
4	AS-Convoy	179,670	70,353,726	5,624,906.00	11/11/2009 03:37
13979	DM-Under_LE	161,751	21,080,040	2,546,795.20	11/11/2009 04:30
70	dm-de-ironic	160,217	7,842,090	3,539,387.10	10/11/2009 22:46
181	DM-Compressed	153,300	15,571,516	2,423,451.10	11/11/2009 03:45
197	DM-Goose2k4	147,413	24,808,393	3,344,910.20	11/11/2009 03:46
75	DM-Antalus	141,867	8,890,223	2,719,148.20	11/11/2009 00:47
251	DM-Gael	126,098	15,051,147	1,575,655.00	10/11/2009 22:15
73	DM-Goliath	125,126	14,965,397	2,637,973.30	10/11/2009 23:46
54	DM-1on1-Albatross	121,093	6,575,818	1,806,090.50	10/11/2009 17:13
190	DM-1on1-Roughinery	110,451	4,739,311	2,343,161.70	10/11/2009 21:01
154	DM-DE-Osiris2	95,255	5,335,467	2,185,368.30	11/11/2009 03:04
50	ONS-ArcticStronghold	91,007	25,958,856	3,069,539.40	11/11/2009 01:26
37	DM-Corrugation	84,022	7,172,289	1,609,522.40	11/11/2009 01:28
89	DM-TrainingDay	80,815	5,762,245	1,004,679.50	11/11/2009 04:12
17	ONS-CROSSFIRE	74,630	22,578,501	2,131,283.50	10/11/2009 22:48
1109	DM-CSDust080	71,089	6,059,665	1,332,336.70	10/11/2009 18:57
453	CTF-Grendelkeep	68,259	25,812,281	1,414,843.70	11/11/2009 00:43
628	CTF-Switchback-PRO2	67,212	57,694,770	1,358,018.70	11/11/2009 04:12
171	ONS-Severance	66,072	15,666,204	1,908,443.50	10/11/2009 15:08
81	DM-1on1-Mixer	64,490	2,956,423	1,239,773.10	10/11/2009 23:32
225	DM-Asbestos	63,241	4,198,515	1,082,706.60	11/11/2009 02:59
9355	CTF-Bioxeh	59,843	72,635,862	1,216,980.10	11/11/2009 04:28
106	DM-DE-Grendelkeep-RE	58,529	7,295,220	1,290,209.70	11/11/2009 04:29
74	CTF-Citadel	58,234	19,968,155	1,017,517.00	10/11/2009 14:42
112	DM-1on1-Crash	56,700	3,607,091	727,819.20	10/11/2009 18:29
123	DM-StalwartXLClassic	56,542	9,377,532	914,772.40	11/11/2009 01:11
130	DM-Curse4	54,059	4,600,344	781,108.60	11/11/2009 04:06
207	DM-Insidious	54,039	205,361,848	694,129.70	10/11/2009 17:08
42	ONS-RedPlanet	53,535	12,860,304	1,695,041.70	09/11/2009 06:27
18	ONS-Dawn	51,109	19,691,053	1,719,718.70	10/11/2009 08:31

Appendix 6 - UT2004 Map list:

This map list contains all the 101 standard Unreal Tournament 2004 Maps including those added in the official Unreal bonus packs.

Assault [6 maps]

- AS-Convoy
- AS-FallenCity
- AS-Glacier
- AS-Junkyard
- AS-Mothership
- AS-RobotFactory

Bombing Run [11 maps]

- BR-Anubis
- BR-Bitfrost
- BR- BridgeOfFate
- BR-Canyon
- BR-Colossus
- BR-Disclosure
- BR-IceFields

- BR-Serenity
- BR-Skyline
- BR-Slaughterhouse
- BR-TwinTombs

Capture the Flag [22 maps]

- CTF-1on1-Joust
- CTF-AbsoluteZero
- CTF-Avaris
- CTF-BridgeOfFate
- CTF-Chrome
- CTF-Citadel
- CTF-Colossus
- CTF-December
- CTF-DoubleDamage
- CTF-Face3
- CTF-FaceClassic
- CTF-Geothermal
- CTF-GrassyKnoll
- CTF-GrendelKeep
- CTF-January
- CTF-Lostfaith

- CTF-Magma
- CTF-Maul
- CTF-MoonDragon
- CTF-Orbital2
- CTF-Smote
- CTF-Twin Tombs

Deathmatch [41 maps]

- DM-1on1-Albatross
- DM-1on1-Crash
- DM-1on1-Desolation
- DM-1on1-Idoma
- DM-1on1-Irondust
- DM-1on1-Mixer
- DM-1on1-Roughinery
- DM-1on1-Serpentine
- DM-1on1-Spirit
- DM-1on1-Squader
- DM-1on1-Trite
- DM-Antalus
- DM-Asbestos
- DM-Compressed
- DM-Corrugation

- DM-Curse4
- DM-Deck17
- DM-DE-Grendelkeep
- DM-DE-Ironic
- DM-DE-Osiris2
- DM-DesertIsle
- DM-Flux2
- DM-Gael
- DM-Gestalt
- DM-Goliath
- DM-Hyperblast2
- DM-IceTomb
- DM-Inferno
- DM-Injector
- DM-Insidious
- DM-IronDeity
- DM-Junkyard
- DM-Leviathan
- DM-Metallurgy
- DM-Morpheus3
- DM-Oceanic
- DM-Phobos2
- DM-Plunge

- DM-Rankin
- DM-Rrajigar
- DM-Rustatorium
- DM-Sulphur
- DM-TokaraForest
- DM-TrainingDay

DoubleDomination [12 maps]

- DOM-Access
- DOM-Aswan
- DOM-Atlantis
- DOM-Conduit

- DOM-Core
- DOM-Junkyard
- DOM-OutRigger
- DOM-Renascent
- DOM-Ruination

- DOM-ScorchedEarth
- DOM-SepukkuGorge
- DOM-Suntemple

Onslaught [9 maps]

- ONS-Arctic Stronghold
- ONS-CrossFire
- ONS-Dawn
- ONS-Dria
- ONS-Frostbite
- ONS-Primeval
- ONS-Redplanet
- ONS-Severance
- ONS-Torlan

Total [101]

Appendix 7 – DM – Rankin:

5.2.2. DM-Rankin:

Rankin was quickly singled out as the first map for player observation. It can clearly be seen from the official Epic Games statistics that it is by far the most popular UT2K4 map, reporting roughly double the amount of games as the second placed map.[6]

The vast majority of UT2K4 Death Match maps fall into one of two camps, Industrial or Futuristic, Rankin falls into the first of these categories. The textures used within Rankin predominantly iron, concrete, steel and wood in appearance creating the feel of an old unused industrial building, to add to the dark atmosphere the windows show a thunder storm raging outside. The pickups within the level are placed quite evenly and there are multiple routes to each major room meaning player do not have to take a set path, the game level is also slip into multiple levels (floors) allowing three dimensional movement. The shape of the level is created through a combination of

[6] See Appendix 5 for the Epic Dataset.

static meshes and brush based constructions creating the feel of a realist environment. The level should give the opportunity to observe different player paths and allow interrogation of the player to ascertain the reasons for their movement patterns.

Appendix 7.1 – DM-Antalus:

5.2.3. DM-Antalus:

Deciding upon a second map for research was a harder task, finally Antalus was decided upon. Antalus fits into neither of the two unreal map categories (Industrial and Futuristic) instead focusing on a more natural appearance, for this reason the map lends itself to be used in a general study of semiotics within IEs rather than purely focusing on UT2K4 player movement. The visual differences between Antalus and Rankin are so striking that the environments could have been created by two different game engines.

Texturally Antalus is filled with natural greens and stones, the static meshes continue the natural theme throughout with the inclusion of large stone columns jutting up into the air and trees throughout. Unlike Rankin the levels shape is created by the terrain of the level itself, allowing movement through certain path but restricting others; this

does not limit the players choices as the outdoors environment is one of the most open to be found outside of the Onslaught game type. Like Rankin the level is three dimensional giving two main playing fields however the more adventurous explorer will find a small basement which continues the natural feel of the level with broken slabs as well as tall observation points that require skill and practise to reach.

Appendix 8 – Questionnaire Analysis:

6.2.1. Questionnaire Section One:

Question 1: Rate your exposure to computer games or immersive environments.

Mean results show a value of 3.7 for player exposure, this is a relatively centralised score meaning the majority of participants have had some experience with computer games. However the range of the data (4) shows that results from 1-5 (the full range of the scale) have been chosen. This would suggest a wide range of participants with a broader expanse of experience within IEs, however, the mode result of 5 would suggest that the majority of participants have a high exposure. From the results it has been ascertained that the majority of participants have advanced experience of playing computer games, there are a few participants who have little or no experience meaning the study should be able to incorporate general human (Westernised) behaviour rather than the culture of game players.

