



University of HUDDERSFIELD

University of Huddersfield Repository

Fricker, Helen

Game User-Interface Guidelines: Creating a set of Usability Design Guidelines for the FPS Game User-Interface

Original Citation

Fricker, Helen (2012) Game User-Interface Guidelines: Creating a set of Usability Design Guidelines for the FPS Game User-Interface. Masters thesis, University of Huddersfield.

This version is available at <http://eprints.hud.ac.uk/id/eprint/17809/>

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

For more information, including our policy and submission procedure, please contact the Repository Team at: E.mailbox@hud.ac.uk.

<http://eprints.hud.ac.uk/>

GAME USER-INTERFACE GUIDELINES

CREATING A SET OF USABILITY DESIGN GUIDELINES FOR THE FPS GAME USER-INTERFACE

HELEN FRICKER

MASTER OF ARTS THESIS

COMPUTING AND ENGINEERING

UNIVERSITY OF HUDDERSFIELD.

SEPTEMBER 2012.

ABSTRACT

This study reports on how usability principles can be implemented into a game development framework for the in-game user interface and head-up display. The concepts of usability and how to evaluate for usability were found from literature, usability heuristics (Desurvire & Wiberg, 2009; Nielson & Mack, 1994) provided a structure to carry out the research studies.

The research aimed to explore and interpret how UI features were been designed within current video games and extract findings on whether the UI incorporated usability measure. A collection of first-person shooter (FPS) video games were selected by *Metacritic* and a selection medium to high rated titles was chosen. The duration of the research period involved playing the selected game titles in week long play sessions. The play sessions generated the majority of the findings, which appear within the final recommendations of the study. The research was taken further where it surveyed a small sample of the target demographic player of first-person shooter games. The findings provided an understanding of certain UI features used with the FPS game that players found the most helpful.

CONTENTS

Figures.....	5
Tables.....	6
1. INTRODUCTION	7
1.1 Purpose.....	7
Who	8
Why	8
2. LITERATURE REVIEW	10
2.1 Usability	10
Usability can be measured using heuristics.....	10
Usability Heuristics for software	11
Usability Heuristics for video games	13
Usability methods used within the games industry at the moment.....	13
2.2 Designing for the user	15
User-Centred Design	15
2.3 The video game UI and HUD.....	16
What are the UI and HUD?	16
2.4 Fun, flow, and the user experience.....	18
What is flow?	18
Flow within the gaming experience	18
Designing the in-game UI so that flow and fun are not affected.....	18
The user experience and why it is important within any product.....	19
2.5 Designing the game GUI	20
Designing for the goals and purpose of different video game genres	20
The importance of visual feedback, audio feedback, and peripheral control.....	21
Aesthetic Design.....	23
Designing for cognitive loads	25
2.6 Game heuristics taken from the literature	29
3. METHODOLOGY.....	32
3.1 Introduction	32
3.2 Play Sessions.....	32
Goal.....	32
Which games?	33

Pilot test - Beta tested other people's games.....	33
How will I collect and analyse this data?	33
3.3 Online surveys	34
Goal.....	34
What is my sample size?	34
Demographic players and survey distribution.....	35
How will I collect this data?	36
How will I analyse this data?	36
3.4 Scope and planning.....	37
4. RESEARCH FINDINGS & DISCUSSION.....	38
4.1 Play Session Findings	38
Serious Sam 3: BFE	39
Brink	42
Crysis 2.....	46
Call of Duty: Modern Warfare 3.....	49
FEAR 3	53
Half Life 2	55
4.2 Further findings	57
Criteria list.....	57
4.3 Online survey findings	59
Closed Format Questions	60
Open Format Questions.....	62
Entertainment Value	67
5. DISCUSSION OF THE FINDINGS.....	68
6. FINAL RECOMMENDATIONS.....	69
6.1 The Usability Design Guidelines.....	69
7. CONCLUSIONS & FINAL WORDS.....	73
7.1 Where the goals of the study met?	73
Were the final recommendations what was expected?.....	73
Do you think the final recommendations have achieved their goal?	74
How do these guidelines fit into a games development studio?	74
7.2 Suggestions for the future research.....	75
APPENDICES.....	76
REFERENCES	116

Figures

1. Comparing the design of new and old games titles from the Serious Sam series.
2. The game is in the player is in the game from Schell (2008).
3. Screenshot from Battlefield 3 provides an example of the 'player avatar'.
4. In Dead Space the players health has be integrated into the game world.
5. In Serious Sam 3: BFE 3D world objects are used to provide feedback.
6. Gantt chart showing the time management for each part of the study.
7. Serious Sam 3: BFE screenshot : colour-coded outlines indicated the type of pick-ups throughout the levels.
8. Serious Sam 3: BFE screenshot : crosshair informs the player on the enemy's health by using a traffic light colour code system.
9. Serious Sam 3: BFE screenshot : player's health is low.
10. Brink screenshot: class type icons: Soldier, Engineer, Operative and, Medic.
11. Brink screenshot: floating visual icons appear above teammates' heads.
12. Brink screenshot: mission objectives appear in colour-coded visuals.
13. Brink screenshot: primary objective in yellow has been visually outlined in the 3D game world.
14. Brink screenshot: players health bar.
15. Crisis 2 screenshot: Tactical Visor mode shows tactical options within game environment.
16. Crisis 2 screenshot: returning to the main HUD interface shows tactical option player has tagged.
17. Crisis 2 screenshot: Nanosuit voice commands are backed up using visual text.
18. Call of Duty Modern Warfare 3 screenshot: size and style of font are used to show different types of information.
19. Call of Duty Modern Warfare 3 screenshot: different types of information grouped to specific areas on screen.
20. Call of Duty Modern Warfare 3 screenshot: mission objectives and status listed via visual text feed.
21. Call of Duty Modern Warfare 3 screenshot: underwater motor vehicle presents feedback to the player.
22. FEAR 3 screenshot: candle signifiers used to convey navigational information to the player.
23. Half Life 2 screenshot: HUD visuals show the state of player's health and HEV suit protection.
24. Half Life 2 screenshot: HUD visual is heightened in colour tone to show player the increase in suit protection.
25. The response rates for the single player and multiplayer surveys.

26. The overall ratings for both visual and auditory UI for each game that gained responses.
27. The overall ratings for the visual UI for each game that gained responses.
28. The overall ratings for the auditory UI for each game that gained responses.
29. The overall responses for how entertaining each game was.

Tables

1. How usability within a video is perceived by a collection of game developers
2. Three different categories in-game feedback can be separated into; visual, auditory and haptic.
3. Four terms used to classify the types of UI found in an FPS UI by Fagerholt & Lorentzon (2009).
4. A list of the usability heuristics found in the literature.
5. The list of games that were selected using the criteria set out.
6. Common UI features within the FPS games studied.
7. The number of respondents that played the games (used within the survey) on PC and/or Console

1. INTRODUCTION

Current research into the video games community shows a recent increase in interest into usability and accessibility of on screen graphics and feedback in video games. The lack of emphasis on this specific discipline in the past has led to the user-interface (UI) and heads-up displays (HUD) being under developed compared to the other areas within the video game design process e.g. game mechanics, game play and audio. The *Serious Sam series* provides a good example of this (Figure 1).



Figure 1. *Serious Sam: The First Encounter* (Croteam, 2001) (left) and *Serious Sam 3: BFE* (Croteam, 2011) (right). Comparing the original game with the latest in the series shows the big difference in the in-game UI and HUD design.

According to Barr, Noble and Biddle (2007); video games are an extremely influential form of computer software. Players dedicate large amounts of time and effort into them, which is becoming a part of everyday life, and in a report done by the BBC News, Jason Bradbury states: "*video games are bigger than Hollywood*" (Emery, 2010). This level of popularity has led to an increased interest from the academic community in understanding how games work, what they do and what they could do. A search was done to get an estimate of the amount of academic papers and articles which included the phrase 'video games' within their opening titles released within the last 6 years. The results found an estimated total of 2,170 results. When looking at the amount that were released in the years previous to that, between the period of 2000 - 2006, the search showed less results, with a estimated total of 1,330 (See Appendix A). This provides reason to believe that video games are becoming more widely accepted into the academic community. Saunders and Novak (2007) believe that as the game industry continues to mature, game interface design will become increasingly important.

1.1 Purpose

The purpose of this study is to investigate how the in-game video game UI can be designed so that the player can easily access all the available UI features, without affecting the entertainment value. The methods in how the

feedback is presented to the player will be covered, including an investigation into; visual feedback and audio feedback and how this affects the overall playability of the video game. It was decided early on that investigations into the peripheral UI / interaction would not be included, as this would require more time and scope (section 3.4). This study will look at the following areas; flow (cognitive science), usability design, usability heuristics, game design, user experience (UX), user-centred design and user-interface (UI) design. This study was focused specifically on first-person shooter (FPS) video games for both PC and console platforms. In order to complete the study in the 12 month time period, the study would focus specifically on one genre of video game only. A number of other game genres were considered at the beginning of this study; Role-Playing Games (RPG) and Real-Time Strategy (RTS). Due to the fact these genres contained a complex amount of information within their UI design, it was determined the scope and depth would have been too big to carry out the necessary methods needed to produce the final outcome of this study. The FPS genre provided a scope that was sufficient enough to provide results needed, and evidence of a good amount of ongoing research to provide enough insight for the study. One example of some current research within the area of FPS UI design was carried out by Fagerholt and Lorentzon (2009), where they offer a particularly interesting study into the design for the immersive FPS UI. This study explores the FPS video game UI from the perspective of usability and the main aim of this study was to create a set of usability guidelines for the FPS game genre.

Who

The intention is to give designers and artists within game development a better guide when designing the in-game user interfaces for their video games. Research was carried out to find out what current and existing guidelines are being used to create the game UI and HUD displays within games development, and also, how the UI features are measured for usability.

A variety of small to large game development studios were asked whether they were currently using any particular guidelines when creating the game UI. Out of the responses received, the majority of the small companies stated they did not use any. There were mixed responses from the larger companies, some stating they used other game UI design as reference, some stating they did not use any guidelines apart from the technical legacy requirements set out by the game console software companies. In an email received on the 16th August 2012, M. Molcher and C. Payton answered; *"we always apply logic and best practice to ensure that players aren't confused or frustrated by menus and HUD items"*. It can be concluded that the majority of games companies who responded, do not have a set of guidelines when producing the game UI. The questions asked and responses can be found in Appendix B.

Why

Research was carried out to find what current usability techniques were being used. Laitinen (2005) touches on current usability testing methods that have, and are being used within the games industry today. 'Usability Expert Evaluation' and 'Usability Testing' are used throughout game development. In Usability Testing, a group of the target demographic players for this type of game are gathered, and are used as to test the game. This sort of usability testing allows the development team to observe the players playing the game, within a controlled environment. Usability Expert Evaluation is slightly different as this method uses a set of usability experts to draw and evaluate usability issues from the game. At the end of the evaluation, the experts present the development team with a detailed list of the usability issues found, rated by the severity, and offer solutions to each. Christou (2012) concludes by stating Usability Expert Evaluation is the better method for evaluating the user-interface, although suggesting using this type of method is a costly process, which puts the smaller development games companies at a disadvantage. However

Desurvire (1994) suggests heuristic evaluation methods can be used as a more cost-effective way to evaluate the usability of video games.

A preliminary review of the literature indicated there was research covering this field, which is a developing area of study. Heuristics that cover an array of game genres have been written by many authors (Desurvire & Wiberg, 2009), (Federoff, 2002) and (Pinelle, Wong, & Stach, 2008a), but little was found on usability heuristics that focus entirely on one genre of video game. The study will focus on just one game genre.

In the past, heuristic evaluation tools have appeared throughout software development, and have been a large part of human-computer interaction (HCI) community. Nielson (1994) contributed a set of usability heuristics for the web, more specifically to evaluate the web user interface. The usability evaluation methods from the field of HCI are considered by some game and usability experts (Monk, 2002; Pinelle, et al., 2008a) as too broad and generic for the evaluation of today's entertainment technology i.e. video games.

(Pinelle, et al., 2008a) and (Desurvire & Wiberg, 2009) offer a deep insight into game usability evaluation. While these usability methods are a step closer to usability evaluation for video games, they focus their investigations around the usability of the entire game design, offering a generalised approach. The study focuses on the usability of the game user-interface, which tackles usability within more focused area of games.

2. LITERATURE REVIEW

2.1 Usability

Usability is often referred to as:

“The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”

(ISO:9241-11 1998, p.2)

The effectiveness, efficiency and satisfaction are used by many others in the field of software development as methods of measuring usability (Bevan, Kirkowski, & Maissel, 1991; Conyer, 1995; Federoff, 2002; Frokjaer, Hertzum, & Hornb, 2000; Laitinen, 2005; Nielson & Mack, 1994). Although Microsoft (2000) defines software usability under three measurements: discovery, learning and efficiency.

Bevan (1995) states that the main measure of a usable product is the ‘quality of use’, however according to Quesenbery (2001); usability is the experience that provides the user with the easiest and simplest method of getting their task done.

A collection of definitions for usability within the game’s industry is offered by Federoff (2002). Federoff (2002) uses a collection of participants from a game development team to find out how they perceive usability within video games (Table 1).

Responses :
• Pick up and play value
• Ease of enjoyment
• Screen interface
• Controls
• The combination of the interface and gameplay
• The level of immersion the game provides

Table 1. How usability within a video is perceived by a collection of game developers (Federoff 2002, p.29)

Usability can be measured using heuristics

Usability can be measured through multiple evaluation methods. Ziegler & Burmester (1995) and Desurvire (1994) offer two main methods used within software development:

- Usability Testing
- User Testing

Conyer (1995) defines both these methods. 'User Testing' gives the responsibility to the product users to determine the usability, which is assessed by analysis of the user behaviour during the use of the product, whereas, 'Usability Testing' requires a set of expert 'human factor' evaluators to evaluate the usability of a product. Lee (1999) describes the 'Usability Testing' method as particularly important for evaluating six specific aspects of a user-system, which are; learnability, performance effectiveness, flexibility, error tolerance and system integrity, and user satisfaction.

As described by Conyer (1995), there are many methods of Usability Testing, 'Heuristic Evaluation' being one of these. Heuristic Evaluation is one way to test and evaluate the usability of a user-interface. Nielsen (1994) points out that video games and personal computers have shown users examples of how easy it is to produce approachable and pleasant interfaces. This has led to a demand for products with a higher standard of usability. He states; "*user interfaces are now a much more important part of computers than they used to be*".

In Nielsen and Molich's (1990) paper on 'Heuristic Evaluation of User Interfaces', they offer theories on usability testing methods, and list four methods a user interface can be evaluated under:

1. *Formally*
By analysis technique
2. *Automatically*
By computerized procedure
3. *Empirically*
By experiments with test users
4. *Heuristically*
By simply by looking at the interface and passing judgement, according to one's own opinion".

Nielsen and Molich (1990) offered a set of 'heuristics' to evaluate the usability of web user interfaces, and these were later refined by Nielsen (1994) into something more explanatory. These were called the '10 Heuristics for User Interface Design', which set the standards for general usability design of the user interface. These are included as part of the Table 4 within section 2.6.

Usability Heuristics for software

Usability Heuristics are stated below by two important sources from the field of heuristic evaluation:

"Usability heuristics are identified usability principles that trained evaluators use to assess the goodness of software design".

(Federoff, 2002).

“Heuristic evaluation involves having a small set of evaluators examine the interface and judge its compliance with recognized usability principles (the “heuristics”).”

(Nielson, 2005).

Microsoft (2012) state that usability heuristic evaluation is usually applied at the earlier stages of development to avoid more design iterations than necessary. This is referred as being a fast and easy method for UI evaluation.

Nokia (2006), Apple .Inc (2012) and Microsoft (2012) all incorporate ‘heuristics’ into their usability evaluation process, which demonstrates the growing number of software companies incorporating this method into their product design. We see other areas of software development, such as; mobile phone companies and game developers exploring this method. Korhonen & Koivisto (2006) explain they use heuristic evaluation methods within their product development process. They state the use of Nielson’s (1994) heuristics is part of their evaluation process.

Although such usability and heuristic evaluation techniques within software products (Bevan, 1995; Bevan, et al., 1991; Frokjaer, et al., 2000; Lee, 1999; Nielsen & Molich, 1990; Nielson & Mack, 1994) highlight some important factors about usability design, these cover a very broad area. The usability of a video game product presents a slightly different set of challenges and goals compared to other software products.

“Measuring satisfaction should be central to the evaluation of the usability of games since the goal of a game is entertainment not productivity”.

Federoff (2002);

Pinelle, Wong and Stach, (2008a) state that common usability evaluation methods do not allow for extensive and detailed tests for video games, as they either rely on formal specifications of task sequences or are orientated around user interface techniques used in desktop applications (Nielson & Mack, 1994). Monk (2002) identifies that the three variables software usability design takes into account:

- Ease-of-learning
- Low level ease-of-use
- Task fit.

Monk (2002) points out that the ‘complex interfaces’ of the new technology for home entertainment provides a new set of challenges, and argues the conventional usability design approach used within software development are no longer wide enough to evaluate whether a product is ‘usable’ anymore. Monk (2002) explains this new wave of technology should also take into consideration the entertainment value. He offers three additional variables:

- Enjoyment,
- Effective communication
- Dependability.

This suggests that the usability and design principles from the software development can be applied to the usability design for video games.

Usability Heuristics for video games

It has been observed that many of the game usability heuristics to date; (Malone, 1982), (Federoff, 2002), (Desurvire, Caplan, & Toth, 2004), (Desurvire & Wiberg, 2009), (Pinelle, et al., 2008a), and (Pinelle, Wong, & Stach, 2008b) all take a strong influence from fields such as software design and human-computer interaction (HCI).

Pinelle et al. (2008a, 2008b) defines the usability of video games by how easy the player is able to control, learn and understand the game. Malone (1982) was the first to take the software principles of usability heuristics and apply it to video games. In his paper, he uses a number of play testers to explore the difference of video game interface compared to interfaces found in software applications. He finds video game interfaces are much more captivating, and provide entertainment for the players which he uses to produce a set of usability heuristics.

In Federoff's (2002) paper on 'Heuristics and Usability Guidelines for the Creation and Evaluation of Fun in Video Games', she uses three usability categories taken from Clanton (1998) to construct a list of preliminary game usability heuristics. These categories are; game interface, game mechanics and game play.

The game usability heuristics explained in 'Heuristic Evaluation for Games: Usability Principles for Video Game Design' (Pinelle, et al., 2008a) were created for usability evaluation of a range of different video game genres. Later the same year, in a different study, Pinelle et al. (2008b) make an interesting exploration of the use of the 'genre' to determine the usability issues within video games, which they claim to be a practical 'framework' for usability evaluation. As a result, Pinelle, et.al, (2009) then moved onto produce a study for networked multiplayer video games, and presented a host of usability issues that were found in these types of video games. This generated a different set of heuristics aimed at networked multiplayer games.

More recently, we see this research and usability heuristic techniques being applied directly into the video games industry (Desurvire & Wiberg, 2009). 'Desurvire' is a well known behaviouristic specialist, who helped shape some of the game industry's most well known game companies' usability testing methods. In 2009, Desurvire and Wiberg (2009) set out defining a list of usability heuristics that were aimed specifically at video games design and the game user-interface design. These were named; PLAY (Desurvire & Wiberg, 2009).

The heuristics taken from Nielson (1994) and Desurvire and Wiberg (2009) provided an important framework for the research, and these are explained in more depth later on in this study (section 2.6).

Usability methods used within the games industry at the moment

Laitinen (2005) states the current usability testing methods used within the games industry:

- Usability Expert Evaluation
- Usability Testing.

Usability Testing

Usability Testing is essentially the same as User Testing, elaborated by software usability evaluation methods (section 1). As Laitinen (2005) explains; this method involves testing the game on specially selected 'playtesters', who represent the target group of the game. This method typically uses 3-6 players. As Shelley (2001) explains, the 'prototype' is often used within this sort of testing, and provides the initial proof of concept, and first working version of the game. Mechner (2009) notes this should be reached as soon as possible in the development cycle, as it provides feedback on the key elements of the game. The playtesters are each tested separately within laboratory environment,

where playtesters will be given selected parts of the game to play. These testing sessions can be between 1-2 hours long and an expert tester will usually sit in on each session and observe, prompt and give the players tasks. Laitinen (2005) explains the playtesters are to think out loud so their behaviour can be monitored.

As explained by a group of usability experts and game developers (EdgeStaff, McAllister, Viggers, Avent, & Hopson, 2011), the Usability Testing method is good for identifying whether the player understands how to play the game properly. Christou (2012) refers to 'Usability Testing' as a method which applies procedures used within psychology experiments to uncover the usability issues. This is where the players must play the game in a strictly controlled environment, whereby the timelimit, software specs, and environment conditions stay the same for each session.

As Korhonen & Koivisto (2006) explain, Playability Testing is another form of usability testing within video games, although with a few differences. Playability Testing uses alternative methods for gathering the information from the playtesters, which are through interviews and surveys.

Usability Expert Evaluation

Laitinen (2005) discusses the use of 'Usability Expert Evaluation'. Laitinen (2005) continues, explaining this method commonly employs 3 usability experts to evaluate the game, and unlike 'Usability Testing,' is more flexible as it can be applied to the game development process at almost any point. In this method, the usability experts separately review the game, searching for problems based on their experience and knowledge. Once this stage has been carried out, all the experts then hold a meeting and report their findings together and rate the severity of each usability problem found. Each usability problem is listed, stating the; title, severity rating and a solution and then given back to the game development team.

Christou (2012) says this method is particularly useful for uncovering usability issues within the game UI design. Due to the benefits of using expert evaluators, this method can be used as soon as the first draft of the UI has been laid out. Christou (2012) explains the drawbacks to this method, saying it may be difficult for smaller game development teams to acquire this type of expert evaluator to conduct their usability testing, overall making it less feasible to conduct this type of usability evaluation method.

Christou (2012) argues that usability evaluation methods should be incorporated into the mainframe of all games companies' development process, stating; *"the benefits will outweigh the costs"*, suggesting this is a costly process. However, as Desurvire (1994) suggests heuristic evaluation methods can be used as a more cost-effective way to evaluate the usability video games when applied to the early stages of the games development, compared to user testing methods.

2.2 Designing for the user

User-Centred Design

“The essence of a game is rooted in its interactive nature, and there is no game without the player”.

(Ermi & Mäyrä, 2005).

In user-centred design, the consideration of the user is of high importance, and Duvall (2001) believes that understanding the psychology behind the player’s mind can vastly improve games design and its execution.

Weinschenk (2010) explains, in the field of user-centred design, ‘Human Factors’ are taken into consideration when designing a product. Blythe, Overbeeke, Monk & Wright (2007) and Green & Jordan (1999) refer to the user-centred design approach as the relationship between the user and the product, and believe it is important to design for how the user thinks, and what they expect from a product. Apple.Inc (2012) ensure all their products provide a user-experience (UX) that their users will appreciate by adhering to user-centred design principles; they explain that human factors are concerned with the user and user’s capabilities. The goal is to design for how the user thinks and works, how they interact and think about their actions when using the product, and not with the capabilities of the device. Apple.Inc (2012) state that human factors should aim to deliver a good UX that delights the user and creates an emotional attachment between the user and product. Schmitt (1999) states users demand products and communications that they can relate to.

“A beautiful, intuitive, compelling user interface enhances an application’s functionality”, where this inspires a positive emotional attachment in users”.

(Apple.Inc, 2012).

Blythe, Overbeeke, Monk & Wright (2007) clarify that user expectation weren’t always as high as they are today, stating the expectations were only concerned with the basic functional features, benefits, and quality in a product. Now users see these as the minimum expectations, and are now looking for something more in their products; a good user experience.

An interesting point is made by Norman (2002), as he explains that in designing any usable product, the solution is to hide the inner workings of the system from the user in order to provide a good user experience. He says; *“put the task on the machine, not the person”*. The design of the user-interface therefore is the face of the software system, and must meet the user’s expectations and should relate to them on a personal level, without concerning them with the software’s internal functionality.

2.3 The video game UI and HUD.

What are the UI and HUD?



Figure 2. (Schell, 2008 p.222).

"Interface is the infinitely thin membrane that separates white/yang/player and black/yin/game".

(Schell, 2008 p.222).

According to Apple.Inc (2012) a great UI is designed with the user in mind and considers the way humans work and think when interacting with the device. Weinschenk & Barker (2000) explains that the UI is a two-way interaction between computer and user where information is passed on by the user and computer. Saunders and Novak (2007) say the game UI should allow the player to communicate with the game software. Fox (2005) believes a well-designed game UI makes the game experience more fun. Clanton (1999) and Federoff (2002) both describe the game user interface to include both; visual on screen display instruments and any physical controller devices used to control the game.

Fagerholt and Lorentzon (2009) offer an interesting and different perspective on what is defined as a game UI. They refer to the video game 'user-interface' in a broader term and describe it to be; all elements that inform the player within the game, regardless of whether it is channelled visually, auditory or by haptics (peripheral output feedback). Federoff (2002) explains how the visual interface impacts on the game, stating that this allows the players to obtain certain information to help them move through the game. It allows them to see visually the impact their actions are making in the game. The physical UI, controllers, allows them to perform actions, and give instructions to the game letting them; save their game, move through the game and exit the game. This is mentioned in more detail in section 5.

Head-up displays (HUD) are the main part of the UI within any software system, and within video games, they play an important role in displaying necessary information to the player. Wilson (2006) claims the HUD is an invaluable tool

used to inform the player of important information throughout the game. The HUD is made of separate, on-screen elements which indicate various messages to the player, such as; player health status, where the player is ranked in game and navigational indicators, so the player knows where to go. In addition to these; Fagerholt and Lorentzon (2009) include information messages regarding the game progression and game goals. Zammitto (2008) states the HUD is a permanent type of information given to the player in the game, which contains information on health status, available weapons, armour, resources etc, which depends greatly on the game genre.

Despite the in depth description of the game UI described earlier by Federoff (2002), she argues that the game UI is not typically identified as being a major aspect of player satisfaction (Federoff, 2002). Shelley (2001) disagrees, and explains the game UI can play a very important part of player satisfaction; *“A confusing, difficult, and frustrating interface can ruin a game”*, and if this is the first thing the player experiences on entering the game, they are likely to give up on the game (Shelley, 2001).

Designing a UI for video games can be quite different to designing for other software system i.e. web.

“It’s not one size fits all. How you design depends on whether you are trying to engage, entertain, or have someone get the job done”

(Weinschenk, 2010).

(Pagulayan, et al., 2003) makes the important point that the purpose of each software product is quite different and explains that software systems are largely ‘productivity applications’ and at their root are designed to make tasks faster, easier and reduce the possibility of errors. On the other hand, video games are designed from the perspective of the designers’ vision, thus defining their own goals, and are not made to support external ‘user-defined’ tasks.

“The goal of both design and usability when applied to video games is creating a pleasurable process”.

(Pagulayan, Keeker, Wixon, Romero, & Fuller, 2003).

(Barr, Noble, & Biddle, 2007) say video games offer something much more than productivity, as their intent is to provide a pleasurable experience for the players, stimulating their mind and making them feel and think when interacting with this software.

2.4 Fun, flow, and the user experience

What is flow?

In his book 'Flow: The Psychology of Optimal Experience', Csikszentmihalyi (1990) describes a condition of the conscious mind, called flow. Flow is the genuinely satisfying feeling of the consciousness that someone gets when they are fully absorbed within an activity. This happens when the person is completely focused and concentrated on the activity they are performing, and is said to be one of the most enjoyable and valuable experiences (Csikszentmihalyi, Harper, & Row, 1990), (Johnson & Wiles, 2003).

Flow within the gaming experience

Sweetser and Wyeth (2005) mention an important point, and say flow is also *the "match between the person's skills and the challenges associated with the task"*. Getting the balance between the player's emotions of anxiety and boredom is crucial for acquiring the state of flow within a game (Gregory, 2008). Therefore, if the gameplay is too challenging, the player is likely to become anxious and frustrated, on the other hand, if the gameplay is too easy; the player will soon become bored.

Csikszentmihalyi (1990) states there are eight elements that are required to produce this flow experience:

- Concentration on the task
- Confronting a task we have a chance of completing
- The task has clear goal
- The task provides immediate feedback
- A sense of duration of time is altered
- To exercise a sense of control over your own actions
- To act with deep but effortless involvement; removing self-awareness and worries of everyday life
- The sense of self-reward after the flow experience is over.

Gregory (2008) states the experience of flow is obtained through the use of well designed interactive technology. Pinelle, et al (2008a) say if the interface design is unusable then this will have an impact on the goal of creating a compelling user experience, thus the design of the UI is accountable for producing a certain percentage of the flow experience within a video game and therefore, should be considered when designing the game UI.

Designing the in-game UI so that flow and fun are not affected.

In 2004, Shneiderman (2004) published a journal paper on how to design a UI to be more fun, and in this, he encapsulated eight golden rules for designing a fun UI:

- Strive for consistency.

- Cater to universal usability.
- Offer informative feedback.
- Design dialogs to yield closure.
- Prevent errors.
- Permit easy reversal of actions.
- Support internal locus of control.
- Reduce short-term memory load.

(Shneiderman, 2004).

The user experience and why it is important within any product

It is evident that flow is a crucial aspect in the video game design process (Schell, 2008). Flow is an important concept for game designers to understand, as this is the desired experience one hopes to deliver within any video game (Schell 2008, p.118). "*Placing players in this state of flow is important to video gaming's universal appeal*" (Christou, 2012). It was explored by Chen, Wigand and Nilan (1999) the positive experiences users had when interacting with interactive software; websites. The focus on providing a positive experience for players and users within video games has been of great interest over the years. Sweetser and Wyeth (2005) say the most important goal of the game is to provide a an experience the player will enjoy, and others are in agreement that player enjoyment is very important; (Federoff, 2002), (Malone, 1981) (Johnson & Wiles, 2003).

Johnson and Wiles (2003) state; "*the key motivating factor for the majority of game players is to experience positive affect*", but when this does not generate the positive emotions the player is looking for, the game is unlikely to succeed.

Bernhaupt et al. (2005) refers to the game flow, playability and fun as terms often explained as the 'user experience' and has also been said to be in close proximity to the area of usability. Sweetser and Wyeth (2005) refer to usability and user experience to be equally important when designing and evaluating a video game.

User experience is not just about creating a 'good' experience, it relies on a number of things, one of these being; what the designer wants the player experience, which may be referred to as the 'desired experience' (McAllister & Long, 2012).

2.5 Designing the game GUI

Designing for the goals and purpose of different video game genres

Saunders and Novak (2007) state to design a great UI for a game, you should first understand their role in design, taking into consideration the; goals, and the purpose of the game.

Pagulayan et.al (2003) argues all games are different and often define their own set of goals, purposes and obstacles that the player must overcome. The most common method of defining each game is to categorise them into 'genres'. Games are usually designed within these defined genres due to the fact that different genres often hold different goals and objectives for the user to complete, so we must also take into consideration the genre of the game before designing any aspect of the its content, in this case; the UI.

"We demonstrate games from different genres because they require different perceptual and cognitive skills and thus illustrate different principles".

Clanton (1998).

Clanton (1998) defines first-person shooter (FPS) games under a broad genre called 'Action' games. The goals and purpose of action games have been noted by Clanton (1998) to require a number of skills from the player to be able to play these games to their fullest. These include; perceptual and motor skills; to operate in-game vehicles and act out different motions within the game world, as well as; good strategic and tactical thinking; to devise a plan of action to win and to defeat the enemies. As mentioned by Fagerholt and Lorentzon (2009) it can be argued the FPS genre in particular, requires excellent perceptual skills because of the nature the camera angle; where this puts the player in the first-person perspective of the 'player avatar'. An example of the player avatar can be seen in Figure 3.



Figure 3. A typical view of an FPS game can be seen from this screenshot of the game: Battlefield 3 (DICE, 2011b) , where this puts the player in the shoes of the ‘player avatar’. A snippet of the ‘player avatar’ is usually shown via the view is his lower arms, hands and/ or the weapon he is holding; giving the player the sense that they are the person behind the camera.

The importance of visual feedback, audio feedback, and peripheral control.

Schell (2008) states the main goals for the UI is to communicate information to the players, this is done via feedback. He continues, since there is a lot of information in a video game, this information feedback must be designed in a well thought out manner. According to Mechner (2009) feedback is an important part of video games, as it gives the player information on their current state within the game, can be used to indicate to the player their in-game goals, and how close they are to completing them. Mechner (2009) says this information must be both, clear and consistent to the player. Schell (2008) says feedback is important in any game, as it provides the player with important things such as; judgment, reward, instruction, encouragement, and challenge. Saunders & Novak (2007) state there are two primary goals to any interface; feedback and control.

- **Feedback** is usually accomplished through visual means; monitor or televisions, and conveys to the player what is happening in the game. As explained by Christou (2011) ; for the players to understand what affects they’ve just made in the game world, players need a clear indication, which is the feedback. Saunders & Novak (2007) clearly state; *“without conveying to the player the state of the game, there is no game”*.
- **Control** is as just as important and is explained by Saunders & Novak (2007) as the communication between the game and the player. As Saunders & Novak (2007) explain further, it is the controller or external peripheral that provides the player with the control over what is happening in the game world or ‘UI’.

Saunders & Novak (2007) say to accomplish these goals, four considerations should be taken into account; functionality, usability, aesthetics and accessibility. Fox (2005) points out; *“the more the player has to search for*

information and think about how to play, the less enjoyable the games becomes”, which clearly states the importance of both; the visual feedback, audio feedback and controller input within a video game.