This result, according to Bell (DATE) shows that player will know what to expect from the game (due to the higher than average exposure [3.7]). However, Myers (1992) argues that player's experiences differ depending upon their skills with the game; consequently, even though the group is generally experienced more advanced game players may react differently to the stimulus within a game than a less experienced player.

Question 2: How many hours per week do you spend playing computer games?

This question is related to question one, ascertaining the amount of time players spend playing computer games. The median result for the amount of time spent playing per week is 6-8 hours. Concluding from this it would seem that game players have enough experience to ascertain what they find important within a computer game.

Question 3: For the time you spend playing, how much is single player?

The study is being completed using a single player IE, for this reason it is important to understand a player preference between single and multiplayer environments. Results show that with a mode of 6 the majority of players prefer online game playing. Section 2 Question 3 will show what genre of game they play the most and as such what cultural perceptions they will come into the game with. Due to the participants' preference for online gaming, the codes used to make sense of the GW are based upon a sociotechnical interpretation (Cypher and Richardson, 2007) meaning that the

participants may attempt to apply this context to the IE created in UT2K4. Should this be the case players may move around the game world in the same manner that they would move around an MMORPG.

Question 4: Do you think it is important for games to be open and free flowing (5), or is it important that games have a set path (1)?

This is the most critical question within this research project, an attempt is being made to understand how player interact within an IE. Therefore, how to make the player believe the game level is allowing free movement whilst the developer is constricting the player to a set path. Here we have a mean result of 3.5 suggesting that the majority of people would like their games to be open and free flowing.

Question 5: On average how long do you spend playing a new game in hours before you move on to another game?

The more time a gamer spends playing each game the more they explore the GW. A shorter play time would suggest that players purely do the main tasks within the game rather than fully exploring the environment. The mode result of 4 shows that players between 16-20 hours on each game. This is the central value for the questions. A range of 6 means that the full range of results (1-7) were logged, showing that the amount of time spent playing a new game is a very individual figure however, it also shows a wide range of participants helping to improve the studies validity.

Question 6: Is this playing time affected by the size of the game world?

This question has been designed to attempt to find a correlation between game playing and the size of a GW. Here the results are slightly contradictory, a mode result of 2 would suggest that the size of the GW is not related to the amount of time spent playing a game. However, the full range of answers were logged providing a mean result of 3.1 showing that in general participants believe they would play a game for longer if the GW is large. If a theory for guiding player movement through semiotic hints can be found it would mean that developers could spend less time developing smaller GWs whilst maximising playing time.

Question 7: How do you find your way around the game world? Rate the importance of the following:

Question 7 of the questionnaire is designed to ascertain which in-game objects a player regards as important, by ascertaining this and then carefully placing the objects within the GW it should be theoretically possible to guide a player around the world. It is this section that will have the greatest influence on the development of this study's IE. Here Ferri's (2009) theory of procedural player involvement will be tested alongside each of the available options within the questionnaire.

i. Visible paths e.g. Roads/walkways.

Mean, Median and Mode here provide a result of 4, suggesting that the vast majority of players believe that a clear visible path is important for guiding their movement around the IE. Whilst this is a relatively obvious result it is still critical for the development of computer game levels, allowing developers to both guide and trick a player into performing certain tasks. In some contexts the path may be something to avoid (e.g. when attempting to avoid detection), in this case the path provides a negative guide to player movement meaning that through its presence the game developer can control the players actions.

ii. Standout objects e.g. Towers/trees.

Standout objects are less important to the participants than visual paths, here a mean result of 3.3 was found. This would suggest that players are influenced by the positioning of tall objects, however, further research is needed to qualify this assumption; this will be tested within the project's levels.

iii. Terrain e.g. Rivers/mountains.

Results for terrain are again ambiguous, further testing is needed to result in a clear level of influence. Significance of terrain seems to be more personal than that of standout objects, the full range of results were logged however the mean result was 2 showing that the majority of players do not believe terrain to be important. The mean

result of 3.1 counteracts as when averaged out between all participants general feeling is that terrain is slightly more important than average (by 0.1).

iv. Open buildings.

Through the historical development of computer games a major issue of contention has been the interactivity of terrain. Whilst playing an early version of a FPS franchise (e.g. Call of Duty) the game was constructed in a linear form whilst later versions of the game allow interaction with the game level.

Image 4: Linear Call of Duty 2 (Infinity Ward, 2005).

Here, the human player can only move forwards, all of the buildings are solid brushes blocking player movement.

Image 5: None Linear Call of Duty: Modern Warfare 2 (Infinity Ward, 2009).

Here in a later version of Call of Duty, the buildings can be accessed and manipulated (not destroyed but distorted by bullet fire.) In the background of the image a texture has been applied to create the illusion of the building continuing into the distance. Using a non-linear level development requires far more developer time and computer resources (for both developer and gamer) thus it is critical for both player enjoyment and developer profitability to find a way to reduce the size of game levels whilst maintaining the sense of freedom. This is supported by data from the questionnaire with a mean result of 3.7 and a mode of 4 showing the majority of gamers want games to have a non-liner environment.

v. Moving objects e.g. Fire/water.

With a mean of 3 it would seem that players do not believe they are influenced by moving objects within the GW. These objects would seem to be points of interest and so should create player observation if not movement; this will need to be tested further.

vi. In-game pickups e.g. Weapons/ammunition/armour.

With a mean of 3.7 and a median and mode of 4 in-game pickups would appear to be one of the most effective tools for controlling player movement. Whilst high it is perhaps unusual that the mean of 3.7 is not higher with pickups being the way to gain strength and health within the game, greatly increasing the chance of success. Player movement in regard to pickups will be observed within the observation section (6.2).

vii. Lighting.

Lighting can affect the atmosphere of an IE; a mean result of 3.3 shows that in general the participants feel lighting is an important tool within IEs. However, eight

participants gave a score between 1 and 2 suggesting that they do not regard light as important for their actions; this will also be tested with the IEs created.

viii. The location of Non Player Characters (NPCs).

Certain genres of computer games require a high level of interaction with NPCs. Through this the games storyline, missions and objectives can unfold, therefore it is presumed that players would be inclined to approach NPCs. The mean result of 3.4 supports this assumption however is not definitive and requires testing within the created IE.

Question 8: Do you leave behind real world perceptions when you enter the game world? E.g. walk towards danger/fight instead of run?

A mean of 3.7 would suggest that the majority of gamers leave behind their real world perceptions when going into a GW, a form of suspended disbelief. This will allow them to take actions that they would not in the real world and as such their behaviours may seem unusual upon observation. Simply this means our real world presumptions cannot be placed into computer games and a study such as this is needed to understand player movement. This is supported by Megehelli's (2009) concept of a "digital prothesis", the character which the player controls allows the gamer to move in ways they would not in their human form.

Question 9: Should games have maps advising you on the path to take?

Many RPG games with large environments have maps telling the player which way to go. These maps come in two main forms, open and closed. An open map shows a full view of the environment whilst a closed map only shows areas the human player has explored. A score of 0.575 means that 58% of participants would like games to have a clear map showing their location and the way to mission objectives. This form of guidance does not have to reduce the influence of semiotic hints within the IE as players can still be influenced in the local area whilst moving to a distant area. It does however show that players may not want to spend a long period of time moving in the GW to achieve an objective. This supports the research allowing developers to produce smaller GWs.

Question 10: You are standing in a plain white room; there is nothing around you except two wooden doors. One is to your left, the other to your right. Which way will you turn?

This question is designed to test the participant's general inclination to turn right or left. Understanding this is critical to understand how players move around the GW, there may be many cultural factors in this decision such as being left or right handed or coming from a country with left hand or right hand drive road network. The results of the questionnaire show that 67% of participants would turn right first; this will be tested within the IE created.

Appendix 8.1 – Questionnaire Analysis:

6.2.2. Questionnaire Section Two:

Due to the nature of these questions (about the participant) the mode result will be taken to create an idea of the 'average' participant.

Question 1: Gender?

Mode: 1 (Male).

Mean: 0.85.

85% of the studies participants were male, leaving just 15% females; according to BBC News (2005) 48% of gamers are female. This figure takes into account all forms and genres of computers games. A presumption has been made that the demography for violent FPS games which this research focuses on is primarily male. However, the limited number of female participants can be seen as a negative and as such further research needs to be conducted into the female gamer.

Question 2: Age?

Mode: 2 (19-21).

Range: 6

The most common age group in the server is 19-21 however the age range of 6 shows that members from every age group in the server have been tested. Whilst all age groups are used within the study a further focus on mature gamers would be needed to understand their movement within IEs compared to younger audiences.

Question 3: What is your preferred gaming genre?

Mode: 5 (Role playing game).

The purpose of this question is to ascertain which type of game player prefer, this will help to test the players exposure to the FPS environment used within this research. Using the COUNTIF function within excel the see the most popular choices, from this we can see that FPS is the second most preferred genre. Both FPS and RPG make use of large interactive IEs however the ways in which player interactive with these differs greatly. Theoretically this should mean a wide range player interactions should be seen, helping to improve the study's validity.

Appendix 8.2 – Questionnaire Data:

On the following unnumbered pages a direct printout from excel of the questionnaire and observation data has been supplied. Appendix 9 continues from page 139 onwards.

Appendix 9 – Observation Antalus:

This section contains a play by play description of player's movements; this information has then been used to inform the results in section 6.4.

6.3.1 Observation Antalus:

- **Participant 1 (Male, 22-24, RPG, high exposure to IE):**

Player one, who has a high exposure to IEs, initially looks around his starting position to find any passages or pickups. Upon seeing a pickup he heads straight for it collecting a "shock rifle." This is unnecessary as participants were aware that there were no hostiles within the game level, suggesting that it is the natural reaction of an established gamer to collect all available pickups. Next, the participant asked to enter their preferred first person viewpoint; this can be achieved within Unreal Tournament through pressing the F4 key at any stage. Participant one heads down the left hand path; this could be down to an inherent bias towards left however the path, unlike the right path, is marked with pickups urging players to walk towards them.

Coming out of the path into the clearing participant one stops to view the space (A) in front of them, pausing on the pickups to the left hand side of the screen near the water. The player also pauses momentarily on the emitter which forms the list, this is an unreal object that emits some form of movement, in this case floating white dots; suggesting an interest in moving objects. They then move towards and collect these available pickups before taking a sharp right past a tall tree towards a previously hidden door. Walking towards this door shows a pickup inside a small room, the player heads directly toward the pickup, stops and looks around the room before deciding to move right. Here no reason can be seen for the right hand move, it appears to be a subconscious choice.

The player emerges from the room and instantly heads left and then takes the next right, here they look around the local area (B) stopping and pausing to look at the available pickups. It is interesting that in this case the player paid no attention to the emitter by the lift, perhaps because they had seen it before. The available pickups were health pickups which the player doesn't need, and following this observation they head back the way they came and take the next left. Coming into the next open space (C) the player walks until they can see pickups, they then head directly to the pickups and follow the path up towards higher ground. The player is now at their original starting location; all the pickups are collected in this zone.

Back at the first clearing (A) the player decides to take the same path again, heading into the small room. The same exit of the room is taken and again the player heads left, entering the clearing (B) the player realises they have been to this area before and

heads back to the room. Here the exit that has not yet been used is taken; the player walks forwards looking straight at a large tree before taking a right heading into the same clearing (B) for the third time. This time the player takes the health pickup and walks towards the emitter which forms part of the lift, the lift takes the player to higher ground. Taking a left the player walks towards a “rocket launcher” and collects the item. At the brow of the hill participant one looks left and right, seeing pickups in both locations left is chosen and the player takes the “minigun.” An interesting behaviour of the player is that they stay close to the walls throughout the IE where possible, perhaps as a method of defence to stop hostiles coming up to them from behind.

- **Participant 16 (Male, 19-21, driving, high exposure to IE):**

Player 16 does not spend as long as the majority of participants observing their surroundings upon start up, however, like most they take the left path collecting pickups along the way. Upon entering the clearing the use the large tree straight ahead as a focus for their movement, unusually they ignore the pickups available. The player takes a right turn at the tree to head into the underground room; this room was obscured from their view suggesting they knew its location before starting the test. The player then collects an adrenaline pickup and heads to the right-hand (most visible) exit, it could be suggested that if the player knew the location of the room they would also be aware that the shield pickup was also here (it had not generated yet). Leaving the room they turn left.

Following the outside path the participant takes the next left entering the clearing; they leave the clearing to the left hand exit and follow the path around collecting pickups along the way. Here they enter the original clearing and collect a few more pickups, however once again the weapons are not taken; perhaps as they are aware that there are no opponents. The player then enters the underground room and then heads through the unused left hand exit. Then they enter the clearing and jump to the higher ground, collecting a weapon for the first time. They then continue on the high ground collecting a "Rocket Launcher."

- **Participant 6 (Female, 27-29, RPG, average exposure to IE):**

Again the player starts by observing their local surroundings, getting a feel of the world they are about to explore. Unusually participant 6 decides not to collect the pickup next to them however they focus on the ammunition pickups to the right and head straight towards these. This leads the player to take the right hand path out of the starting area, unlike the majority of the other participants. They then take another moment to observe their surroundings before advancing down the path. The player first heads around a right hand corner on high ground before heading back to collect the pickups on the lower ground that have now become visible; a clear example of a pickup changing the players intentions. After this collection the player walks into the clearing initially heading left until their attention is turned towards the lift emitter. The player uses the lift and retakes high ground before heading across the bridge marked with pickups.

Now on top of the hill the player's movement is casually directed to the cluster of adrenalin pickups before continuing towards the centre of the hill which is marked by large stone structures on either side. Again the player's path is adjusted to collect the "lightning gun" on a lookout spot to the left, using their time here to observe the visible world. The player heads to the other end of the hill taking time to view available pickups and emitters; however, not walking towards them, they then head to a new hill across a bridge. Here emitters lure the player to the right and the player collects the "minigun." The player then heads towards the nearest available bridge and heads around the high ground, all pickups are ignored until a shield comes into view, this is collected.

Coming to the end of the higher ground the player ventures into the lower clearing for the first time in the IE, heading straight towards a door. Inside the room all pickups are taken and the left hand exit is chosen, the player observes both left and right but is unable to see anything of interest heads back into the room and out of the unused right hand exit. This player's behaviour is slightly different to that of participant one, pickups and the emitter again play a crucial role but the player became bored with collecting them for no return. Instead a distinct wish to stick to higher ground was observed only changing upon viewing an open doorway, a chance to see something completely new.

- **Participant 23 (Female, 32+, Non-Gamer, average exposure to IE):**

The player spends a long period of time looking around before asking to play in the first person viewpoint; the researcher complies with this request by pressing the F4 key. The player then, getting used to the controls heads left to collect an ammunition pickup. Following this they continue along the path drawn in by the pickups, but upon walking over them they are confused as to why they are still there. This is because the player is already on 100 health. They then head into the clearing and spend a long period of time looking around, using the above bridge as a focal point, perhaps suggesting a desire to be on high ground. The player continues down the path and the game ends.

- **Participant 5 (Male, 32+, FPS, high exposure to IE):**

Player five starts by looking around the see their local surroundings, they then collect the nearby weapon and head left collecting the ammunition pickups on their way to the clearing. Here they jump down and have a quick scan of their environment. The player then changes to a first person viewpoint. Heading forward the tunnel to the underground room appears, as something different the player is drawn towards this and enters the room collecting the shield and a few of the other pickups, a left turn is made out of the room. Heading into the clearing the player sees a pickup to the left and a rock formation to the right, and sensing this can be climbed the player attempts to jump up the rocks to reach high ground. This fails and the player heads to the pickup they saw before, a clear example of the player prioritising interactive elements within the level. The player's path is slightly adjusted to collect the ammunition pickups for the weapon they have just found.

Continuing along the path the player keeps close to the edge of the game level, perhaps as a form of defence. Seeing the emitter to the left the player is drawn towards the movement signifying the presence of the lift. Now the player is on high ground the advance along their path, slightly adjusting course to collect a series of pickups, after this the player continues on the original trajectory. An opening to the left is signalled by the placement of two large stone structures, entering this area the "lightning gun" becomes visible this is collected. The player pauses briefly to observe the level from the vantage point. The adrenaline pickups that could be seen ahead of the player are now collected, before the player maintains high ground collecting a series of health pickups along a bridge. Seeing a weapons pickup to the right the player heads directly for this, noticing a lift the player goes to see if there is anything of interest below it. Realising this is not the original path along high ground is taken and the player enters their starting location.

In the starting location a "U Damage" pickup has spawned, this is collected. The player stops to see if there are any more hidden exits from the spawn point. Entering the clearing the player heads straight forwards, ignoring the underground room the entered first time around. Pickups are collected and the path is followed entering a clearing, the player realises the whole level has been explored and heads towards the rock formation for earlier. The game ends.

Appendix 9.1 – Observation Rankin:

6.3.2 Observation Rankin:

This section contains a play by play description of player's movements; this information has then been used to inform the results in section 6.4.

- **Participant 1(Male, 22-24, RPG, high exposure to IE):**

Player one starts by having a quick look around, collecting the nearest pickup and then heading right towards high ground; the series of health pickups are collected along the ascent. Next the player looks right to see if there is anything of interest, not finding anything the player heads down the left hand path. Again there is nothing of interest here so they jump down to the pickups at the lower level, the height of this jump would suggest a separation of real world and GW beliefs. The pickup is collected and the player continues on their path towards the crossroads, here they look left, straight on and then right. Unable to see anything of relevance the player moves right (probably as this was their last choice) and enters a small room heading directly towards the "flak cannon" pickup. Both exits from this room are viewed but the one with a series of adrenaline pickups is chosen, these are collected bringing the player out to where they had jumped down to. The player shoots their weapon for no apparent reason.