Fagerholt & Lorentzon (2009) present some interesting results on the type of information feedback found in present-day FPS game UIs (Table 2). They state that that this information feedback from both, controller and the on-screen UI display, can be separated into three categories; visual, auditory and haptic:

Information Channel	Types of Feedback in FPS games.	
Visual	<p>2D overlay graphics: Traditional HUD visual indicators which are super imposed on the screen. For example; player’s health bar shows damage taken using on-screen graphic.</p> <p>Filtered graphics: Bloodsplatter graphic overlay shows up when player gets hit.</p> <p>In-game world: These are subtle and more natural information indicators, where a 3D object may be used to indicate a message to the player. Example: damage state of players weapon shown through textures, instead of using 2D overlay graphic.</p>	
Auditory	<p>Sound Effects: Example: Gunshot fire, explosions or door creaking when opening it.</p> <p>Dynamic Soundtrack: Background audio which may be used as an ambient tone to subtly suggest information to the player.</p> <p>Dialogue / Speech: May help towards player progression, an example may be; a friendly in-game character may speak to player and suggest or give hints towards next game goal.</p>	
Haptic	<p>This is conveyed by external feedback elements, taking advantage of the player’s touch; such as the controller vibration, this can come in two forms; casual feedback and decision making (by player).</p>	<p>Casual feedback: would be when a gunshot has been fired.</p> <p>Decision making: an good example; most driving/racing games involve you driving a vehicle around at a high speed, if player hits a wall or object the controller will vibrate to indicate you have crashed into something. In both these cases, it’s up to the player what he/she does next.</p>

Table 2. In-game feedback can be separated into three different categories, visual, auditory and haptic (Fagerholt & Lorentzon 2009, p. 30-34).

They observed through their study of present-day games, that the largest part of the FPS in-game UI was made up of visual information, the next largest was auditory feedback, and with the smallest fraction making up the in-game UI, was the haptic feedback.

Aesthetic Design

Schell (2008) points out that visual and auditory feedback makes up the aesthetics in a game. Aesthetics are how the game is seen, felt, heard, tastes and smells, and are the most direct link to the player experience. As Saunders & Novak (2012) point out, while it is important to provide feedback that is clear and usable, careful design for the aesthetics of the UI should also be thought about.

According to Schell (2008), audio is one of the most powerful elements of a game. Norman (2002) agrees, and considers sound to be as essential as the visual information provided within an interface, it communicates to the user about things they cannot see, and does this while their focus is elsewhere.

“Audio provides another avenue for the game to communicate with the player, and it’s particularly useful for eliminating ambiguity, providing feedback without interrupting the gameplay, reinforcing visual effects and creating atmosphere”.

(K. Saunders & Novak, 2007).

According to Zammitto (2008) the main techniques used for information visualisation, within FPS video games are made up of colour-coding, silhouettes and way finding. Zammitto (2008) explains further, that the use of silhouettes is a common technique used to provide the information that the player's ammo may need reloading. Similarly, Fox (2005) states three techniques that can be used to enhance the game's HUD and UI; colour, size, and movement (animation), which can all help the player to differentiate the more important information.

Screen space and sizing

Fox (2005) points out the importance of sizing of UI features, stating the less unimportant HUD features small so that the more critical information can be spotted by the player.

Mullet and Sano (1995) state, grouping certain types of information together helps reduce the complex information display into a more manageable amount for the user to deal with. Fox (2005) says by organising this information, the player will find it less of a strain to search for the different types of on-screen information.

Colour

Saunders and Novak (2012) say colour provides the overall atmosphere and mood of the game, and choosing a colour scheme will allow for a consistent atmosphere throughout the game's UI. Choosing the colours carefully can avoid a confusing, unclear UI and also, an unpleasant one. Warm colours like; reds, oranges, yellows; can create anxiety, stress and excitement, signalling danger. While, cool colours like; purples, blues, greens; can create calming effect, signalling safety and harmony. Using colours to convey the correct message must adhere to the colour contrast also, as the player will usually adapt to the game's colour standards.

Saunders & Novak (2012) say the number of different colours on screen must be limited, as too many colours can reduce the overall effect the designer has intended, and also may send out the incorrect message to the player. Using

a maximum of five colours at any one time will help players easily differentiate interface elements, allowing the player to recognise the different game goals.

Typography

As Saunders & Novak (2012) and (Fox) 2005) both state that any interface should be easy to read. Saunders & Novak (2012) consider the type within the interface as a high importance, and say any specific types of information, given in text format, should stick to a consistent style of font. i.e. – tool tips should all be within the same style. They believe limiting the font styles within a certain screen space; a maximum of 3 styles, allows for a clearer interface. Saunders and Novak (2012) offer some suggestions when using colour within the format of text :

- Brighter and warmer colours; easier to read on dark backgrounds.
- Blue is harder to read, and less desirable for any text elements in game.

Icons

As Saunders & Novak (2012) believe icons are a great source of visual feedback within the game UI as they compact a lot of information together, allowing players to quickly access the information they need.

“The purpose of icons is to reduce interface clutter while maximizing the amount of information that’s conveyed”.

(K. D. Saunders & Novak, 2012) .

They offer some guidance on how to best use icons within the game UI:

- Icons should use universal symbols or ‘semiotics’ whenever possible.
- Icons that are not universally known would need players to learn their meanings. In this case icons should contain minimal detail and tooltips should provide explanation to which icons represent what.
- Icons used for the same purpose, should share the same style or displayed in the same size.

Immersion

Fox (2005) explains animations are a great tool to use when bringing something to life, and may be something worth using to indicate the more critical information to a player. Animations can be used as part of the environment to indicate certain messages. According to Fagerholt and Lorentzon (2009), the UI features within an FPS game can be classified under main four terms (Table 3). These four terms draw on terminology taken from the film industry to make the distinction between UI elements that occur within a static, 2D overlay manner, and UI elements that occur within 3D space of the FPS game, and refer to UI features that can be used to either enhance or simply maintain the immersion within the game.

UI Type	Meaning	Example
Diegetic representations	"Interface that is included in the game world -- i.e., it can be seen and heard by the game characters".	"The holographic interface in <i>Dead Space</i> ".
Non-diegetic representations	"Interface that is rendered outside the game world, only visible and audible to the players in the real world".	"Most classic heads-up display (HUD) elements".
Spatial representations	"UI elements presented in the game's 3D space with or without being an entity of the actual game world (diegetic or non-diegetic)".	"The character outlines in <i>Left 4 Dead</i> are an example of non-diegetic spatial UI".
Meta representations	"Representations can exist in the game world, but aren't necessarily visualized spatially for the player".	"Effects rendered on the screen, such as; blood spatter on the camera to indicate damage".

Table 3. Four terms used to classify the types of UI found in an FPS UI (Fagerholt & Lorentzon, 2009).

Designing for cognitive loads

"Complex things may require explanation, but simple things should not. When simple things need pictures, labels or instructions, the design had failed".

(Norman, 2002).

Norman (2002) believes when designing any product the designer must have a general understanding of how everyday things work, function and behave, along with the knowledge of how people function and behave. The discipline of Human Factors uses the study of the human mind to design products. A term that is often used when designing for Human Factors is 'loads'. Weinschenk (2010) refers to a 'load' as being the amount of work you require from someone, which can be categorised under:

- Cognitive load (thinking and memory)
- Visual loads (perceiving and noticing)
- Motor loads (keyboard, mouse and pointing)

Weinschenk (2010) explains getting the balance between these three types of loads can determine the usability of the design.

"When it comes to HUD, less is more".

(Fox 2005, p.145).

There is such a thing as having too much feedback in the video game UI. Duvall (2001) discusses this theory in an article on *'Gamasutra'*, and agrees that too many elements on screen at any one time may result in the player getting distracted, feeling overwhelmed and ultimately, losing concentration on the goal(s) in front of them. Miller (1956)

introduces the theory on human cognitive ability; 'The Magical Number Seven'. He explains on average the amount of items that can be stored in the human mind at any one time is seven, and breaking down information into 'chunks' or groups can make it easier to memorise and store information. Fox (2005) states that placing an odd number of objects on screen can be more pleasing to the visual eye than an even amount of objects.

Mayer (2001) explains the theory of how people learn through words, pictures and imagery. He believes successful presentation and communication design facilitates the way humans learn from pictures and words. Here are the seven research-based principles for the design of multimedia messages specified by Mayer (2001):

1. Multimedia Principle

Students learn better from words and pictures than from words alone.

2. Spatial Contiguity Principle

Students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen.

3. Temporal Contiguity Principle

Students learn better when corresponding words and pictures are presented simultaneously rather than successively.

4. Coherence Principle

Students learn better when extraneous words, pictures, and sounds are excluded rather than included.

5. Modality Principle

Students learn better from animation and narration than from animation and onscreen text.

6. Redundancy Principle

Students learn better from animation and narration than from animation, narration, and on-screen text.

7. Individual Differences Principles

Design effects are stronger for low-knowledge learners than for high-knowledge learners and for high spatial learners rather than from low spatial learners.

(Mayer 2001, pg. 184)

Wilson (2006) tells us how game companies have adopted the system of using pre-existing game HUD designs to create and develop their own. Wilson (2006) states this has become a well developed framework for creating the game HUD, especially in the FPS genre. Wilson (2006) says the danger in using this type of framework is that repeated mistakes can be made, having a knock on affect throughout game development. For example; some do not consider changing the amount of elements and layout of this design, leaving elements on the screen that may not necessarily be needed. He elaborates by prompting designers to ask whether the information they have designed is really adding to the player's experience and giving out necessary information the player needs.

Schell (2008) points out the importance of 'transparency' in the design of the UI; by designing a intuitive, easy to use, and customizable UI this provides more freedom for the player and allows the player to forget the UI is there, letting them carry on with the game. Weidman (2011) explores the more extreme side to this, which involves removing the HUD information completely.

“Take it off the HUD and put it into the game”.

(Wilson, 2006).

Some professionals in the field of games and game research (Llanos & Jorgenson, 2011), (Fagerholt and Lorentzon, 2009), (Wilson, 2006) argue that the in-game information should be integrated into the game world so that the UI is more intuitive and gives the player a more immersive experience within the game. Wilson (2006) agrees and discusses the more recent trends in the creation of the video game HUD, observing that rather than games displaying information through the traditional HUD like many have done in the past; games are starting to adopt more subtle techniques by using the game world itself to display important information to the player. Some games, such as Battlefield 3 (DICE, 2011) include game options where the HUD is switched off completely, allowing players to rely on a more realistic interface. Llanos & Jorgenson (2011) predict this trend may define how game UIs are designed in future, discarding the use of icons, overlay graphics and windows and transferring them over into the game world.

The video game; *Dead Space* is a good example of this, the health bar is displayed using the player avatar (Figure 4). In *Serious Sam 3: BFE* (Croteam, 2011) we see in-game objects being used to display critical information to the player (Figure 5).



Figure 4. In *Dead Space*, we see the player's health indicator has been transferred into the game world by the use of four illuminated blue lights down the back of the player avatar (IGN, 2008).



Figure 5. In *Serious Sam 3: BFE* (Croteam, 2011) we see the player avatar holding a detonator switch for the explosives planted. The explosives are clearly indicated in the game world via 3D objects, highlighted in red (on the in-game wall in front of the player here).

Wilson (2006) presents three attributes that may have contributed to this change in the way in-game information is displayed; high-definition television, the use of the traditional HUD takes something away from the immersive experience, and, simpler and more intuitive interfaces are needed to suit the needs of more casual gamers (non-traditional gamers) coming into the market. Llanos & Jorgenson (2011) give some examples of visual techniques that create a more 'integrated' in-game world interface; character dialogue, animations and particle effects.

Fagerholt & Lorentzon (2009) do however explain there should be a balance between an intergrated HUD and superimposed one, explaining; if the intergrated in-game world information compromises the functionality, consistency and clarity of the UI, then a compromise between both extremes need to be made. (Cameron, 2011) talks about 'immersive' game HUD's, he argues that more and more game developers are creating games that incorporate realistic and transparent HUD's to reach the goal of creating an immersive game experience, which Cameron (2011) argues to be a 'false design goal'. This goal often can have a negative affect on the game, resulting in disfunctional and unclear information being presented to the player, and ultimately distracting the player from the game experience that was intended.

The theory of removing the in-game HUD was put to the test in the quite recent study carried out by Llanos & Jorgenson (2011). They did this by observing a set of playtesters playing a well-known, modern-day game with the absence of the HUD. Their study set out to gather relevant data on whether the players were able to play the game as they would do with the reliance of the HUD, whether their sense of involvement was affected by this, and whether the players could carry out given goals and navigate through the game without the use of the this information on-screen. The results they gained showed varied responses from their playtest subjects, saying; an aesthetically pleasing, minimal UI can boost the attractiveness of the information display for players, but overall the players wanted a UI that gave them important, relevant and sufficient information, allowing them to interact meaningfully and carry out the goals that were asked in game.

2.6 Game heuristics taken from the literature

At this point it is important to outline the main usability heuristics that were found in the literature (Table 4) as these provided a foundation for my own research (section 4). These following heuristics were taken from a wider list of literature, which can be found in identified in Appendix B. The usability heuristics within Table 4 were specifically chosen because they are relevant to the game user-interface.

	Heuristic Title	Description	Literature Author
a.	Consistency in Game World:	<ul style="list-style-type: none"> - The game world reacts to the player and remembers their passage through it. - Changes the player make in the game world are persistent and noticeable if they back-track to where they have been before. 	(Desurvire & Wiberg, 2009)
b.	Variety of Players and Game Styles	<ul style="list-style-type: none"> - The first ten minutes of play and player actions are painfully obvious and should result in immediate and positive feedback for all types of players. 	(Desurvire & Wiberg, 2009)
c.	Status and Score	<ul style="list-style-type: none"> - Status score Indicators are seamless, obvious, available and do not interfere with game play. - Controls are intuitive, and mapped in a natural way; they are customizable and default to industry standard settings. - Consistency shortens the learning curve by following the trends set by the gaming industry to meet users' expectations. If no industry standard exists, perform usability/playability research to ascertain the best mapping for the majority of intended players. 	(Desurvire & Wiberg, 2009)
d.	Feedback	<ul style="list-style-type: none"> - Game provides feedback and reacts in a consistent, immediate, challenging and exciting way to the players' actions. - Provide appropriate audio/visual/visceral feedback (music, sound effects, controller vibration). 	(Desurvire & Wiberg, 2009)
e.	Terminology	<ul style="list-style-type: none"> - The game goals are clear. The game provides clear goals, presents overriding goals early as well as short term goals throughout game play. 	(Desurvire & Wiberg, 2009)
f.	Screen Layout	<ul style="list-style-type: none"> - Screen layout is efficient, integrated, and visually pleasing. - The player experiences the user interface as consistent (in controller, colour, typographic, dialogue and user interface design). - The players experience the user interface/HUD as a part of the game. - Art is recognizable to the player and speaks to its function. 	(Desurvire & Wiberg, 2009)
g.	Navigation	<ul style="list-style-type: none"> - Navigation is consistent, logical and minimalist. 	(Desurvire &

			Wiberg, 2009)
h.	Error prevention	- Players should be given context sensitive help while playing so that they are not stuck and need to rely on a manual for help.	(Desurvire & Wiberg, 2009)
i.	Visibility of system status	- The system should always keep users informed about what is going on, through appropriate feedback within a reasonable time.	Nielson, J. (1994).
j.	Match between system and the real world	- The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.	(Nielson, J. (1994).
k.	User control and freedom	- Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.	(Nielson, J. (1994).
l.	Consistency and standards	- Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.	(Nielson, J. (1994).
m.	Error prevention	- Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.	(Nielson, J. (1994).
n.	Recognition rather than recall	- Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.	(Nielson, J. (1994).
o.	Flexibility and efficiency of use	- Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user so that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	(Nielson, J. (1994).
p.	Aesthetic and minimalist design	- Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	(Nielson, J. (1994).
q.	Help users recognize, diagnose, and recover from errors	- Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	(Nielson, J. (1994).
r.	Help and documentation	- Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.	(Nielson, J. (1994).

Table 4. This table lists the usability heuristics that were found in the literature, which were identified as being relevant to evaluate the usability of the game user-interface. Here the table lists each usability heuristic using; it's title, description of its function, and identifies the literature it has been taken from.

3. METHODOLOGY

3.1 Introduction

Davies (2007) refers to the 'triangulated approach' or the mixed methods approach, where two or three different methods can be used to explore the same subject. In order to collect the research data two methods were used; online surveys and analysing and playing a number of games in the play sessions. The methodology used throughout the thesis varied depending on the goal that was intended for each part of my research collection. The first part of my study involved studying a selection of FPS game titles, which were played for over a number of weeks. The goal of the play sessions was to gain insight into how the UI features were presented, and what techniques were being used to present the game UI features. At the end of each play session a in-depth reflective analysis was conducted to collect the UI features that were most important.

The goal of the online surveys were to gain opinions from the target demographic player(s) about which game UI features they regarded the most helpful to them. Closed questions were used to collect numerical ratings of the UI features for each game, so that they could be compared to one another. A small amount of open format question was used within the survey so that respondents had the opportunity to express their own opinions and thoughts on certain aspects of the game's UI features throughout the survey. The closed format questions were analysed through quantitative methods and presented through bar charts, which displayed comparative data. Due to the wide variation of responses gained from the respondents for the open ended questions, these were analysed through quantitative methods.

3.2 Play Sessions

Goal

The purpose of this part of the study was to gain an understanding of the type of in-game information that appeared in the most popular and most current FPS games to date, and to get a feel for what in-game information is needed at hand when playing this sort of game. The visual and auditory UI features were analysed, due to scope issues, analysis of peripheral output features was left out. This study was also used to find out whether any common patterns existed from game to game, that may be able to form a set of standard conventions for designing a usable FPS in-game UI.

- **What UI information was most important to me when playing the game?**
- **Are there new or different UI features that emerge in some of the FPS titles I'm playing, that don't occur in others? (Compare each game).**
- **Are there any UI features that may need to be included in my final FPS game usability guidelines?**

Which games?

The first stage was selecting and finding the most appropriate FPS game titles for the study, this involved researching the most popular and up to date games, along with the most popular FPS titles to date. A number of well-known and reputable game forums were used to select the games. *Metacritic* (2012) provided a good starting point, which gave me a general overview of well rated games and bad rated games. *Metacritic's* (2012) coloured numerical rating system allowed me to quickly assemble a list of potential FPS titles; a mixed selection of high to medium rated games were chosen. It was decided for the purposes of this part of the study that the games would look at a variation of both multiplayer (MP) and single player (SP) modes. This variation of both modes may draw some interesting findings, which may lend some different ideas on the design of UI features. The meta-scores for the games chosen can be seen in Appendix C.

Games chosen were:

- Serious Same 3: BFE (Croteam, 2011)
- Brink (SplashDamage, 2011)
- Crysis 2 (CrytekStudios, 2011)
- Call of Duty Modern Warfare 3 (InfinityWard & SledgehammerGames, 2011)
- FEAR 3 (Day1Studios, 2011)
- Half Life 2 (Valve, 2004)

Pilot test - Beta tested other people's games.

To get in the right mindset for carrying out the play sessions I participated in a collection of beta tests for different game companies. This gave me a good insight to the way beta tests are conducted at the beginning of a games testing phase, and gave me an insight into the methods they use to glean important information from their game testers.

A diary was made to note down the information that must be kept in mind when carrying out the play sessions. These included the correct mind set to be in when analysing certain elements of the UI and gave me more of an idea of how and what to look out for when carrying out the reflective write up at the end of each play session.

How will I collect and analyse this data?

After compiling and collecting these FPS games, it was time to start playing each. Each game was played for a week and, while conducting each play session notes would be made to jot down any areas of importance within the game UI, taking note of any interesting UI features. At the end of each week, these notes would be transferred over into a reflective written account, where this would analyse the game UI. This allowed me to organise and compile only the most important UI features within each game.

After conducting the first few play sessions, it became apparent the amount of UI features first set out to measure; visual, audio and peripheral were too wide a scope. It was decided on these terms, to leave out any analysis of the peripheral interaction, and focus the study around visual and auditory UI features.

While analysing each game it was important to stay focused on the usability of each. The table of usability heuristics taken from the literature (section 2.6) provided a set of standards that could be applied to each play session. This ensured I had a loose set of goals each time I started analysing a new game, and made sure each study stayed consistent and fair.

3.3 Online surveys

Goal

It was important to understand the expectations of common FPS players, and get an insight to what UI features they found useful, needed, and did not find useful. The online surveys allowed me to gather this type data.

- **What does the player expect from the games UI?**
- **What elements of the UI do the players find most useful / an inconvenience?**

The survey allowed the user to rate how useful the visual and auditory feedback was on a scale of 1-5. The criteria list formed at the end of the play sessions, found in section 4.2, were used within this online survey. There were opportunities for the player to give further comments about any UI features which provided a good help within the game.

What is my sample size?

The goal was to collect an overall number of ratings for the UI features within the selected FPS game titles. In order to get this information it was decided a high quantity of responses was the desirable sample size. As Niles (2012) states *“the chance that your sample is off the mark will decrease as you add more people to your sample”*. In other words, the more responses received the more chance you have of gaining a reliable, representative sample.

To make the survey worthwhile, a similar response rate for each game had to be met. In order to increase the chances of this, particular attention had to be given to the game titles that were chosen for this part of the study. The original plan for the online survey was to use the same game titles that were chosen within the play sessions, however, due to the amount of responses needed, the amount of games had to be downsized. Downsizing the amount of games would provide a more feasible study, which would allow for a more in-depth analysis of each survey response. When assessing which games to keep, and which to take out, a set criterion was created:

The game must have both:

- **Single Player – Railshooter / Linear style campaign.**
- **Multiplayer – Free-roam / Team Deathmatch (TDM) and or/ Capture the flag (CTF) modes.**

To help decide further, the following factors were also taken into consideration:

- **How accessible each game was to buy and play? For example, to buy from the Steam store.**
- **Popularity and reception of each game; was this game received well at the time of its release?**
- **How reputable are the game company/development team? Have they got a good record of producing quality FPS games?**
- **What platform types each were available on. The type of platform the games were available on was a consideration when selecting the appropriate games, as the more platforms the game is released on, the higher the possibility of responses for each game (Table 5).**

Game Title	PC	Console
Battlefield 3	✓	✓
Call of Duty Modern Warfare 2 / 3	✓	✓
Half Life	✓	
Half Life 2 (single player campaign only)	✓	✓
Half Life 2: Deathmatch (separate multiplayer version)	✓	
Serious Sam 3: BFE	✓	
Crysis 2	✓	✓
Far Cry	✓	
Halo Combat Evolved Anniversary		✓

Table 5. The list of games that were selected using the criteria set out.

Demographic players and survey distribution

In order to increase the chances of getting a high response rate, the survey had to reach the maximum amount of players that represented the target group of the FPS game genre, which would be asked to fill in the online surveys. Relevant research was carried out to find out who these players were, and for what purposes they play this genre. *Mintel* was used to extract this information. This information provided me with an understanding of where I may go to find my survey respondents. The *Mintel* reports can be found within Appendix D.

The surveys were distributed via social networking sites, game community forums, and through the internal email system within the university. The strategy was to gather as many people as possible, more specifically, the players that represented the target demographic market of FPS games. *Facebook* was used to set up a dedicated group. The goal was to provide an area where members could share their thoughts and feeling about FPS games, which may encourage the members to invite others alike to join the group. This area encouraged suggestions from each member about any of the game titles that were included in the online surveys and any questions they may have regarding the online surveys. There were a lot of comments received about the game titles selected, and as a result, one game was switched. The surveys would stay online for a duration of a maximum time of 2 months, although, it was decided, if they accumulated a high enough response rate before this time, they could be taken down early.

Six games were finally selected for the online survey study:

- Half Life 2/Deathmatch (Valve, 2004)
- Crysis 2 (CrytekStudios, 2011)
- Call of Duty: Modern warfare 2/3 (InfinityWard, 2009; InfinityWard & SledgehammerGames, 2011)
- Battlefield 3 (DICE, 2011a)
- Serious Sam 3: BFE (Croteam, 2011)
- Halo Combat Evolved Anniversary (SaberInteractive & 343Industries, 2011)

How will I collect this data?

A survey was created for both SP and MP game modes. The surveys were constructed as online surveys, using Google Docs. Google Docs was an easy and quick solution to designing and collecting data, as the filled out surveys would automatically be transferred into a separate spreadsheet. This allowed for an easy overview throughout the surveying stage and once they were completed, it allowed for easy exporting into Excel.

For the final analysis I wanted a quick method for comparing my data from each survey, so 1-5 rating system was used, which made up the majority of the survey. Using 5 different ratings allowed the survey to record the 'neutral' opinions of the respondents (Garland, 1991), which would provide an overall average rating for each game's UI feature at the end of the survey completion. In the surveys the following rating system was used:

- 1 = very poor
- 2 = poor
- 2 = average
- 3 = good
- 4 = excellent

How will I analyse this data?

Google spreadsheet also has the function of displaying your results within a 'summary of results' which gives access to view your results in visual charts format. The filter function within the spreadsheet allowed me to filter results so that specific data could be analysed. For example; due to the amount of games being surveyed, the filter tool provided a good solution for analysing the data from each game separately.

To analyse the results from the online surveys, a mean average was taken for each game. Each game's UI features were averaged out, and calculated separately.

Firstly, the average rating for the visual UI features, and auditory UI features from each game were calculated. Secondly, the averages calculated from both the visual UI features and auditory UI features were then combined for each game, to find the overall UI rating.

Finally, the overall average was used to compare each game, to measure which game owns the most usable UI.

3.4 Scope and planning

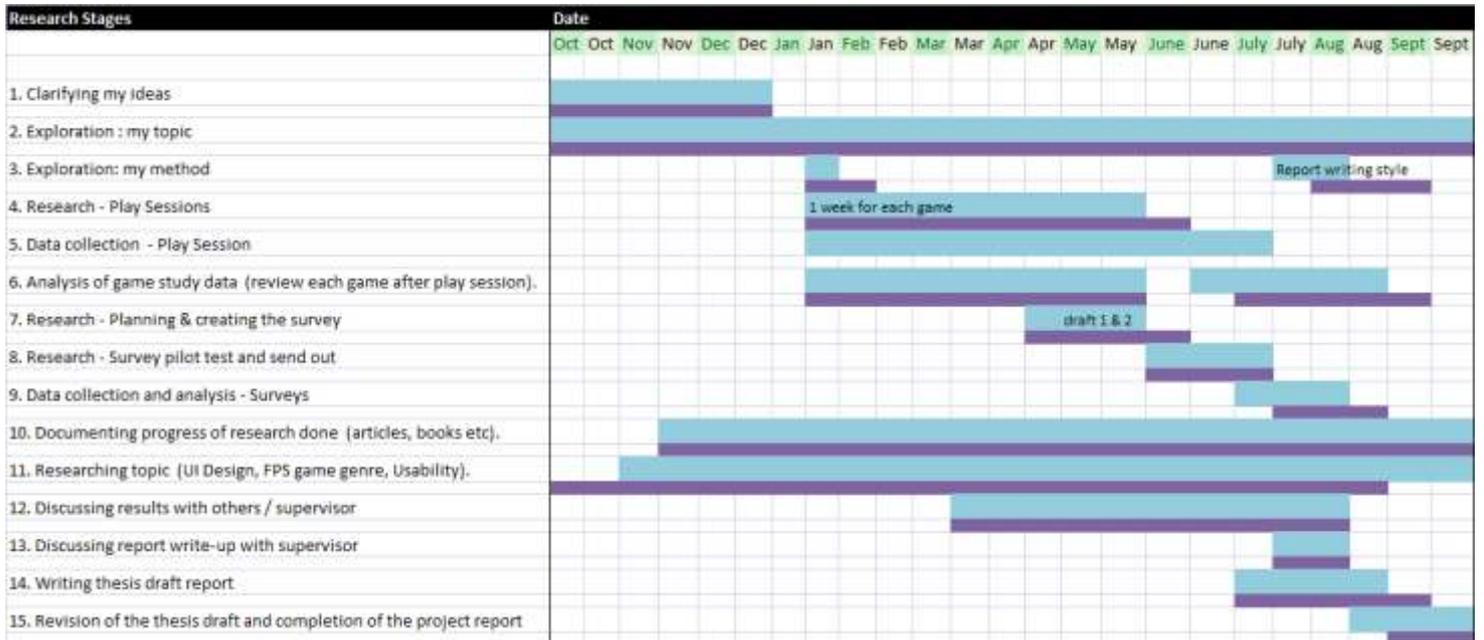


Figure 6. Gantt chart showing the time management for each part of the study over the 12 month period.

A time scope was set at the beginning of the study to make sure all deadlines were met so that important tasks could be prioritised to ensure the project was completed on time.

A list of each section of the study has been presented in order they would be carried out in during the 12 month period. The blue bars represent the predicted time it would take to complete each part of the study, and the purple bars represent the amount of time each actually took.

4. RESEARCH FINDINGS & DISCUSSION

Within this part of section, the findings from the research are presented. Alongside the research findings, discussions and analysis are made.

4.1 Play Session Findings

The most interesting findings i.e. unique UI features for each game, were recorded at the end of each play session which can be seen below. To make it easier to locate each finding, they have each been formatted into bullet points, and then lead on with an analysis. Further findings were presented at the end of this section.

Each unique UI feature was categorised into groups; auditory and visual feedback, which can be referred back to in the literature, in Fagerholt & Lorentzon (2009) table figure (section 2.5). These were used to categorise the appropriate data found in this part of the study and throughout the entire write up, and helped compare each game's UI features.

Serious Sam 3: BFE

Visual

- Colour coded pick-ups.

The use of colour coded elements were the most significant in this game. Picking up health supplies, armour and ammo quickly was essential for taking down your enemies so providing the player with information about specific pick-ups was very important. There was always ammo, health supplements and armour lying around each corner throughout the game, and the player would need to find these fast if they had any chance of surviving. The use of the brightly coloured-coded glow around these pick-ups made it easy for the player to locate clearly, from afar where they needed to go if any of their supplies were low. Colour-coded outlines around the items in the game helped the player distinguish what type of pick-up item they were. There were individual colours for each type of pick-up; **Blue:** Armour, **Yellow:** Ammo, and **Red:** Health supplies. Giving the player this sort of information was important; as it gave them the choice and control over which items they risked their lives to get hold of (Figure 7).



Figure 7. Colour-coded outlines indicated the type of pick-ups throughout the levels, the vivid coloured glow let the player know exactly what sort of pick-ups were available from a great distance.

- Enemy health colour code crosshair prompts.

The game used a clever system to inform the player of when an enemy's health was low. When placing your crosshair on an enemy, the crosshair would change colour depending on your enemy's health state. The focus point throughout this game was the location of your crosshair target, the fact that the enemy health indicator was in the in the same location meant that the player didn't have to take their eyes off the target. This made it a lot easier and faster to find out the current state of your enemy, which offered the player extra time in case they wanted to take a look at their own status.

The enemy health indicator informed the player of the enemy's exact dipping points in health, and this was done using coloured traffic light system; **Dark red**: very low health, **Light red**: low health, **Yellow**: medium health and **Green**: full health (Figure 8). This traffic light colour code is a well used universal system, which makes it easier for a wider audience player's to understand.



Figure 8. Hovering over the enemy with your crosshair informs the player on the enemy's health by using a traffic light colour code system.

- Flashing health icon

The in-game interface assisted well in providing crucial information to the player when needed. The icon for your health could be located at the bottom left hand side of the screen (Figure 9). This was represented as a small white heart icon and a number value beside it, which represented your current amount health remaining out of 100. Whenever the player was hit by an enemy, the icon would shake vigorously to indicate the player's health had

decreased. This use of simple animation made it easy to know when the armour was low, without having to take your eyes off the centre of the screen (crosshair). Knowing whether you had low health was a critical element within the game, so a more evident animation was used to inform the player of this. Whenever your health was at a very low status, the player would see the heart icon, now change to an alarming red flashing colour from its previous static white coloured state (Figure 9). The use of colour and animation had a more alarming effect, making the player take notice. The visual 'heart' icon was instantly recognisable among the other visuals on screen, and this representation of the player's health easily translates over into the real-world, and universally known concepts. This link to real-world makes it less of an effort for the player to conceive what this icon may represent

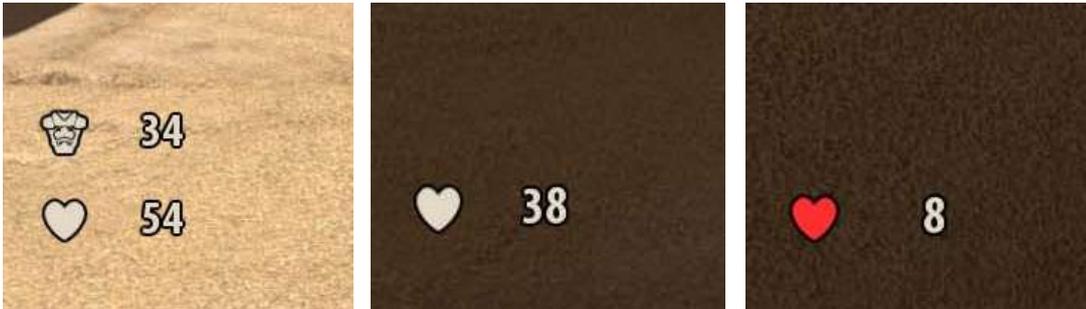


Figure 9. The player's health is shown on the left, as we move along the images, and you can see how the player's health diminishes until you reach critical health; shown as a flashing red heart.

Brink

Visual

- Teammate's location and class type.

The clever use of, both recognisable and simplistic icons in certain parts of the game made the interface easier to use. As a fast paced online multiplayer game, the main aim was to work with your teammates to complete mission objectives. You were against the clock, so locating your mission objectives and teammates had to be done quickly. Before entering a game, each player would assign themselves a class type. Your class type defined what types of abilities you had, and each served as a different element in supporting your team. The class types were; Soldier, Engineer, Operative and, Medic, and each were represented with individual icons (Figure 10).



Figure 10. Class type icons; (from left) Soldier, Engineer, Operative and, Medic.

These 'class icons' were used throughout the game, and before entering the game specified what each icon meant. If the player was in need of refilling their supplies, i.e. - ammo, health or armour, they would need to either find a command point or easier; a teammate. The 'class icons' appeared above each teammate's head, and could be seen through any environment surface from any position within the level (Figure 11). The fact you could spot these icons from a long distance and see them through any surface within the map, made it extremely easy to track your teammates down. Therefore, obtaining the supplies you required was as easy as possible, which kept you wanting to play the game to its full potential.



Figure 11. Each teammate's class type and name would appear as a floating visual above their heads, which can be seen anywhere in the game level.

- Consistent colour scheme helped perform mission objectives.