They then take a left moving into the original spawn room, the exit to the right is taken (as they had taken what is now the left the first time around). A series of pickups are collected before the player makes a move to higher ground at the first available

opportunity. Seeing a “lightning gun” the player ignores the available left hand turn fixating on the pickup, this is collected and the player continues around until jumping back down to the “flak cannon.” Walking straight forwards to an unexplored section of the level the player is again taking high ground, a left turn is favoured, probably because of the visible pickups. Next the player enter a corridor with the choice of a left or right hand turn, left is chosen as it allows the player to move to higher ground, again all pickups are taken. Sensing that they have achieved all this section of the map has to offer they jump down two levels and collect a rocket launcher.

Back at the crossroads the player looks left and straight on; unusually the player does not even look right and in doing so misses the chance to collect the shield pickup. Back in the “shock rifle” room the player takes a left, collects the weapon and takes a further left, they are now back by the “flak cannon.” The player takes a left out of this room and can immediately see the waiting “super shield” walking towards the item the player fires a shot down the right hand corridor, perhaps as a pre-emptive strike to any enemies. After collecting the item the player returns to the “flak cannon” room and takes the upper right had exit (the lower would take them back to the “shock rifle” room). All pickups are collected including a “U damage” and the game ends.

- **Participant 21 (Male, 16-18, RPG, average exposure to IE):**

Participant 21 heads straight for high ground collecting the “health” pickups along the way, entering the room at the top of this path they collect the “lightning gun.” Following this they continue straight on ignoring the room below or room to the left,

this may be because the path forwards is marked by pickups. Collecting these, the player enters the room, collects the health and makes the choice to move to higher ground rather than lower ground. The “minigun” is taken and the “shield” in the adjacent left-hand corridor, exiting this corridor the player has a choice of right or left. Right is selected due to the evident pickups; these are collected as the player walks down the path.

At the end of the pickups the player jumps down to lower ground where more pickups can be seen, these are collecting including “health” and the “shock rifle.” Seeing “adrenaline,” the player’s movement is guided by the pickups’ locations. Entering the “flak cannon” room the weapon is taken and the left hand exit chosen, this brings the player towards the crossroads. Seeing the available “super shield” all exits are ignored until the item has been collected, retracing their steps the player then takes the right hand exit of the crossroads, seemingly interested in the rusted iron staircase which is visually different to the stone tiled floor. Knowing they have been here before the player ignores the “shock rifle” room and moves towards the spawn room, the unused exit (now a right hand turn) is taken and the player movies directly to the “bio-rifle.”

They then decide to take higher ground by walking up the wooden plank to a new platform, seeing the “minigun” the weapon is collected again before the player drops down to the lower level to continue exploring. The player enters the “flak cannon” room and moves towards the corridor that holds the “U damage;” collecting this item brings the player out to the “shock rifle” room. With the weapon now glowing purple (signifying it is temporarily double strength) the player fires a few shots and heads

down to the crossroads. Changing their mind they head back to the spawn room, make a right and re-enter higher ground. The game ends.

- **Participant 31 (Female, 19-21, RPG, relatively low exposure to IE):**

Player 31 starts by looking around the environment and collecting all local pickups, they see the right hand passage heading to higher ground laden with “health” pickups. Unusually they take the left hand path instead; they then only collect one out of the three “adrenaline” pickups, instead heading straight for the “Bio-Rifle” perhaps suggesting an aggressive gaming nature. The player continues along the corridor again ignoring the chance to move to higher ground, upon exiting the corridor at the far end the link gun is seen and collected. High ground is now taken and the “minigun” pickup collected.

The player decides to turn left and collects the waiting “shield,” they then head left through a small hole in the wall and jump down, again a separation of the game from reality. The upper left passage is taken and this time all pickups are collected including the available “U damage.” The player looks around the lower ground and collect the “shock rifle,” they then head left to look down the crossroads; walking backwards the player shoots down the crossroads. Now on slightly higher ground the player looks forwards and heads towards the lift going up a level the player walks forwards coming to a gap in the floor, they attempt to make a jump demonstrating the double jump technique (pressing space to jump and space again at the jumps peak for an extra height boost). It seems that the player is experienced within Unreal Tournament and

perhaps this level as they seemed to know the position of the lift and the available weapons.

Due to the failed jump the player enters the “flak cannon” room and attempts to jump up a piece of metal placed horizontally. Failing this they walk up the ramp to the higher ground, now upstairs a third jump is attempted towards a small hole in the wall, again this is failed. They walk back up to high ground and collect the shield before shooting at the opposite wall in the main room, it appears the player has now lost interest in exploring the map, seemingly that have played it before. A fourth jump across the gap between the upper walkways is attempted successfully; the player attempts the first jump again but fails. The game ends.

It seems unusual that a gamer that describes them self as having a low exposing to IEs moved so confidently attempting large jumps, clearly separating reality for the game. The player seemed to know the level in detail which is considered unusual due to their RPG preference.

- **Participant 15 (Male, 32+, RTS, low exposure to IE):**

Like the majority of players participant 15 looks around at the local area, here noticeable pauses occur when a pickup appears in the centre of the screen, unusually the player does not collect this. The player instead walks forward towards the open door ahead of them upon approaching this the path to the left can be seen to head upstairs and is marked out by a series of health pickups, the player changes direction

and collects these. Now upstairs the player continues on the path chosen not to go down either the left or right paths available, they continue forwards to collect the “lightning gun” pickup (the player actually misses this but collects all the lightning gun ammunition). They then continue around the path looking down to see a “double damage” pickup appear, this does not lure the player of the higher ground. The player, as an inexperienced gamer loses control of the controls and looks towards the ceiling. Upon correction the player heads forwards down the path collecting health pickups on the way, they then turn right down the next corridor missing the available pickups. The player notices a health pickup to their left, pauses to look at it but continues towards the end of the corridor, here they walk up a plank of wood to higher ground.

The player walks towards pickups as a path but does not collect them, after passing the “minigun” the player turns around and decides to collect it. They then continue forward until the next available left is taken, meaning they are heading into an unexplored area. The player walks towards and collects a shield pickup. Now back by the “lightning gun” the player collects the weapon before continuing forwards, taking a right to an unexplored walkway with a door at the end. The player stands here visually exploring the small room unsure what it is, jumping into the room shows the player that it is a lift and the player exits the lift at the same level they entered. The player heads forward towards the “lightning gun” pickup, again collecting the weapon for the second (should have been third) time. The player heads towards the edge of the level but before jumping decides to continue on the high ground and follows the path all the way around, sticking to the wall and continually heading for high ground.

Participant 15's actions are confusing, there is a draw towards pickups however the player does not necessarily collect them. Items such as the "lightning gun" seem to be used as a locator, allowing the player to explore from a position they are comfortable with. Primarily participant 15 stays on high ground, in fact the player next enters the lowest floor level of the map.

- **Participant 24 (Male, 22-24, FPS, high exposure to IE):**

Participant 24 fits into all the key marketing criteria that many games developers target, they are a young, experienced gamer that focuses of FPS games. Unreal Tournament being one of the leading FPS brands we can expect participant 24 to be confident with their actions making informed decisions.

Participant 24 walks straight of the starting room through the door in front of them, they then appear to ignore all visible pickups instead heading towards a large piece of corrugated steel which stands out of the environment due to its light colour. They attempt to jump up to this item, after failing to do this they continue along their path down the stairs, at the crossroad they stop and observe each direction. Seeing a moving wheel to the left the player heads towards this and observes its movement, suggesting that movement does effect the player's direction. The player stands and waits for the "super shield" (it is created on a timer system) to spawn before collecting the item, it appears the player has experience with this level and knows their way around. This would explain their starting actions, not looking around or collecting any pickups.

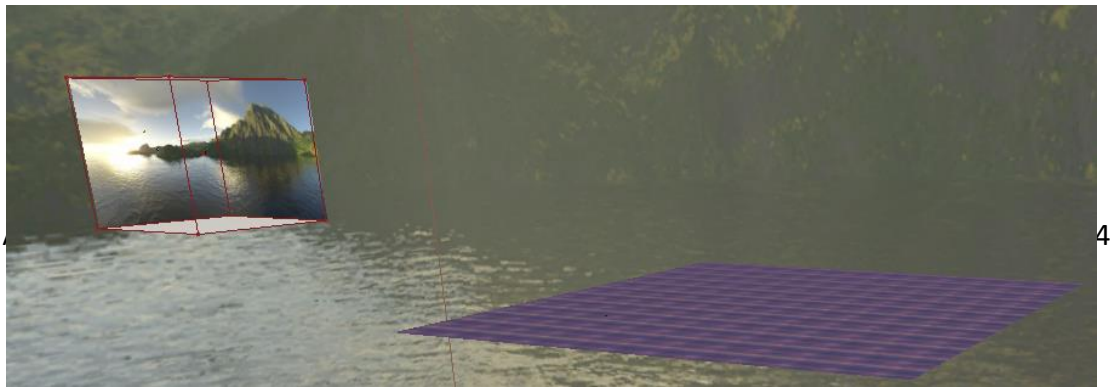
The player leaves the shield area taking a left at the crossroads; they then collect the "rocket launcher" pickup. This gives the player what is considered to be the strongest combination of attack and defence in the game. The player then takes the shortest path to reach high ground, placing them in an offensive position. Now the player has their desired weapon a pickup is found and collected during their movement. The player then heads directly to the "flak cannon" the second strongest gun in the game, further increasing the weapons arsenal. A conscious decision is then taken to move towards the "U Damage" pickup, doubling weapon damage. The player's movement is now very offensive, strafing from left to right to avoid any fire that may be directed at them and quickly exploring the level as a whole, only stopping to view the map at vantage points. The player then heads back to the "super shield" area which they know has just respawned.