The purpose of any game is to reach the end, where you gain reward. The mission objectives were the whole purpose of each level, and without these you could not complete the game. Your objectives were given to you and your team at the beginning of each level. The use of visual displays assisted the player in finding out what their mission objectives were and where to locate them. Current active objectives could be found in the top right hand corner of the screen, your primary objective highlighted in **yellow**, and any secondary objectives in **blue** and mission time in white (Figure 12). This colour scheme was integrated into the majority of this game's visual UI information; the 3D game world (Figure 13). When coming across any of these colours throughout the game, I immediately knew the meaning for each, helping me associate the objective colours presented in Figure 12 to the correct objective within the 3D world.



Figure 12. Your objectives appear on screen when they become active. Here you can see your primary objective is shown in yellow, your secondary objective shown in blue and the mission time in white.



Figure 13. Primary objective in yellow has been visually outlined in the 3D game world.

Auditory

- Heart beat health audio prompter.

A lot of my time was spent focused on the current state of my health. This was one of the most important features, as the player needed to be informed whether they were close to dying or not. The use of an audio sound effect helped me keep a close eye on this. The heart-beat health audio prompter was used to indicate a critical state in my health. Now I had this information, I could make an informed decision about what action to take. Run for cover; and let my health state regenerate, or be shot down; causing a disruption to other teammates completing the mission objective. This audio heart-beat prompter was also nicely backed up with the use of appropriate visual graphics, so if I was unfortunate enough to miss the visual prompter, the audio prompter was sure to save me (Figure 14).

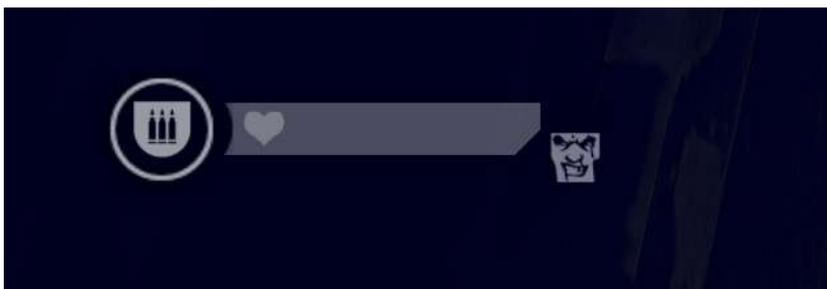




Figure 14. (Top image) Health shown as a white bar with small heart icon, this player's health is full. (Bottom image) Player has been a critically hit, and their health has decreased even more; shown by a bright red bar / heart graphics now – this is where the audio heartbeat prompter would sound out.

Crysis 2

Visual

- The 'Tactical Visor' mode.

The 'Tactical Visor' mode gave the player the chance to view the mission objectives from a tactical standpoint, and was used to give the player choice and control when planning out motives before entering the battlefield. The Tactical Visor mode was displayed as a secondary screen, which separated the more detailed HUD elements from the main screen.

The Tactical Visor mode displayed a collection of information. The mission objectives and tactical options could be seen in more detail within this mode. 4 different tactical options were available to choose from, depending on the mission type. These options were provided via visual UI features, and audio sound effects. Floating icons within the environment showed each option within a numerical order. Once hovering over one of the four tactical options, a text title of the option would appear in the top centre of the screen (Figure 15). An example of a few of the available options may be; Tactical Option: 'Secure', this option may help you reach a safe location, helping you gain the advantage over the enemy. Another option might be 'Observe', shown in Figure 15, where you may wish to overlook and analyse the enemy situation before jumping in and attacking.

Once decided on the tactic option, the player was able to manually tag the tactical option, and when exiting tactical visor mode, this tagged option would now be present in the main screen / HUD of the game (Figure 16). When following the tagged tactical option, it felt easy to navigate in the vast and complex surrounding scenery. Shown above each tactical option was the distance of each. This was represented in a numerical fashion, indicated in 'm' meters. This gave the player a great sense of your spatial surroundings, which simulated the environment well. By indicating the distance of your tactical option location, it encouraged you to focus fully on getting to the location and where you needed to be.



Figure 15. The 'Tactical Visor' showing the available tactical options as yellow numbered waypoint markers. Here tactical option number 2 is being hovered over, where a context sensitive button icon is informing the player they are able to 'tag' this option. The main objective is shown as a blue marker in the map, as well as being present in the bottom left hand corner above my map.



Figure 16. After previously tagging a tactical option in the tactical visor, I have now exited my visor mode, revealing the tagged tactical option within the main HUD interface.

Auditory

- ‘Nanosuit’ voice commands.

The ‘Nanosuit’ assisted you through the missions using voice commands. At the beginning of each mission a clean summary of the mission synopsis would be given using voice-over feedback via a robotic sounding voice. This informed the player of their main objectives and kept the player updated with the next objective each time one had been completed. When accessing any of Nanosuit features; thermal-vision, tactical visor, cloak or armour shield, the Nanosuit would automatically feedback to the player their action or option just taken using the auditory voice feedback. These would also let the player know whether they had been spotted by any enemies, and whether they were taking any damage hits.

Any voice commands spoken by your Nanosuit were backed up with a small text graphic, which popped up in the centre of your screen, which indicated clearly the next step in the game (Figure 17). Primary objectives were always shown in the continuous colour **blue** format throughout the interface; “Primary: Locate Hive Entrance: Break through into City Hall” (Figure 17). Voice commands or recommended actions to take would occur a lot, so the Nanosuit would help you with possible actions to take, making things easier.



Figure 17. Your Nanosuit speaks to you about the current objective you must complete (top line of text). The Nanosuit would recommend you on possible options to make things easier, shown in brackets on the second line of text.

Call of Duty: Modern Warfare 3

Visual

- Prioritising important information through text size and font style.

Throughout the entire game there was a common pattern in the way the visual HUD information was displayed. Throughout the game there were a number of visual text prompts indicating certain information. Objectives and mission status was usually presented within the top right hand corner of the screen, shown in Figure 18. The sizing and font style of this text differed from other visual text features, and the sizing of the font was used to differentiate the more important text information. For example, in Figure 18 there are two types of information; shown in the far left corner, is information regarding the player's mission objectives. The text positioned at the bottom of the screen represents the words that are being spoken by your team allies, giving the player a detailed description of surrounding activity, and we can see they use different font styles and sizing. The mission objectives font is much bigger, it is clear by the size that this information is of more importance than the text (at the bottom) regarding the spoken words by the allies.



Figure 18. Shows two different types of information presented through text format, where the size and font style has been used to differentiate them.

- Grouping similar UI features

A common layout of the UI features could be seen within the visual on-screen graphics. Similar types of information would be grouped together and had a designated location on screen, which helped reduce the amount of visual information to a more manageable size. Mission status and objectives were usually presented within the top left hand corner of the screen, shown in Figure 19. Any critical information about the weapons or ammo status could be found in the bottom right. Any information regarding help or context sensitive buttons appeared in the centre of the screen. This allowed the player to easily differentiate the different types of information displayed, and helped the player immediately locate any information needed.



Figure 19. Mission objectives and status is shown in the top left hand corner of the player's screen, and weapon status shown in the bottom right. Context sensitive buttons (interactive objects) or helpers would appear in the middle of the screen.

- Ordering stack of mission objectives.

The mission status and objectives were given to the player through text format (Figure 20), which appeared and acted like a live action feed. When receiving these multiple information messages, the stacking order was useful for keeping track of your current mission status' and objectives. Each line of information text would appear in a listed format, in order of timing. New missions and mission updates would appear on the bottom. The maximum amount of information was limited to four lines, so as new information appeared, the old information would move up to the top of the list, gradually being overridden. This was a clear format for the player to understand which objectives had been completed and which needed completing.



Figure 20. Mission objectives and status are listed via live action visual text feed, which can be seen in the top left hand corner of the player's screen.

- New visual HUD introduced with the help of voice commands.

Throughout part of the game, different methods of presenting information feedback were used. For example, sometimes when the player was given missions, the player would have to perform certain objectives within a different environment or use a unfamiliar type of transport. Early on within this game, a different type of mission presented itself. For this mission the player avatar was placed in an underwater environment, where the player must control a underwater motor vehicle. This also presented a new set of visual features (Figure 21), which replaced the familiar HUD which had been used in all previous levels. The HUD visuals were integrated into the motor vehicle, and this displayed a UAV radar and warned me of enemy threats nearby. As the HUD and any familiar visual features had been replaced with the underwater motor HUD Before entering into the mission for this level, audio voice commands were used to introduce the mission objective. With the aid of the voice commands, they helped provide a clear briefing on what I must do with this new interface. This eased me into the initial presentation of new visual interface features and provided me with enough information for me to easily and quickly get to grips with the HUD visual features.



Figure 21. Underwater motor vehicle the player has to control, this allowed the player to see any potential nearby threats and acted like UAV system – this was the main source of information feedback for this mission.

FEAR 3

Visual

- Subtle interface features were integrated into the 3D world to direct the player through levels.

There was a strong use of interface elements that were used to subtly direct the player through the game world. These appeared throughout the more complex environment levels, where a lot of the scenery (outdoor) looked exactly the same. Here, the use of red lit candles scattered in a linear pattern indicated my path ahead, and in a fairly gloomy dark environment the animated candle flame caught my attention straight away (Figure 22). As they were fitting to the theme of the game, this meant they were very subtle, allowing your sense of direction to become second nature, while focusing on more important aspects of the game i.e. shooting any enemies that popped up.

As well as directing the player around the maps, this may be used to indicate other messages to the player. It could be occupied by be someone or something living here. The height of some the candles differed; some were almost burnt out, and others seemed to be newly lit candles. This may be an indication the occupant may be located not far from here. This clever use of in-game 3D models was very subtle, which added suspense and provided a design which didn't take the player away from the main actions and goals within the game.



Figure 22. Signifiers – Candles may indicate there is someone or something living here in this area. Also used for directing the player through parts of the map.

Auditory

- Audio cued prompts for each enemy type.

Sound effects were used as a main tool to make the player feel on edge, and more importantly; give the player information about the current state of events within the game. A timed audio cue would sound out when an enemy appeared. This let the player know that there was an enemy approaching and also what type of enemy. For example; enemies with explosives would appear randomly throughout levels, a timer sound effect would play. The closer the enemy got, the louder the explosive timer sound effect got. This audio sound effect was also sped up as it urged closer and closer to the player, and ultimately increasing the player's awareness.

- Enemy voice commands passed between one another.

The use of voice commands played a very important role in giving the player the information about the enemy, allowing the player to make an informed decision about what action to take next. The voice commands were used as a source of communication between the enemy targets, which could be heard by the avatar player. A good example; when killing an enemy, the enemy would call out; "We've got another one down", indicating to the player that they have killed the enemy successfully. These voice commands were also important in letting the player know whether there were enemy targets hiding around the corner. Before entering a new room and standing behind the opposite side of the door to the enemy, automatic voice commands would sound out, indicating their presence to the player. This would let the player then know whether to enter with caution, or enter with ease.

Knowing the location of the enemy targets was essential when under fire, as you may be taking cover behind obstacles, with no clear sight. Voice commands such as; "Copy that, advancing" indicated that the enemy was on the move and advancing closer towards the location of the player. Voice commands such as; "Enemy spotted", or "Enemy target sighted" let the player know his/her location had been found out. Other commands such as; "Enemy target lost" and "Get a visual" would inform the player the enemy had lost their location for the time being. "All alone here" was called out when you had wiped out the majority of the enemy squad in that area. This voice command was used to highlight the low quantity of threats waiting, allowing the player to emerge from behind his cover and possibly refill needed supplies from the enemy targets just killed.

Half Life 2

Visual

- HEV Suit visual feature disappears when player is no longer protected.

When an option is no longer available to the player, this would disappear from the screen. For example, your avatar is provided with a 'HEV suit' (Hazardous Environment suit), which protects the player's character from hazardous materials, and radiation. When your suit provided full protection, a visual graphical icon appeared (as part of your HUD) showing a name label; 'SUIT' and a numerical value, indicating the amount of protection the player has (Figure 23). When your suit no longer protects you, maybe due to a number of attacks taken from enemies, this visual graphic disappears from the HUD (Figure 23). This is a simple method, which clearly indicates to the player if they have armour protection or not.



Figure 23. Here we can see the HUD clearly shows the state of the avatar's health and HEV suit protection through visual graphics. (Top) The avatar has suit protection. (Bottom) the avatar has no suit protection.

- The duration of time a piece of important information should stay on the screen for.

The tool tips and helpers within the UI provided an effective and clear message. For example, when a new action was being presented for the first time, a context sensitive button visual would appear to the far right of the screen, (Figure 24) which would provide help to the players that needed it. This tool tip would present itself once, allowing any other important information to be presented clearly, through visual display features, which would allow the player to instead, focus on visual information they may have not come across before. This tool tip stayed on screen for a reasonable duration for the players to grasp the concept of what they must do, i.e. hold down 'E' button to charge HEV suit.

- The use of a heightened colour tone and a subtle highlight to the 'suit' HUD visual graphic is used to instantly deliver the correct message.

The use of the low amount of visual UI features within the in-game UI layout provided a good opportunity for the features that were present, to be used to effect when certain messages need to be provided to the player. When

there was an important state of change to some part of the game; your avatars' status - this was shown in a clear and bold manner. For example; from time to time your avatar player would need a re-charge boost for the HEV suit. While your avatar re-charged the suit (Figure 24), a clear indication of the state of change or action can be seen to the related visual (HUD) display feature. Here, the use of a heightened colour tone and a subtle highlight to the 'suit' HUD feature instantly delivers the correct message.



Figure 24. The player's avatar HEV suit on occasion needs re-charging. Here you can see the change of state and output of the player's action by the use of change of colour tone and vividness of the visual 'suit' UI feature. Tool tips provided on the right hand side, allowed for player to understand what action they must perform.

4.2 Further findings

Criteria list

A pattern appeared to emerge while carrying out this part of the study, as a number of UI features seemed to re-occur within each of the games, these were recorded and written down. These recordings depicted the most common type of UI features found in these FPS games, which evolved over the course of studying each game, allowing UI features to be added, each time a new one was found. This became a criteria list in later stages of the study, allowing me to refer back to each time a game was played.

This final state of this criteria list can be seen in Table 6.

It was later decided that this criteria list should be used for the online survey, which would allow the demographic players to rate each of these UI features within FPS game(s) they experienced.

Audio Feedback	Visual Feedback
Avatar Status (Such as: avatar health audio indicator, damage or hit audio indicator, lives, crouched down etc).	Avatar Status (Such as: avatar health indicator, damage or hit indicator, lives, crouched down etc).
Enemy Status (Such as: enemy health or damage audio indicator, defeated enemy sound effects, enemy defeated etc).	Enemy Status (Such as: enemy health indicator, clear animation showing enemy has been defeated or hit etc).
Equipment Status (Such as: the audio indicated weapon out of ammo, ammo count, weapon switched, weapon damaged, armour damaged etc).	Equipment Status (Such as: out of ammo visual indicator, ammo count, weapon switched, weapon damage, armour damage, available weapons, special weapons etc).
Spatial Awareness (Such as: your location, teammate's location, voices of enemy may give away their location, location of enemy gunfire or grenades dropped, close to checkpoint etc).	Spatial Awareness (Such as: your location, map, radar, teammate's location, location of enemy gunfire, close to checkpoint etc).
Mission Status & Objectives (Such as: aim of mission audio indicators, checkpoint reached, timer, score system, level completed or failed etc).	Mission Status & Objectives (Such as: aim of mission indicators, checkpoint reached, timer, score system, level completed or failed etc).
Rewards & Achievements (Such as: sound effect to alert player of a in-game reward, levelled up, gained XP, in-game achievable items, discovered easter egg etc).	Rewards & Achievements (Such as: level up icon, gain XP indicator, in-game achievable items, achievements, discovered easter egg etc).
Audio cues / Sound effects (Such as: door creaks when opened, timed audio-cues, sound backed up any event or action taken etc).	Help & Guides (Such as: tutorial mode, tool tips, visual prompters made basic controls easy to pick up and learn etc).
Speech / Dialogue (Such as: voice commands, avatar speech and dialog etc)	Accessibility of Features (Such as: the visual display mapped controller well, easy to access all available features, efficient use of the screen space, most important features were highlighted first, customize your visual display features etc).
Conveyed Important Messages (Such as: action event was bad or good? Instant audio feedback etc).	

Table 6. Table of common UI features within the FPS games studied.

Each of the UI features found, were appropriately categorised into two groups; auditory and visual feedback. The sub-categories within the visual and auditory groups, i.e. 'Avatar Status', 'Help & Guides', describe the different types of information feedback the player receives when playing an FPS game. Under each sub-category title, there are a few listed examples of what sort of UI features would be commonly found in this sub-category.

4.3 Online survey findings

Surveys for both Single Player (SP) and Multiplayer (MP) were done in order to gain insight into both modes, and whether or not the user-interface differed within each.

The response rate for the SP survey saw 31 responses, and MP survey gained 19 responses, shown in Figure 25. Due to the higher response rate for the SP survey, it was decided to drop the results from MP survey, and focus on the SP surveys for the study. The game *Serious Sam 3: BFE* did not generate any responses, so therefore was not included in this part of the study.

It was asked what platform type the respondents had played these games on. Table 7 shows the responses. The SP survey can be found within Appendix E.

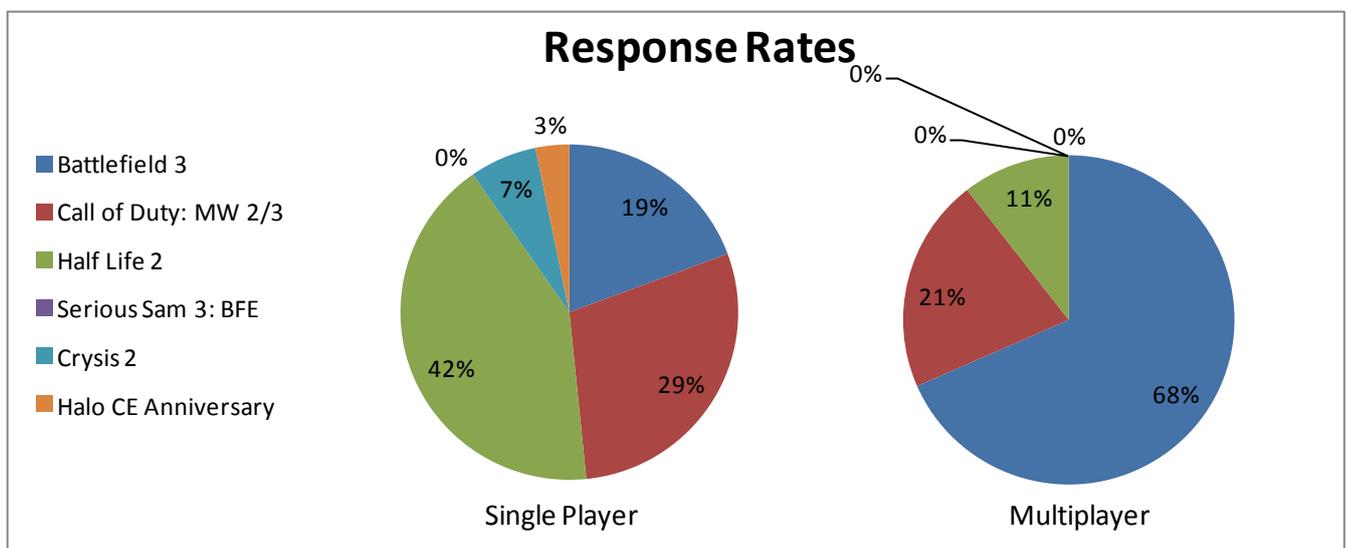


Figure 25. This shows the response rates for the single player and multiplayer surveys.

Platform Type	Single Player Responses	Multiplayer Responses
PC	20	10
Console	11	9

Table 7. Shows the number of respondents that played these games on PC and/or Console.

Closed Format Questions

The largest part of the online survey was made up of closed format questions, where the respondents were asked to rate the usability of each game's UI features. These UI features within the 'criteria list' (section 4.2) were used. The respondents were asked to rate each on a scale of 1 to 5. Where 1 equalled; 'very poor' and 5 equalled; 'excellent'. When the online survey data was collected, these ratings were put into a spreadsheet, and a calculation of the (mean) average was taken to provide the overall usability rating for each game. This can be seen in Figure 26.

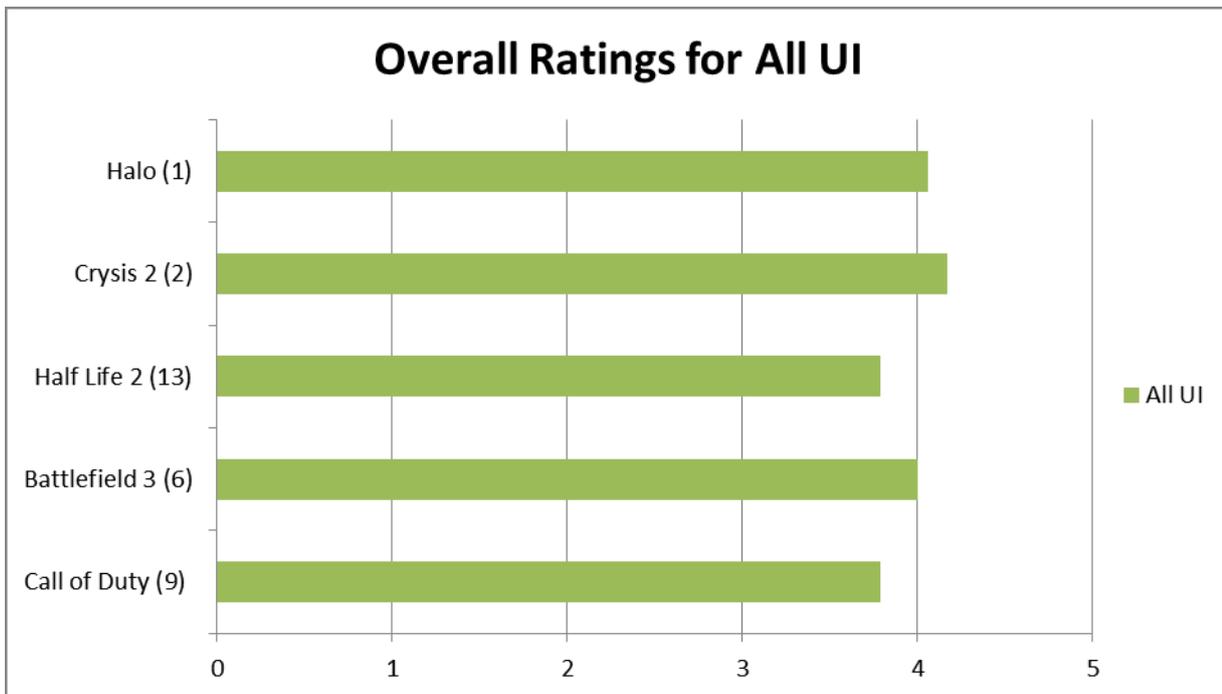


Figure 26. These are the overall ratings for both visual and auditory UI for each game that gained responses.

Figure 26 shows that overall; **Crysis 2** has the most usable UI, with *Halo: Combat Evolved Anniversary* having the second most usable UI features and *Battlefield 3* coming in third. *Half Life 2* came in fourth and *Call of Duty* came last..

It can be seen that the response rate for each game has a huge impact on the overall ratings for the UI features, which has resulted in inaccurate results for each (Figure 26). *Crysis 2* has ended up scoring the highest UI rating out of the all games, although it has one of the lowest response rates. *Call of Duty* and *Half Life 2* generated the highest response rates of all, scoring almost the exact same overall UI ratings as one another, although both have the lowest UI ratings.

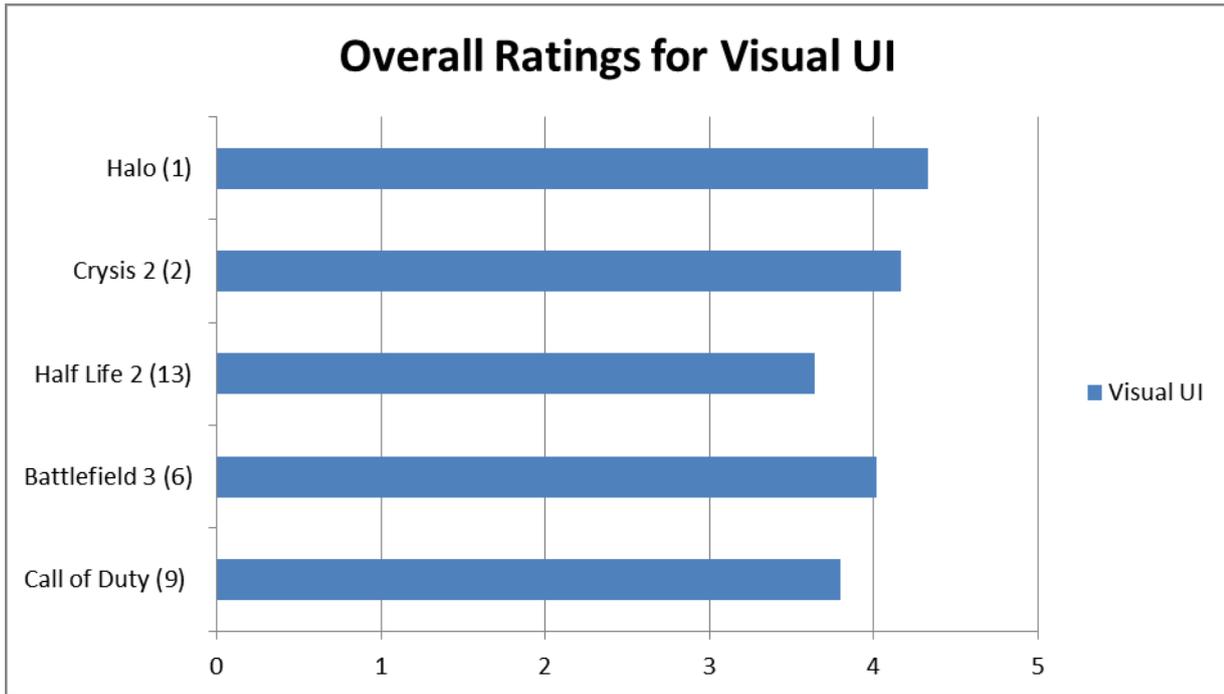


Figure 27. These are the overall ratings for the visual UI for each game that gained responses.

Out of the responses for the overall visual UI, we can see from Figure 27 that ***Halo: Combat Evolved Anniversary*** has by far has the most useable visual UI, ***Crysis 2*** has the second most usable visual UI, then ***Battlefield 3***, ***Call of Duty*** coming in joint fourth, and then in last place, with the lowest rating for usability of the visual UI, was; ***Half Life 2***.

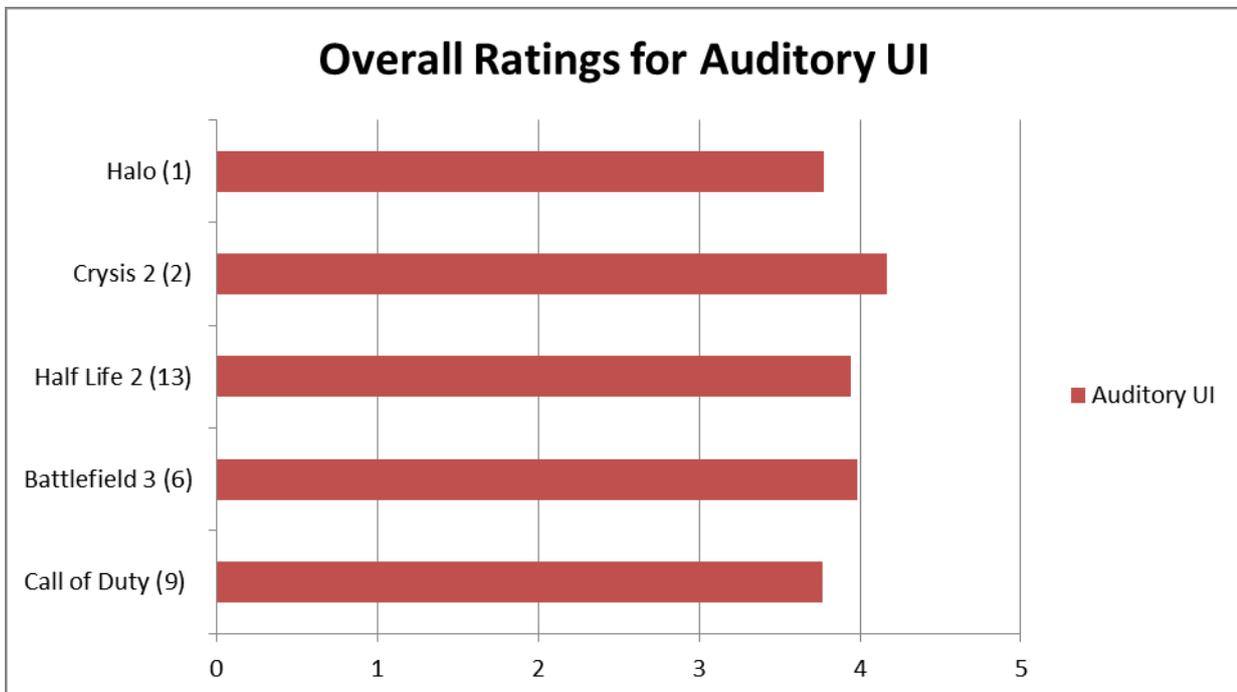


Figure 28. These are the overall ratings for the auditory UI for each game that gained responses.

We can see from Figure 28 that **Crysis 2** was rated the highest for the usability of the auditory UI, *Battlefield 3* coming in second, *Half Life 2* third, and then the ratings for *Halo: Combat Evolved Anniversary* and *Call of Duty* are almost equal, although *Halo: Combat Evolved Anniversary* slightly beats *Call of Duty*.

In depth bar charts have been drawn up, showing and comparing each individual UI feature for both the auditory and visual UI. These give a more detailed representation of the overall UI rating seen in this section. These can be found in the Appendix F.

By looking at the open formatted questions, used at the end of each section; visual UI and auditory UI, we may be able to draw up a more in depth analogy to reasons and explanations why the games were rated the way they were.

Open Format Questions

At the end of each section of the survey, open format questions were used to glean any additional information from the respondents, these questions were optional.

These were the questions asked:

- **Were there any key moments in the game, where the use of visual display features helped you?**
- **Were there any key moments in the game where the use of audio feedback helped you?**
- **Did the game keep you entertained and keep your full attention throughout? If no, was it any aspect of the user interface that caused this?**

The open-ended questions allowed the respondents to comment freely, and provide their opinions about how useful the visual and auditory UI features were in aiding them through the game. These were used to understand which particular UI features the players considered the most important and most usable.

As these were optional questions, the response rate varied from game to game, where some games did not receive any additional responses at all. *Half Life 2* and *Battlefield 3* received the highest response rate from the open formatted questions. *Call of Duty* received a lot more responses for the visual UI, compared to the responses for its audio UI. *Crysis 2* received the lowest responses within the open formatted questions, gaining more responses in connection to its visual UI than for its auditory UI features. *Halo: Combat Evolved Anniversary* did not receive any responses for the open format questions.

The responses have been presented within two categories; visual UI and auditory UI, and the responses that were seen as useful have been presented in a summarised list for both UI categories, which were used towards the final design guidelines. There were some rather interesting responses in regards to certain UI features, that the play sessions did not generate, which have been presented within this section. The full responses can be found in Appendix G, along with any inconclusive responses.

Visual UI

The open format questions generated a range of useful responses about visual UI. The following list presents a summary of the features the players found to be the most helpful:

- **Markers used within 3D environment helped identify spatial surroundings and identified; allied troops, enemies, pick-ups and objectives.**
- **Radar was good for identifying locations of objectives and enemy target before going out into battlefield.**
- **Spatial hit marker (centre of screen) provided spatial awareness by showing the player the direction the hit came from.**
- **Hit crosshair marker indicated when player successfully hit an enemy.**
- **Icons for grenades would appear as an on screen 2D graphic, mapping the spatial awareness of explosive threats.**
- **Timing of the visual feedback was used to associate certain objects/functions in the game.**
- **Use of minimal visual features helped player keep track of feedback information.**
- **Health HUD visual was used to show player a clear indication their health had decreased.**
- **Customisable tutorial tips and help guides were made accessible to any level of player - (turn context sensitive helpers on/off)**

Battlefield 3 generated the most responses for the visual UI, with a lot of comments made about the use of visual prompts to alert the player of surrounding threats. These were said to have saved players from near death experiences on a number of occasions, and also helped locate the enemy where gunfire shots. Call of Duty received quite a large amount of responses. The responses for Call of Duty referred to the permanent visual UI features such as the HUD. One particular comment was made about Call of Duty's tool tip features, where the player could customise them depending on how experienced they were at playing the game.

The biggest amount of responses regarding the visual UI came from the use of markers within the 3D environment, which indicates this is a highly regarded feature by the players. Common visual HUD features, such as; health bar and radar were mentioned. There were some interesting comments made about the use of minimal visual features within the UI of Half Life 2. The respondent stated they found it easy to keep track of information because of a spacious user-interface. Respondents commented on the visual cues for when either your player avatar was hit, or the enemy was successfully hit. The different games seemed to use similar techniques in displaying this information, some used spatial hit markers for when the player got hit, which indicated whereabouts the fire came from. The player's crosshair marker would change when an enemy target was successfully hit by the player.

The more interesting responses from the summary list have been discussed below.

Timing of the visual feedback was used to associate certain objects/functions in the game.

When the HEV suit is put onto the player avatar for the first time, a new set of visual HUD features are also presented on screen. These are the player's health meter and energy meter. The respondent has noticed the use of timing here has helped show the player the connection between superimposed visuals and the (3D) integrated visuals within the

game. Further suggesting, whatever happens to the HEV suit (your player avatar), will be represented via these HUD visuals.

“The suit energy display appears on the HUD for the first time, which makes the player notice it in connection with the suit. Similarly, they are then asked to use a power terminal to charge up the suit, which takes a second to fill up the power indicator and further reinforce the connection.”

(Half Life 2)

Customisable tutorial tips and help guides were made accessible to any level of player

The use of visual help and tutorial tips were available through the game, which one respondent stated as being the most useful visual UI. The respondent commented on this feature's accessibility, and usefulness for different levels of players. For beginners and/or a player entering the game for the first time, the tutorial and helper tips are provided on screen. For an experience player, they turn off the visual helpers.