Participant 24 is clearly very experienced in playing FPS games including Unreal Tournament 2004 and the map DM-Rankin. Their movement is based on tactics rather than whim or amusement, collecting the items they need to win the game should an enemy appear. However, this is not to say that lessons cannot be learned from their movement, like many experienced players participant 24 keeps their back to the wall in open spaces. They were also distracted by the moving wall near the "super shield", suggesting that moving object affect both experienced and inexperienced gamers alike.

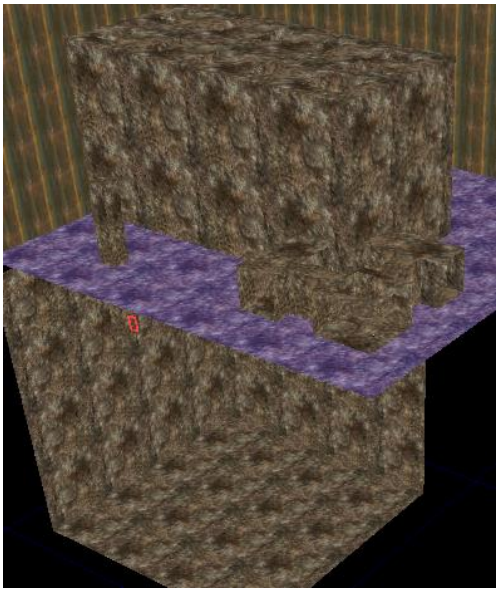
Appendix 10 – Stage One:

6.1 Stage One:

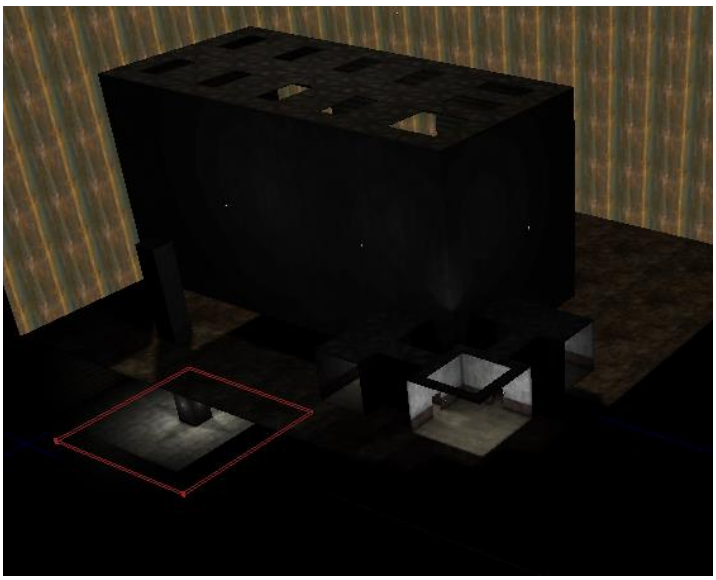
To begin with a large space needs to be created that will later house the created level. It was decided that the skybox would be created next in order to give the level its context, meaning that each addition to the level can be seen with the correct generic light effects. The map in its initial form can be seen below.



Following this, the structure off the level needs to be added. In order to test all aspects of IE's the level requires both an inside and an outside space to be constructed. For simplicity the inside spaces were created first, terrain was then added to create an overall effect. A series of interconnected rooms were created each of these will be used to test observations found from the research study, an initial room layout can be found below and to the right. The map has been constructed using a non linear design according to the findings of section 6.3.3:

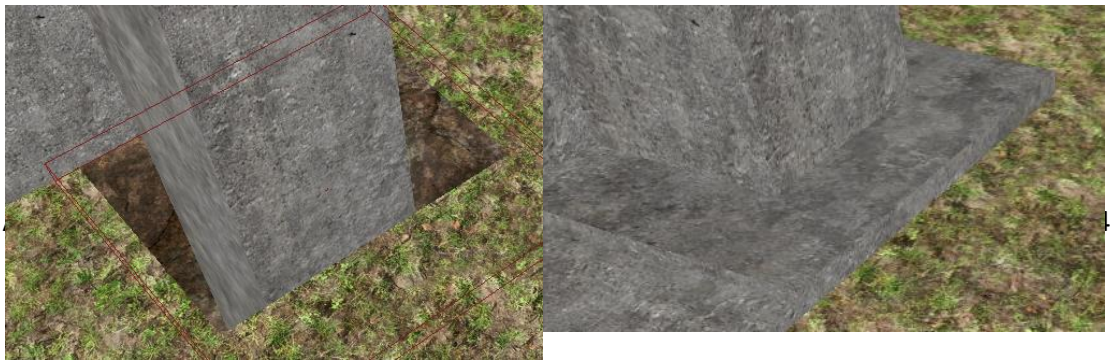


The next stage of the process is to texture all of the brushes appropriately. In this case an industrial theme was selected; this fits into the standard Unreal Tournament 2004



aesthetic and provides a stark contrast to the tranquil lake and mountain landscape used for the skybox. Limiting the number of textures used helps to create a coherent uncluttered and believable IE, once the texture has been placed it is then right clicked and aligned in the best way possible. Some textures such as the walls used for the smaller rooms were shrunk by 50% to display the textures full size (1024 unreal unit (UU) texture, on 512UU room). The next stage is to add some realistic lighting to the IE. In the image to the left this is implemented. By doing this one of the tests can be completed, we can see if the participant heads towards a room which is dark or light.

Now the map was textured and lit the terrain needed to be added for the outside world, this was done using the terrain editor and a grass texture was chosen to fit in with the skybox texture. Adding the terrain caused one major issue, it now intersected the lift. Terrain was removed from a localised area using the visibility tool and then covered using concrete blocks (below).

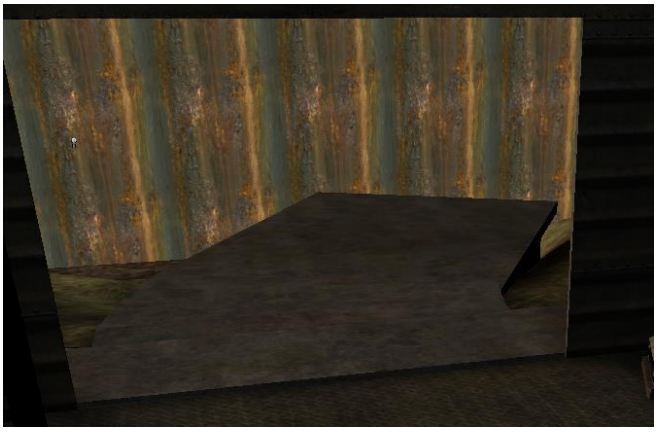


Now the base structure of the level is complete, additions were made to test the ideas within section 5.4. Here, the left/right bias test which consists of two identical rooms right in front of the player spawn was implemented; this will test the player's preference to either left or right. As noted early the majority (67%) of participants felt that they would take a right turn when given the chance, a result which seemed surprising due to the direction of the British road system.

Another test idea revolves around a player's concept of the meaning of colours; it has been found in this study that players leave behind their real world perceptions upon entering an IE. Leaving behind these perceptions should mean that player no longer associate green with safety or go and no longer see red as danger or stop. This will be tested by observing whether the player heads towards a green or red light:

In the image to the direct left a series of metal shelving units have been placed to create a visible path. Players have enough space to the left of this path to progress further into the room and as such this can be test can be used to see if objects do effect a players movement.

A further test has been placed outside of the main hall, this will show if players purposefully avoid objects and in doing so leave the physical path (direct left). Here low profile items have been placed, these items are easy to walk or jump over in game, testing a player's choice to interact with the environment.



The early research has shown that players follow physical paths in the environment; in the same manner people have been culturally conditioned to follow paths in the

real world. A presumption has been made that the curve of the path (image left) will cause players to favour a right hand turn leaving the main room.