“During tutorial primarily. Most of the game works under the assumption that you have passed this tutorial and that you can play the game without this aid. If you do require aid during the game, then you can turn this on, either by selecting a lower difficulty, or by turning it on during the options. This information includes help and hints, such as when you die what killed you and why.”

(Call of Duty)

Auditory UI

The open format questions generated a range of useful responses about auditory UI. The following list presents a summary of the features the players found be the most helpful:

- **Surround sound effects provided information about location of gunfire and other threats.**
- **Ambient music and sounds were used to inform the player of change of situation – enemy nearby.**
- **Voice commands and NPC's voices were used to indicate important information**
- **Sound effects were used to inform the player of avatar's limits**
- **Sound effects used to inform players of weapons status**
- **Sound effects were used to inform player of an enemy death.**

For some of the games, the same response occurred more than once, for example Half Life 2 generated a lot of responses centred around the auditory feedback, specifically for providing messages about enemy approaching. Similar answers could also be seen throughout the responses for the different games. For example; one respondent commented on the use of surround sound within Battlefield 3, to convey messages about how close the player was to getting hit. A similar type of comment was also made about Call of Duty.

Some of these games offered more of an insight into how the players of the FPS genre perceive the UI features due to the response rate. Some games provided little responses, but did provide some insight into how usable these auditory

UI features are for each game. We can see for each game, the audio UI has been used in different ways to communicate important messages to the player. Some games use audio to set the ambience and scene of a level, like Half Life 2, where background music is said to be used to convey a change in surroundings, or provide a message enemies are close by.

Other games, like Battlefield 3 focus on providing a realistic auditory experience. This game uses subtle, realistic surround sound features to enhance the game surroundings and provide the important messages to the player. The realistic sound effect of a gun overheating, or a gun being fired close by are used within Battlefield 3. Mentioned in some of the games, was the use of speech and voices of other player characters, and non-player character (NPC), which helped convey locations and motives of the enemy or signalled important events happening in the game.

The more interesting responses from the summary list have been discussed below.

Ambient music and sounds were used to inform the player of change of situation – enemy nearby

A big number of the respondents made some insightful comments on how ambient audio and music was a useful tool within game. Ambient noises from enemy characters indicated their enemy's presence before they appeared on screen, and ambient music was also regarded as a useful feedback feature.

"Audio was also key for making the world feel alive and also brought with it interesting ways to play the game, such as if you took your time and were cautious as you advanced through the level you would often hear enemies before you could see them."

"Mostly music wise."

"Excellent use of audio to communicate all sorts of things to the player is the trademark of Half-Life 2. Too many examples to list each and every one of them - hopper mines alert you when you get close, slim zombies howl when they are alerted, NPCs grab your attention by calling out to you, and many, many more".

"Ambient enemy sounds are used to hint at their presence to the player."

(Half Life 2)

Voice commands and NPC's voices were used to indicate important information

- **NPC's voices provide useful information about surrounding situation.**

There were a number of comments made about the immersive and excellent use of audio within Battlefield 3. A few respondents made some interesting comments about audio surround sound, and how it helped provide information

about both your enemies and people around you. These responses explained how the use of the NPC's voices provided the player with useful information about the enemies' strategy and situation:

"Battlefield 3 makes good use of audio for your surroundings, making it easier to hear people around you".

"The audio overall in Battlefield is excellent, it fully immerses you in the game and as the NPC's shout out loud, indications of their situation is often given away."

(Battlefield 3)

- **Automated voices used to indicate avatar's status.**

One respondent pointed out how important the automated voice commands were in emphasising certain information. The voice commands informed the player of certain changes of their health condition, and this was done through short detailed descriptions. Audio sound effects were also used to indicate critical information such as: the source of the damage (poison or radiation), and health/armour pick-ups. This respondent regarded this audio feature to be of great use.

"When the avatar receives damage, an automated voice often says things like "minor lacerations", or "blood toxin detected" to emphasise that they have been injured and their suit is protecting / healing them.

"The use of audio in Half Life 2 was fantastic for me; your suit gave you audio indicators when you were low on health, affected by poison or radiation and also when you picked up a health or armour increase."

(Half Life 2)

Sound effects were used to inform the player of avatar's limits

An interesting audio feature pointed out, was the sound of the player avatar's breathing rate. The breathing rate of the player avatar could be heard when sprinting, and when the avatar could no longer sprint, the volume and rate of this sound effect increased to signal you were about to stop running.

"Player starts to pant when they near the end of their sprint, letting you know you're about to stop running."

(Battlefield 3)

Entertainment Value

Finding out whether the respondents regarded the game as entertaining was important to understand. As mentioned with the literature (section 2.4); providing a good user experience, keeping the player in the state of Flow, and providing an entertaining experience is an important aspect of any game. Therefore, any negative experience encountered within a game may have been caused by the UI. Gathering data on this subject provided an understanding of whether the UI was something that affected the user experience and entertainment value of the game.

The respondents were asked whether the game(s) were entertaining and whether it kept their full attention throughout; their answers were given in 'yes/no' format, the results can be seen in Figure 29.

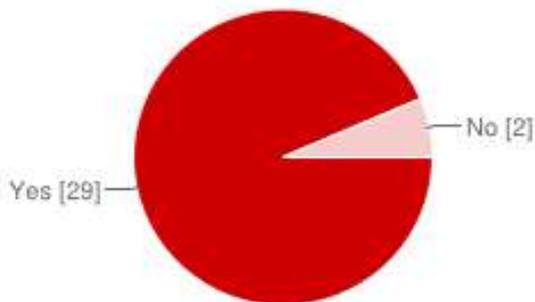


Figure 29. Shows the overall responses for how entertaining each game was.

29 games out of 31 came back with a positive response, suggesting the entertainment value for these 29 were good. The other 2 responses regard the entertainment value of the game(s) to be bad; these responses were in answer to Battlefield 3 and Call of Duty.

A further question was used to find out whether this bad experience was anything to do with the game UI. The respondents answers concluded that the bad ratings were in response to the game story, gameplay, and/or lack of new game mechanics, and were not a reflection of the game's UI features. These responses can be found within Appendix G.

5. DISCUSSION OF THE FINDINGS

The play sessions found a lot of interesting findings, and provided the majority of the data needed to go towards the final recommendations i.e. - usability design guidelines, so this data will be used to construct these. To strengthen the final recommendations, responses from the online survey will be used.

The online surveys provided a mixed amount of useful data, collected from the responses of the closed and open formatted questions. The majority of the useful information was gleaned from the open format question responses, which can be used towards the final usability design guidelines. The closed format question results did provide some relevant information regarding the overall usability of UI features from certain games. Due to the low response rate for most of the games, I think these were not reliable enough to justify a conclusion of how each game's UI features compare to one another. There were three games that did generate a lot of responses, which could be used to justify how each game UI features compare to one another. These were Half Life 2 (13), Battlefield 3(6) and Call of Duty Modern Warfare 2/3 (9), which generated 28 responses between them. Because of the higher response rate for these, these are the most reliable games to take data from within the open format questions. Therefore, the responses for these three game titles within the open format questions compared to the others, are of higher value, for that reason will be put towards the final usability design guidelines.

6. FINAL RECOMMENDATIONS

These final recommendations are aimed at guiding the UI designer, game designer or anyone wishing to create a user-interface for the purpose of the first-person shooter genre, and are based on research carried out on usability. These have been created from the literature review and the research findings.

6.1 The Usability Design Guidelines

Communicating the correct messages and clearly representing the goals of the game can be done through clear and concise feedback, which can be provided through visual and auditory tools. For a video game to clearly communicate to its players, it must adhere to usability guidelines and follow appropriate design principles. These guidelines aim to specify how the in-game information should be presented in order to deliver a user friendly experience , while maintaining the entertainment value.

1. Following platform conventions is important for maintaining consistent information feedback.

Using a strict colour scheme can be used to associate multiple features with one another throughout the game:

Using colour coding for important objects will allow the player to easily distinguish them, i.e. The player can obtain certain pick-ups within the game, which are placed around the game environment. The pick-ups could include; armour, ammunition and health packs and each could be assigned a different colour, so when the player see's these they can differentiate each.

Allow most crucial visual features to be fully discernible within any environment: At all times the player should be able to clearly read and understand the visual UI features on screen, i.e. There may be some areas within the game levels where the player is within dark scenery, for example, in underground tunnels, light scenery; rooftops of a high building. The visuals must be easily distinguished within both environments.

2. Feedback should be given in the most straightforward and logical way possible.

Visual and auditory used in unison to make sure the player doesn't miss important information: Use of audio sound effects and visual feedback can be used in unison to indicate the most crucial information, i.e. this could be used to provide information about the player's health decreasing rapidly into almost zero health. A semi-transparent red overlay visual could cover the screen, while the sound of a heart beat can be vividly heard.

Using the environment at your disposal: Using visual feedback that can be seen through the environment surface, from any standpoint within the game allows the player to rapidly locate places of importance, i.e. Situations and places that may need the player's assistance can be shown through these visual environment markers.

The duration of time a visual feature stays on screen should match amount of information that is being provided: The amount of time a visual feature should stay on screen should be long enough so that it provides enough time for

the player to clearly understand and take in the information that is being presented, i.e. A context sensitive visual icon provides a small amount of information, which could stay on screen for a small amount of time.

3. Information can be presented in an entertaining way once the interface has been presented in a logical and comprehensible manner.

Using animation and colours together, to indicate the most important information: i.e. player's health is low and the health icon turns red alerting player of danger. While a simple animation of the icon flashing on and off could be used to indicate this message further.

Use of subtle indicators within the 3D game world: Implementing the information within the 3D game world can be used to inform the player of certain messages while keeping them entertained and reducing the player's memory load, i.e. Instead of representing the path of the game through a radar or map, this could be done through the 3D environment. For example, lit candles could be placed in a linear pattern throughout the levels to show the player they are travelling in the correct direction. Note: This may be done using different navigational indicators (3D elements), depending on the theme of the game.

NPC audio voice commands used to indicate enemy situation and enemy status: Using voice commands that are passed between the NPC's i.e. enemy squad allows the player to pick up on certain plans of action the enemy might employ, i.e. an enemy target could shout out commands to his allies regarding the player's location "Enemy target lost", which indicates the player is in undetected.

4. The interface should aim to present the information that has minimal strain on the player's memory load.

Using icons within the interface can reduce interface clutter. Using easily recognisable and universally known icons and concepts can help the player pick up and learn the interface faster so it reduces strain on the player's visual and cognitive loads, i.e. heart icon is a universally known concept of health.

Breaking down the more complex information through audio features: Voice commands can be used to assist the player throughout certain missions, and break down the more complex information, i.e. This type of audio feedback could be used to feed to the player while they are making their way through the beginning of a level, providing the mission objective(s). This can also be used to gratify the player on an action they've performed, providing an update on their skills and offer recommendations on their next action.

Grouping similar information features using a designated on screen location to make information more accessible: Assigning certain type of information to specific locations on screen can help the player rapidly locate the information when they need it, i.e. For instance, all mission objectives and mission updates could be placed into the top right hand corner of the screen. All information designed to help the player such as tool tips and context sensitive help could be assigned to the middle of the screen.

5. Use of real-world and universally recognised language, icons and audio

Using realistic auditory sound effects can be easily recognised by players: The use of realistic sound effects can be used as an effective tool for providing the player with critical information such as; a sound of a heart beat informs

them their health state is low, a 'clicking' sound to indicate the weapon is out of ammunition, gunshot sound to indicate a gun has been fired.

Using the speed of an audio sound effect to warn the player: The pace of audio can be used to alarm the player, i.e. the breathing sound of the player avatar could be played when sprinting. When the avatar is no longer able to keep up the sprint, the volume and pace of this sound effect could be increased to signal to the player avatar is about to stop running.

Surround sound helps the player pick up on the spatial area on a subconscious level: By using surround sound this helps the player notice various messages from the spatial surroundings without having to refer to any visual indicators, which may distract them from their current actions i.e. a grenade landing near the player could be conveyed through a surround sound effect, signalling the dropping sound of the explosive. Another example; when the player is close to being hit by enemy fire, the volume of a whizzing bullet sound effect could be heightened as it reaches the player avatar's location, indicating how close the bullet came to the player's body.

6. For an efficient user-interface, only the relevant information should be present.

Use visual features only when necessary: The most important information should be present at all times. For other visual information, which isn't required at all times, this should appear only when necessary i.e. health and ammunition may be present throughout, information such as notifying the player they have levelled up, this could be shown through a visual graphic feature which appears for a short period of time, then disappears.

Using a minimal amount of visual features can enhance the delivery of the more important information: By reducing the amount of visual features, this can help the player keep track of all the information being provided. When a low amount of visuals are present on screen, this can provide more opportunity for the features that are present, to be used more effectively i.e. when a player is in the middle of action his energy levels may be running low, this could be shown through a subtle change in colour tone and the player would immediately pick up on this without having to turn their focus away from the goal of the game.

7. Player should be able to carry out goals without being interrupted by UI features.

Certain information can be conveyed using the focus spot of the player's eyes: When the player is performing most of the actions the player's eyes will usually be focused on the centre of the screen. Information can be conveyed through the crosshair marker so that the player retains focus i.e. while the player has their crosshair focused on an enemy target, this may turn a different colour to indicate they are on target. Another way this could be used is to deliver information about the enemys' health state. The crosshair colour could change to red indicating the enemy has very low health, yellow; for medium health, or green, for full health. Note: this could be used when a big wave of enemies are approaching.

8. Visual UI features should be prioritised so the most crucial information is noticed first.

Prioritising important information through text size and font style: Using font style and sizing within the interface can help the player differentiate between the more important information. When displaying the top priority information i.e. mission objectives, this can be done by using a different font style, and to put further emphasis on this, the size of the font can be made a bigger than other informative font features on the screen.

Assigning different sound effects to different functions: By assigning certain sound effects to the information you wish the player to pick up on first, this will prepare the player over time to recognise which sound effects are associated with which functions and outcomes, i.e. a 'bleeping' sounds effect could be assigned to a grenade or certain type of enemy, which could be played before the player is attacked. This allows the player to recognise the sounds each time a different enemy presents itself.

9. Players should feel they are in control of the system.

Help the player understand new and unfamiliar visual features: Within certain parts of the game the player may be presented with new visual features for new functions. A clear explanation should be provided which eases the player in so they can easily get to grips with the unfamiliar, i.e. Audio voice commands could help guide to the player, talking them through the new features step by step, which could be integrated to the game narrative. i.e. Visual features, such as context sensitive help should appear when appropriate, displaying concise instructions to provide help.

Customisable visual helpers for different levels of players: When the player is in need of helpers these should be present. The interface should provide an option so the player can customise visual and auditory features within the in-game interface as they please, this provides only the help features they need, i.e. Visual context sensitive visual helpers, tool tips and voice commands attempting to assist the player through levels should be able to be turned off or tailored to suit the players needs.

7. CONCLUSIONS & FINAL WORDS

7.1 Where the goals of the study met?

The main goal was: **how the in-game UI can be designed so that the player can easily access all the available UI features, without affecting the entertainment value.**

This was successfully reached by carrying out the research. The literature provided the good framework for the usability standards so that these could be transferred over into the research. The research provided findings from the play sessions. Throughout a number of weeks specific FPS game titles were played and analysed to find out what current design techniques were being used within the in-game UI, and whether any of these were successful at providing a user-friendly UI. The second part of the research asked a number of the target market demographic FPS players what they thought about the in-game UI features within a number of popular FPS titles, and asked how they rated each visual and auditory UI feature.

The finding from the play sessions provided the majority of the framework for the final usability design guidelines, and from this a list of common UI features emerged, which provided the framework for the questions within online survey. Once few play sessions were completed it became clearer what data was most important to this study, which meant it was easier to uncover the data that was needed for the final guidelines. To conclude the final games that were played generated the more useful data. The online surveys overall produced little data which went into the final guidelines, which was due to the response rate being uneven. To conclude the research did deliver the goals initially set out, the data findings were satisfactory enough to be able to construct the final usability design guidelines to a good standard.

Were the final recommendations what was expected?

I set out on creating a set of usability guidelines for the FPS video game genre. The end recommendations provided a list of design rules and usability principles that could be applied to the game UI.

The final recommendation generated more guidelines that cover how the usability of the visual UI may be applied to the UI compared to the amount of guidelines for auditory UI features. This outcome was representative of the research findings, as the initial literature provided more of an understanding about the visual UI compared to the audio UI. This in turn affected the way the play sessions were carried out, where more attention was given to the visual features within each game. When looking at the findings the online surveys provided, these seemed to collect a lot more about the auditory UI features than was found in the play sessions. Concluding there is room to provide more usability guidelines for the auditory UI features if this study was taken further.

The guidelines were created in mind of the FPS genre, although the final outcome provides a more extensive set of usability guidelines that could be taken and also applied to other game genres, concluding that these final recommendations are not limited to the FPS game genre, but may be applied to various genres to integrate usability within the UI.

Do you think the final recommendations have achieved their goal?

It was said these final usability guidelines were to be accessible to for game development teams where these would provide a standard set of guidelines game developers refer to when designing the games in-game UI features and information.