Here is the IEs main room, it is split into a higher and lower section, research has shown that in general player prefer taking the high ground when available. This will be tested by observing player reaction when they reach this section of the map, they will be forced to either continue on low ground or head for high ground. Based upon the observational research carried out it can be expected that the majority of players will explore upstairs first.

Directional arrows have been placed into the level in an attempt to make players take the first available path. Whilst this test does not have any direct correlation to any of

the questionnaire research it will be interesting to see the relationship between this symbol and its signified meaning within an IE.

The addition of a path of “adrenaline” pickups has been placed in a clear section of the map. There is nothing of particular interest here and the path leads directly into the corner of the IE. This was a conscious decision to limit the appeal of the created pathway. Whilst the research is being undertaken through the collection of pickups “adrenaline” is never mentioned, making its collection a pointless activity. Should participants be drawn to the items the pointless nature of this task will further reinforce the power of collectable items to guide a human player around an IE.

Appendix 10.1 – Stage One Map Test Instructions:

6.1.1 Stage 1 Map Test Instructions:

Thank you for participating in this research, the level you are about to play is a draft product used to test some ideas developed during the course of its relevant work. You are asked to explore the level and collect five items; upon doing this the research is complete. If you wish to continue looking around the game level please do so, if not, or if you cannot find all the items please press the “Esc” key to exit.

To operate the lifts press the “E” key in front of the control panel. The lift will then move to your position, enter the lift and press the “E” key again, the lift will then remain on the same level as the in game character. To move levels enter the lift again and press the “E” key at the control panel.

The five collectable items:

Please walk over to the items to collect them.





Appendix 10.2 – Stage One Analysis:

6.1.2 Stage One Analysis:

Here, the information found whilst analysing the stage one pilot study shall be presented and developed to help create a methodology for influencing player movement. The most definitive observations shall be presented first; **(1)** all 11 of the participants took the first walkway after heading up the ramp to higher ground, this is most likely due to the arrows signifying that this is the correct path. There was nothing stopping the participants using the second walkway and the distance is identical to reach the visible "lightning gun" pickup. Due to this it can be hypothesised that players are relatively keen to follow clear indexical markers. **(2)** As previously stated all players observe their local surroundings when spawning, no player moves instantaneously. **(3)** 10 of the 11 participants (91%) in the pilot study walked up the ramp to their left when entering the main room, strongly suggesting a bias towards higher ground. This is supported through the observation that the "U-Damage" pickup was collected last by the majority of participants; this is located on the lowest ground in the map, suggesting that participants are uncomfortable in dropping height.

Here the effects of lighting and left right room test will be analysed, **(4)** the left/right test room created a mixed set of results; however, 74% of participants took the left hand exit. This is a far cry from the 67% that believed they would turn right, showing that participant's preconceptions are often incorrect when they enter the game world.

The questionnaire forced the participant to think about which direction they would turn, but when the participant is within an IE the movement is subconscious. This suggests a clear left hand bias. **(5)** The effects of lighting can be seen throughout the map, many participants seemed to head towards the lift due to the light above it which was clearly visible in a dimly lit section of the IE. One surprising effect of lighting was its ability to carve out paths within the IE, light comes flooding into the main room at the large central door to the outside section of the environment. This then created a brighter section of flooring which extended into the interior of the building. This section acted as a path of the majority of players when re-entering the building, walking along the light section before continuing their movement in their desired direction. **(6)** The effect of red and green lighting were tested when the participant exited the lift on the IEs lower level, with all 11 participants looking left (green) first rather than right (red). This shows a cultural bias towards the colour green perhaps due to reds' connotations of danger or the cultural meaning of stop (traffic lights). However, it must be noted that many participants only looked left first or took a few steps into the green section before turning and moving towards the red section. Perhaps this demonstrates a desire to head into danger due to the digital prothesis guarding the human player.

The proxemics of the IE also provided mixed results, **(7)** player did not show any particular bias towards moving through the path created from static meshes of shelving units and barrels. The same result was found when players were outside, some walked over the ground level objects to which blocked the path to the rear of the building whilst other participants moved around the objects. It would seem that

the effectiveness of static meshes or place able objects to control a players movement is valid however requires additional influence e.g. placement of pickups or lighting effects. **(8)** The dock directly in front of the levels exit to the outside GW meant the majority of participants took a right hand turn, due to the jetties right hand camber. **(9)** The effect of pickups can be seen with the majority of players heading towards the pickups and collecting some if not all of them. The path of the pickups can be clearly seen to head towards the corner of the map with nothing more of interest in this area, suggesting that the pickups and nothing else created the draw for player movement.

Appendix 11 – Stage Two:

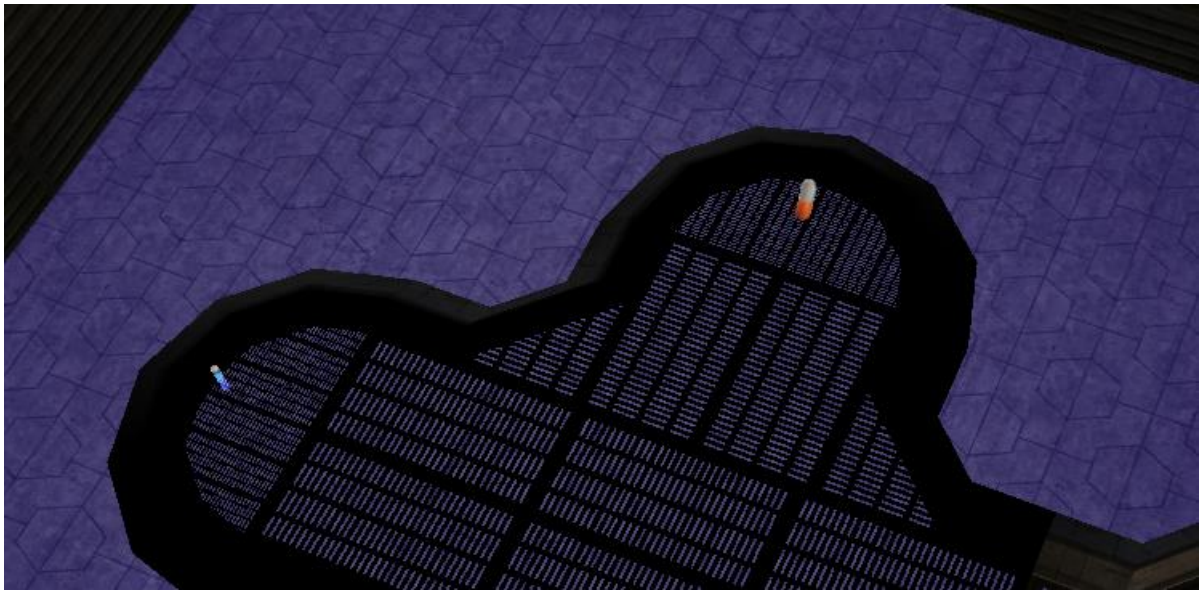
6.2 Stage Two:

Due to participants following the arrow sign and taking the first exit (bottom of the above image) on the walkways it was decided to test if players would take the top exit. In order to encourage this behaviour the sign was moved up unto its new position (see image) and the path was marked with pickups, again, a technique that was seen working in map 1. The inset image shows that this technique has also been used to encourage players to take the path through the metal shelves rather than walking around the items.

At the player's start the left or right choice has been adjusted, play tests showed an overwhelming preference towards the left hand door. Here the light has been removed from the left hand choice emphasising the right door. It is hoped that this technique will encourage players to choose the right hand door; in effect guiding the players around the IE.

Players seemed uncomfortable exploring the lower ground that can be seen to the left of this image. In order to help improve the appeal of this area additional detail was added. Two large cranes were positioned to

suggest the importance of the jetty. It will be seen if players now head into this lower area to collect the pickup hidden underneath it.



Question 8 – “Do you leave behind real world perceptions when you enter the game world? E.g. walk towards danger/fight instead of run?” has yet to be tested more directly within the created IEs. This will be achieved by asking players to walk off a cliff which is clearly high enough to kill their character. It will be seen if players are dubious about this action by asking them to collect a pickup; the health pickup indicates the gamer is calm about walking off the platform whilst the adrenaline pickup signifies that they are nervous. In order for players to get back onto the higher platform a jump pad was placed on the lower floor.

Moving objects were placed into the level to see what affect they had on player behaviour, questionnaire results showed that players don't believe moving objects to have any effect on their in-game movement. However observation has shown that pickups do affect a player's movement, as the majority of Unreal Tournament pickups make use of movement to attract players it would seem logical to suggest that players will wish to investigate the fans placed into the level.

From the questionnaires a mean result of 3.4 was found for players believing that NPCs affected their movement patterns. This figure is rather vague and as such this will be tested within the game level. It was decided that the NPC should not be moving or calling players over to it. This would introduce a further aspect of influence into the equation, it will purely be seen if the presence of an NPC draws players towards itself.

Appendix 11.1 – Stage Two Map Test Instructions:

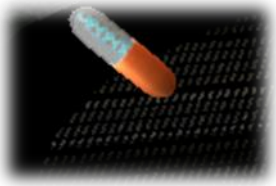
6.2.1. Stage 2 Map Test Instructions:

Thank you for participating in this research, the level you are about to play is a draft product used to test some ideas developed during the course of its relevant work. You are asked to explore the level and collect five items; upon doing this the research is complete. If you wish to continue looking around the game level please do so, if not, or if you cannot find all the items please press the “Esc” key to exit.

To operate the lifts press the “E” key in front of the control panel. The lift will then move to your position, enter the lift and press the “E” key again, the lift will then remain on the same level as the in game character. To move levels enter the lift again and press the “E” key at the control panel.

This is the jump pad, to use it simply walk onto the pad and you will be fired back up to the walkway above.

When you reach this platform please jump down to the ground below, if you feel anxious about this jump choose the “adrenaline pickup” if you are comfortable about this choose the “mini health.” It would be advisable to have collected the shield before jumping!



←Adrenaline | Mini Health →

The five collectable items:

Please walk over to the items to collect them.

Appendix 11.2 – Stage Two Analysis:

6.2.2. Stage Two Analysis:

Similarities can be found between map test one and map test two, the results of the stage two map test will now be analysed. **(1)** The left/right test spawn room showed the effectiveness of lighting for effecting a player's movement, with 85% of participants choosing the right hand exit. This is a contrast to the 74% which took the left hand exit in stage one, the only adjustment between the maps was to reduced the light in the left hand exit. This clearly shows that players movement is affected by the lighting effects a game developer chooses to implement, however, it must be remember that player show a left hand bias when lighting conditions are the same. The light path created by the main rooms' door had less of an effect on player movement in the stage two tests. Whilst some players still walked its length prior to moving in a new direction, the addition of extra stimulus, e.g. NPC proved too interesting for some players to complete their original movements. **(2)** In the stage one map test it was observed that 91% of participants chose to move to higher ground as

soon as they entered the levels main hall; by placing a series of pickups along the path created using static meshes this figure greatly fell. Now only 42% decided to go upstairs first, with the majority of the other participants deciding to collect the pickup walking through the created path. A bias towards higher ground was still seen with most participants exploring the lower sections of the levels last. The pickups placed outside the main hall to the right of the exit also proved to draw players into positions within the IE, even though it was clear they lead nowhere of interest. **(3)** Another similarity found between test two and test one was players' preference to walk towards the green lights, here 85% of participants moved towards the green light before the red.

(4) An NPC was added to this version of the GW; this provided some interesting results with all seven of the participants of the stage two pilot study approaching the NPC. Most interestingly 5 participants decided to kill the NPC in game, showing massively aggressive tendencies. This would suggest that player do in fact leave behind real world ideologies and behaviours when entering the game world. **(5)** In contrast to this when players were asked to jump of a platform to the ground below 85% of participants chose to take the adrenaline pickup, signifying that they felt and element of unease about the jump. This result would suggest that players do not leave behind all real world perceptions upon entry into the GW.

Alongside this it was also found that **(6)** static meshes still meant some players would change their path in order to avoid contact with them; this is evidenced through the small objects to the left hand corner of the main building. Here players would walk in

between the objects and then around the extruding large metal cog (static mesh) in order to avoid collision. Whilst this method is not as effective as some of the above it could be used alongside other to create a realistic game level. **(7)** Movers proved to be a method for attracting player attention; a few players took the time to walk over to the mover to observe its behaviour whilst the majority just paused to view the object. Therefore, movers can be used to draw a player's attention to a certain area of the map to which another visual influence may then be used to draw their movement e.g. a pickup. **(8)** Emitters seem to have the same effect, many players decided to turn left out of the main building, in stage one the majority of players took a right hand turn when leaving the building. The only adjustment to the GW that can be seen to have caused this effect was the rain emitter placed to the left hand side of the map causing a visually clear amount of rain to fall to the left hand side of the building.

The theorems above are starting to create a theory for guiding players' movement around IEs. It was noted that the addition of extra visual stimulus, such as the movers and extra pickups created player confusion, in many cases a player would pause and way up the positives and negatives of their actions before proceeding. This can primarily be seen in the observation videos when players enter the main hall, unsure whether to walk up the ramp to their left or through the shelf path marked by pickups to the right.

Appendix 12 – Stage Three Map Test Instructions:

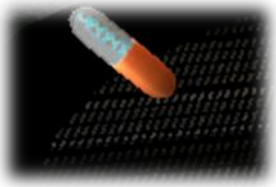
6.3.1 Stage 3 Map Test Instructions:

Thank you for participating in this research, the level you are about to play is a draft product used to test some ideas developed during the course of its relevant work. You are asked to explore the level and collect seven items; upon doing this the research is complete. If you wish to continue looking around the game level please do so, if not, or if you cannot find all the items please press the “Esc” key to exit.

To operate the lifts press the “E” key in front of the control panel. The lift will then move to your position, enter the lift and press the “E” key again, the lift will then remain on the same level as the in game character. To move levels enter the lift again and press the “E” key at the control panel.

This is the jump pad, to use it simply walk onto the pad and you will be fired back up to the walkway above.

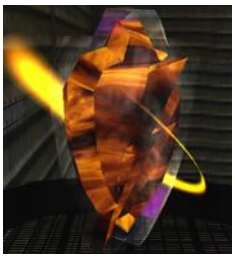
When you reach this platform please jump down to the ground below, if you feel anxious about this jump choose the “adrenaline pickup” if you are comfortable about this choose the “mini health.” It would be advisable to have collected the shield before jumping!

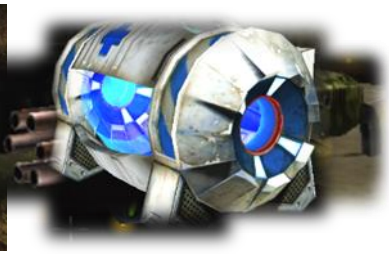


←Adrenaline | Mini Health →

The seven collectable items:

Please walk over to the items to collect them.





References:

Books:

Avison, D. and Fitzgerald, G. (2006) **Information System Development: Methodologies, Techniques and Tools.** 4th ed. New York: McGraw-Hill.

Bennett, S, McRobb, S, Farmer, R. (2002) **Object-Orientated Systems Analysis and Design: Using UML.** Maidenhead: McGraw-Hill Educational.

Chandler, D. (2007) **The Basic: Semiotics.** 2nd ed. New York: Routledge.

Dawson, C. (2005) **Projects in Computing and Information Systems: A Student Guide.** Dorset: Addison Wesley.

Donald, M. (1991) **Origins of the Modern Mind.** Cambridge, Harvard University Press. In: Soneson, G. (2007) "How Global is Global Semiotics: Going beyond Seboek's paradox." Department of Semiotics, Lund University.

Ellis, J. **Visible Fictions: Cinema: Television: Video.** Routledge & Kegan Paul, London., 1982. In: Cypher, M and Richardson, I. (2007) "An actor-network approach to games and virtual environments." Murdoch University.

Gilmour, H. (2008) What Girls Want: The Intersections of Leisure and Power in Female Computer Game Play. In: Carter, C. and Steiner, S. (Ed.) **Critical Readings: Media and Gender.** Maidenhead: Open University Press.

Howells, R. (2003) **Visual Culture: An Introduction.** Polity Press.

Nelson, S., Smith, J and Tosca, S. (2008) **Understanding Video Games: The Essential Introduction.** New York: Routledge.

Morris, C. (1938) **Foundations of the Theory of Signs.** Chicago: Chicago University Press. In: Chandler, D. (2005) **Semiotics for Beginners.** [online]. Available at: http://www.aber.ac.uk/media/Documents/S4B/semiotic.html [Accessed 02/10/2009].

Myers, D. (2003) **The Nature of Computer Games: Play as Semiosis.** New York: Peter Lang Publishing.

Pearson, R. and Simpson, P. (2001) **Critical Dictionary of Film and Television Theory.** London: Routledge.

Philips, E and Pugh, D. (2000) "How to get a PhD: A handbook for students and their supervisors" In: Dawson, C. (2005) **Projects in Computing and Information Systems: A Student Guide.** Dorset: Addison Wesley.

Stokes, J. (2008) **How to do Media and Cultural Studies.** Gateshead: Sage.

Taylor, L. and Willis, A. (1999) **Media Studies: Texts, Institutions and Audiences.** Oxford: Blackwell.

Thwaithes, T., Davis, L. and Mules, W. (2002) **Introducing cultural and media studies: a semiotic approach.** Hampshire: Palgrave.

Images:

Infinity Ward. (2005) **Linear Call of Duty 2** [image]. Available at: http://images.trustedreviews.com/images/article/inline/2140-2.jpg [Accessed 08/04/2010].

Infinity Ward. (2005) **Non Linear Call of Duty: Modern Warfare 2** [image]. Available at: http://www.thetechherald.com/media/images/200946/modern_1.jpg [Accessed 08/04/2010].

Journals:

Casey, D. (2006) "Choosing a Data Collection Method." **Nurse Researcher.** 13(3): pp75-92.

Chesher, Chris. (2004) “Neither gaze nor glance, but glaze: relating to console game screens.” **SCAN Journal of Media Arts Culture**. 1(1). In: Cypher, M and Richardson, I. (2007) “An actor-network approach to games and virtual environments.” Murdoch University.

Cypher, M and Richardson, I. (2007) “An actor-network approach to games and virtual environments.” Murdoch University.

Dillon, G. (1999) “Art and the Semiotics of Images: Three Questions About Visual Meaning.” University of Washington.

Ferri, G. (2009) “Interpretive Cooperation and Procedurality: A dialogue between Semiotics and Procedural Criticism.” **Computer Games: Between Text and Practise.** 3(5): pp.15-20.

Fraile, S. (2009) “*Manic Miner* under the *Shadow of the Colussus*: a Semiotic Analysis of the Spatial Dimension in Platform Video Games.” **Computer Games: Between Text and Practise.** 3(5): pp.67-74.

Friedman, T. (1999) “Semiotics of SimCity” **First Monday: Peer-Reviewed Journal on the Internet.**

Hall, E. (2003) “Proxemics: The Semiotics of Space.” University of California, Berkeley.

Harries, D. (1996) "The Semi-Semiotics of Film: Social Semiotic Methodology for Film Studies." **Film Criticism.** Pp. 39-54.

Hitchens, M. (2007) "Time and Computer Games *Or* "No, that's not what happened."" **ACM International Conference Proceeding Series.** 207: pp. 44-51.

Jarvinen, Aki. (2001) "Quake Goes the Environment: Game Aesthetics and Archaeologies."
Digital Creativity. 12(2): pp. 67-76.

Kucklick, J. (2003) "Perspectives of Computer Game Philology." **Game Studies: The International Journal of Computer Game Research.** 3(1).

Letho, O. (2009) "The Collapse and Reconstitution of the Cinematic Narrative: Interactivity vs. Immersion in-game Worlds." **Computer Games: Between Text and Practise.** 3(5): pp.21-28.

Lindley, C.A. (2005) "The Semiotics of Time Structure in Ludic Space as a Foundation for Analysis and Design." **Game Studies: The International Journal of Computer Game Research.** 5(1).

Meneghelli, A. (2009) "Simulacral and Embodied Enunciation in Computer Games." **Computer Games: Between Text and Practise.** 3(5): pp.42-50.

Moriarty, S. (1994) “VISEMICS: A PROPOSAL FOR A MARRIAGE BETWEEN SEMIOTICS AND VISUAL COMMUNICATION.” Visual Communication 1994, California.

Myers, D. (1991) "Computer Game Semiotics," **Play and Culture***,* 4:pp. 334-346. In: Friedman, T. (1999) “Semiotics of SimCity” **First Monday: Peer-Reviewed Journal on the Internet.**

Myers, David. (1992) “Time, Symbol transformations, and Computer Games." **Play and Culture**, 5(4) November: pp 441-457.

Scalisi, C. (2001) “A semiotic communication model for interface design.” University of Turin.

Sebeok, T.A. (1999) “The Sign Science and the Life Science.” **Applied Semiotics.** 3(6/7): pp. 85-96.

Sonesson, G. (2007) “How Global is Global Semiotics: Going beyond Seboek’s paradox.” Department of Semiotics, Lund University.

Wade, A. (2009) “Spatial Typologies of Games.” **Computer Games: Between Text and Practise.** 3(5): pp.75-80.

Zueva, A., Jackson, P. and Ghauri, P. (2007) "Working Paper Series - Attitudes Towards Cultural Change in Post-M&A Integration: Integrating Theoretical Perspectives." University of Manchester, Manchester Business School Working Paper No. 517.

Websites:

ASPAlliance. (2010) **Software Development Life Cycle.** Available at: http://aspalliance.com/articleViewer.aspx?aId=1017&pId=-1 [Accessed 10/02/2010].

BBC News. (2005) **Gaming in the UK.** Available at: http://news.bbc.co.uk/1/shared/spl/hi/pop_ups/05/entertainment_gaming_in_the_uk/html/4.stm [Accessed 9/04/2010].

Cardozo, E.L. (2002) IBM, **The seven habits of effective iterative development** [online]. Available at: http://www.ibm.com/developerworks/rational/library/1742.html [Accessed 05/02/2010].

Chandler, D. (2005) **Semiotics for Beginners.** [online]. Available at: http://www.aber.ac.uk/media/Documents/S4B/semiotic.html [Accessed 02/10/2009].

El-Nasir, M., Niedenthal, S., Knez, I. and Almeida, P. "Dynamic Lighting for Tension in-games" [online]. **Game Studies: The International Journal of Computer Game Research.** 7(1). Available at:

http://gamestudies.org/0701/articles/elnasr_niedenthal_knez_almeida_zupko [Accessed 09/03/2010].

Epic games (2009) **UT2004 Stats: Totals for all players.** [online]. Available at: http://ut2004stats.epicgames.com/totals.php [Accessed 11/11/2009].

Epic games (2009) **UT2004 Stats: Unreal Tournament 2004 Map List.** [online]. Available at: http://ut2004stats.epicgames.com/index.php?stats=maps [Accessed 11/11/2009].

Gangolly, J.S. (1997) **The waterfall model (system development life cycle)** [image]. Available at: http://www.albany.edu/acc/courses/fall97/acc681/ch7.html [Accessed 01/02/2010].

Jayaswal, B.K. and Patton, P.C. (2006) **Software Development Methodology Today: Software Development Strategies and Life-Cycle Models.** Available at: http://www.informit.com/articles/article.aspx?p=605374&seqNum=2 [Accessed 12/02/2010].

Juul, J. (1998) "A Clash between Game and Narrative. M.A. Thesis" [online]. Available at: http://www.jesperjuul.dk/thesis. Accessed: N/A. In: Kucklick, J. (2003) "Perspectives of Computer Game Philology." **Game Studies: The International Journal of Computer Game Research.** 3(1).

Juul, J. (2001) “Games Telling Stories” [online]. **Game Studies: The International Journal of Computer Game Research.** 1(1). Available at: http://gamestudies.org/0101/juul-gts/ [Accessed 07/03/2010].

Key, J. P. Oklahoma State University. (1997) **Research Design in Occupational Education, Module R8: Questionnaire and Interview as Data-Gathering Tools** [online]. Available at: http://www.okstate.edu/ag/agedcm4h/academic/aged5980a/5980/newpage16.htm [Accessed 29/01/2010].

Klastrup, L. (2009) “The Worldness of EverQuest: Exploring a 21st Century Fiction” [online]. **Game Studies: The International Journal of Computer Game Research.** 9(1). Available at: http://gamestudies.org/0901/articles/klastrup [Accessed 09/03/2010].

Landay, J. (2001) **The Software Life Cycle** [online]. Available at: http://bmrc.berkeley.edu/courseware/cs169/spring01/lectures/lifecycle/sld001.htm [Accessed 23/03/2009].

Port, R. (2000) **Icon, Index and Symbol** [online]. Available at: http://www.cs.indiana.edu/~port/teach/103/sign.symbol.short.html [Accessed 04/04/2009].

University of North Carolina. (2006) **Introduction to systems analysis** [online]. Available at:

http://www.ils.unc.edu/courses/2006_fall/inls46http://www.ils.unc.edu/courses/2006_fall/inls461_001/fall06/db/sysanalysis.pdf1_001/fall06/db/sysanalysis.pdf [Accessed 08/02/2010].

Williams, M. (2001) "Are TV and Film Like a Language Which we Read?" [online]. Available at: http://www.aber.ac.uk/media/Students/mhw0101.html. [Accessed 5/4/2010].

Wright, T., Borina, E and Breidenbach, P. (2002) "Creative Player Actions in FPS Video Games: Playing Counter Strike Source" **Game Studies: The International Journal of Computer Game Research.** 2(2). Available at: http://www.gamestudies.org/0202/wright/ [Accessed 09/03/2010].

Unreal Tournament 2004 Resources:

Whorley, H. (2009) Skybox Texture Pack 2 (UT2K4) [online]. Available at: http://www.hazelwhorley.com/textures.html [Accessed 09/04/2010].

Bibliography:

Books:

Hartley, J. (2007) **Communication, Cultural and Media Studies.** London: Routledge

Nelson, S., Smith, J and Tosca, S. (2008) **Understanding Video Games: The Essential Introduction.** New York: Routledge.

Busby, J., Parrish, Z. and Van Eenwyk, J. (2004) **Mastering Unreal Technology: The art of level design.** Sams Publishing

Journals:

Huhtamo, E. (2003) "VISUAL COMMUNICATION AND SEMIOTICS: Some basic concepts." UCLA Department of Design, DESMA 103 Visual Communication.