I think these guidelines have reached successfully achieved their goal, but have yet to be tested. I would conclude that these guidelines could be used to provide the outcome they were initially expected. However, as these guidelines are at their first stage of development, it would be wise to run a few pilot test studies to conclude how well they are at producing user friendly and functional UI's, and whether they are concise enough for game developers to follow. Following pilot test runs of these guidelines a conclusion can then be made about how useful they are for their intended purpose.

How do these guidelines fit into a games development studio?

To understand where these usability design guidelines would fit into a games development studio and games development process I asked one particular games company some in-depth questions who would design the UI within the development team, what the structure of the team were, and whether they had dedicated UI specialists working as part of the teams.

To give a brief summary of the responses, it appears the main UI decisions are in the hands of the GUI Designers and Game Project Designers to produce the main framework of the game UI. It is the job of the GUI Artists to think about the way the aesthetics will look. Ultimately it seems that all the GUI artists, GUI Designers and Game Project Designers make a collaborative effort to ensure the HUD, in-game information and UI features are working correctly and are appealing to the player. One particular point was made by the head of the art team at *Rebellion*, C.Payton stating it is important each one of the team members understands everyone's roles and know a bit about each other jobs, explain the process should be as organic as possible:

“The GUI design and GUI artists sit right next to one another so that this process is organic as possible – as the two evolve closely together.”

Chris Payton, Head of Art at Rebellion.

In this case the usability design guidelines may suit the needs of this type team structure, where they can exist. The full conversation can be seen in Appendix B.

To find out whereabouts these usability design guidelines would fit within a game development studio would take extensive research and further studies to answer this question.

7.2 Suggestions for the future research

Suggestions for further study within the area of usability for the video game user-interface:

- This study could be taken further, by looking at multiplayer player game modes within the FPS genre. As mentioned within the literature review, some relevant research by Pinelle et al. (2009) within the area usability for online networked video games has been touched upon.
- The interaction of the game UI; peripherals and controllers could be looked at. As this study focused on the visual and auditory UI output, a further study could use this thesis as the framework to research into the usability of the input devices and interaction for video games instead.
- Taking this study further, the guidelines drawn up could be used and applied to a working version of a video game to provide confirmation of how well they work.

APPENDICES

- Appendix A. Number of academic papers and articles found on video games.
- Appendix B. Questions and responses from game development companies.
- Appendix C. Usability Heuristics from literature.
- Appendix D. Metacritic metascores for the games study.
- Appendix E. Demographic players for FPS games.
- Appendix F. Single player online survey.
- Appendix G. Detailed survey response results.
- Appendix H. Open format question responses which were left out.

APPENDIX A

Number of academic papers and articles found on video games

A search was done to find a rough estimate of how many academic papers and articles there were with the phrase 'video games' within their titles. This figure shows the estimate number of results 'Google Scholar' search engine came back with between the period of 2000 and 2006, which shows a number of 1,330 matches.

The screenshot shows a Google Scholar search interface. At the top, the Google logo is on the left, and a search bar contains the text "allintitle: 'video games'". To the right of the search bar is a blue search button with a magnifying glass icon. Below the search bar, the word "Scholar" is displayed in red, followed by the text "About 1,330 results (0.06 sec)".

On the left side of the page, there is a sidebar with several filters and options:

- Articles** (highlighted in red)
- Legal documents**
- Any time** (with sub-options: Since 2012, Since 2011, Since 2008)
- Custom range** (with a date range of 2000 to 2006 and a "Search" button)
- Sort by relevance** (selected) and **Sort by date**
- Checkboxes for **include patents** and **include citations** (both checked)
- Create alert** (with a minus sign icon)

The main content area displays a list of search results. Each result includes a title, author information, a brief abstract, and citation information. Some results also include a link to a PDF or HTML version of the document.

Key search results include:

- What video games have to teach us about learning and literacy** by JP Gee - *Computers in Entertainment (CIE)*, 2003 - [dl.acm.org](#) [PDF] from uts.edu.au
- Half-real: Video games between real rules and fictional worlds** by Juul - 2005 - [mitpress.mit.edu](#)
- Don't Bother Me, Mom, I'm Learning! How Computer and Video Games are Preparing Your Kids for 21st Century Success and how You Can Help!** by M Prensky - 2006 - [uoc.edu](#)
- Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior. A meta-analytic review** by CA Anderson, BJ Bushman - *Psychological science*, 2001 - [ps.sagepub.com](#) [PDF] from iastate.edu
- Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life** by CA Anderson, ICE Dahl - *Journal of personality and social*, 2000 - [psycnet.apa.org](#) [HTML] from clark.edu
- The use of computer and video games for learning: A review of the literature** by A Mitchell, C Savill-Smith - 2004 - [LSDA](#) Cited by 295 Related articles All 5 versions
- An update on the effects of playing violent video games** by CA Anderson - *Journal of Adolescence*, 2004 - Elsevier [PDF] from berkeley.edu

A search was done to find a rough estimate of how many academic papers and articles there were with the phrase 'video games' within their titles. This figure shows the estimate number of results 'Google Scholar' search engine came back with between the period of 2007 and 2012, which shows a number of 2,170 matches.

The screenshot shows a Google Scholar search interface. At the top, the Google logo is on the left, and a search bar contains the text "allintitle: 'video games'". To the right of the search bar is a blue search button with a magnifying glass icon. Below the search bar, the word "Scholar" is displayed in red, followed by the text "About 2,170 results (8.63 sec)".

On the left side of the page, there are several filters and options:

- Articles**: A red heading.
- Legal documents**: A red heading.
- Any time**: A section with radio buttons for "Since 2012", "Since 2011", and "Since 2008". A "Custom range" option is also present.
- 2007 — 2012**: A date range selector with a "Search" button below it.
- Sort by relevance**: A red heading.
- Sort by date**: A red heading.
- include patents**
- include citations**
- Create alert**

The main search results area displays several entries:

- [CITATION] The impact of video games on training surgeons in the 21st century**: By JC Rooser Jr, PJ Lynch, L Cuddihy, DA Gentile... - Archives of ... 2007 - Am Med Assoc. Cited by 219. Related articles | BL Direct | All 18 versions. [PDF] from drdouglas.org
- [BOOK] Good video games+ good learning: Collected essays on video games, learning, and literacy**: By JP Gee - 2007 - books.google.com. This book discusses a broad range of topics concerning video games, learning and literacy. These include the ways games can many pleasure, learning and mastery through the sense of ownership, agency and control players enjoy when gaming, as well as controversial ... Cited by 415. Related articles | Library Search | BL Direct | All 39 versions. [HTML] from citeulike.org
- [CITATION] What video games have to teach us about learning and literacy**: By JP Gee - 2007 - Palgrave Macmillan. Cited by 434. Related articles | Library Search | All 9 versions.
- [CITATION] Teens, video games and civics: Teens' gaming experiences are diverse and include significant social interaction and civic engagement**: By A Lenhart, J Kahne, E Middaugh, AR Macgill... - 2008 - Pew Internet & American Life Project. Cited by 240. Related articles | Library Search | All 4 versions.
- The good, the bad and the ugly: A meta-analytic review of positive and negative effects of violent video games**: [PDF] from lamiu.edu. By CJ Ferguson - Psychiatric Quarterly, 2007 - Springer. Abstract Objective Video game violence has become a highly politicized issue for scientists and the general public. There is continuing concern that playing violent video games may increase the risk of aggression in players. Less often discussed is the possibility that ... Cited by 109. Related articles | BL Direct | All 5 versions.
- [PDF] Energy expended playing video console games: an opportunity to increase children's physical activity?**: [PDF] from uwo.ca. By R Maddison, CN Mhurchu, A Jull, Y Jiang... - Pediatric exercise ... 2007 - ehpl.uwo.ca. ... This study sought to quantify the energy expenditure and physical activity associated with playing the "new generation" active and nonactive console-based video games in 21 children ages 10-14 years. Energy expenditure ... Cited by 54. Related articles | View as HTML | BL Direct | All 5 versions.
- I wish I were a warrior: the role of wishful identification in the effects of violent video games on aggression in adolescent boys**: [PDF] from vu.nl. By EA Koenig, M Nije Ojzani... - Developmental ... 2007 - psycnet.apa.org. Abstract 1. This study tested the hypothesis that violent video games are especially likely to increase aggression when players identify with violent game characters. Dutch adolescent boys with low education ability (N= 112) were randomly assigned to play a realistic or ... Cited by 57. Related articles | BL Direct | All 18 versions.
- Playing for real: Video games and stories for health-related behavior change**: [HTML] from nih.gov. By T Baranowski, R Buday, DI Thompson... - American journal of ... 2008 - Elsevier. BACKGROUND Video games create extensive virtual environments by large numbers of

APPENDIX B

Questions and responses from game development companies.

The following questions were put forward to a number of small to medium games development studios to find out more about this UI design process, and whether the company supported this area of design with a team of dedicated UI designer and artists.

Questions

1. Firstly, I am particularly interested in finding out whether you any specific design guidelines you abide by when designing the UI and HUD for your games?
2. Secondly, are there any dedicated UI expert(s) you have working as part of your game development team, if so, how big is this team?

Email responses

From: Ming-Sheng Lee
Game company: Magitech
Date: 14th August 2012

Hello Helen,

We are a small company so we don't use any guild line or rules for UI and HUD. Our design is based on whatever faster and economic, like from previous project or sample code. Only key features will make us allocate time and resources for development. We don't have dedicated team for UI.

Best regards,

Ming-Sheng Lee
Director
Magitech

One particular games company; *Rebellion*, provided in-depth answers to these questions so further questions were asked about the integration level between each team within the creation of the graphical user-interface (GUI).

Rebellions' email responses

From: Michael Molcher (PR Coordinator) and Christopher Payton, (Head of Art).

Game company: Rebellion

Date: 16th August 2012

Q. Firstly, I am particularly interested in finding out whether there is any specific design guidelines you abide by when designing the UI and HUD for your games?

A. "Games that release on consoles traditionally have to conform to a set of technical requirements laid out by the format owners. For example when saving a game, certain text boxes must appear in a defined order and certain options are obligatory... There are still some legacy requirements which mean that games must still be playable on old 14' CRT televisions - which mean that font sizes can only go so small before they're unreadable.

Taking these requirements in to account, we are then free to design the UI and HUD as we wish. For this particular part of a games development the design and art teams need to work very closely to ensure that we get an aesthetically pleasing GUI (which fits with the games overall art style) but that it's also intuitive to use from an interaction stand-point. I wouldn't say that there are guidelines as such, being that every game is different in its content and what the team want to achieve - for example our most recent game (sniper elite v2) used a 3d UI, but we always apply logic and best practise to ensure that players aren't confused or frustrated by menus and HUD items. With a game team of 60+ people - everyone has a voice and can express concerns and suggestions for improvements"

Recently we've been making more iOS titles (dredd vs zombie, zombie hq & Sinbad) where we've been trying to set up a UI interface structure that can be re-used so that once it's right, we transfer that success and get time savings".

Q. Secondly, are there any dedicated UI experts working as part of your game development team, if so, how many and how big is this team?

A. "Currently we have a dedicated team of five GUI artists and designers whose sole job is to create and implement the game menus and in-game HUD across all our titles. Though each game project also has its own art and design team who will have input in to the GUI to ensure that it's correlating with the plan for the overall game".

Q. What are the main requirements/tasks you ask of your GUI designers? Are they employed to look at things such as the interaction design, and menu flow?

A. "That's pretty much the nail on the head – taking the game requirements and making it flow in the easiest/intuitive way... "

Q. Are the artists assigned just to work on the aesthetics of the GUI or do they have to think about interaction?

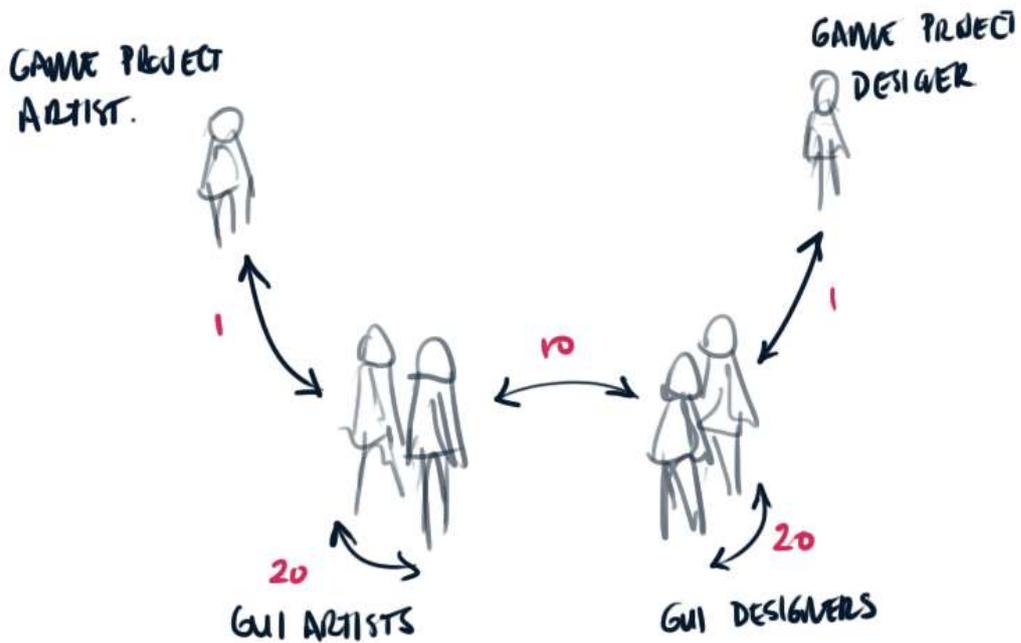
A. "Essentially working on the aesthetics – yes ... (but each has a thorough knowledge of each other's work)..."

"For the two above points, it's worth noting that the GUI design and GUI artists sit right next to one another so that this process is organic as possible – as the two evolve closely together."

Q. How closely do the GUI designers work with designers in other disciplines within the company?

A. "The GUI designer and Game designer need to work fairly closely together to ensure that the GUI is supporting all the game features. For example if we made a racing game and the Game designer wanted to have the car tyres wearing out... then he'd need to be sure that there's a GUI element showing this visually. Even silly things like making sure the level list is long enough (scrolling) to support the number of levels that are going to be made. The Game designer really has overall control for the games design (including GUI) and so may have particular requirements based on their own subjective opinions which they influence the GUI flow/design.

However, for the majority of the time the GUI designer will be focused on the GUI, as the game designer will be focused on the overall game. In addition to their own interactions, all the departments on a project will meet at least once a week – so everyone is kept up to date."



This diagram demonstrates the typical communication structure between the GUI artists, designers and project leads, within a games development team. The red numbers indicate roughly the amount of times the different teams would communicate to one another during a day. This was provided by 'Rebellion' games studio.

Facebook on 'Ga-Ma-Yo' group responses

 **[Name]** I'd say incredibly important
The design of a UI would be dependent on what's being designed I suppose.

For example our current title is an interactive crossword puzzler and we played with a few design ideas for the UI. We're actually going to make one small change as we speak.

It's really depends on what your designing for (have I heard that before?) If you're creating an experience which is designed to be immersive, such as a first person adventure, you'd design the UI/HUD to reflect this. There was a good article on Gama sutra not so long ago, some designers removed the HUD/UI completely from the game design and used visual cues in game.

Then again if your designing for example a simulator style game, you'd want all the UI/HUD you can get.

But IMHO UI design is a big part of the dev process – look at assassins creed btw!
August 13 at 11:56am · Edited · Like

 **Helen Fricker** Thanks, I think I may have skimmed that article, seems 'immersion' is one angle alot of the game community talks about when designing the HUD and UI , this is of course just one aspect of usability, which I'm focusing my studies on :). Puzzles games would have to be designed around good interface communication I'd expect...? Do you have a dedicated UI team for your games then? And if so, do they have a set of guidelines to help them design the UI?
August 13 at 12:03pm · Edited · Like

 **[Name]** I wear all the hats in my company but I worked in design and marketing for many years and I think the UI is one of the most important aspects of the game. The best game in the world with a crappy UI will just look and feel like crap.

UX is very important, you want there to be a natural flow from screen to screen and it's important to get non-gamers and gamers alike to play your game, they should never be left wondering what to press next or what certain UI elements mean. Everything (these days) should be self explanatory and straight forward.

Ultimately however considering UI as part of the development process I usually leave it until last. Get the game working at a prototype level, get it up to graphical standards, work on the gameplay and then drop the UI stuff in. While it's important, it's not terribly time consuming so can be left until last when adding the polish to the game and tweaking it to feel 'just right'.
August 13 at 12:03pm · Unlike · 1

 **Helen Fricker** Do you use a set of guidelines to help you design the UI within your companies?
August 13 at 12:05pm · Like

 **[Name]** Oh yeah just thought, I almost solely work on 3D games too :-p. 2D games would obviously need more consideration taken at an earlier stage of development with regards to UI ;-)
August 13 at 12:05pm · Like

-  **Martin Caine** Personally I don't really follow any guidelines but if I'm playing games on the iPad or something and I see a cool UI or menu I like I'll just take a screenshot, then you can just keep a collection of the cool UIs you've seen and have something to base your own on in future. In particular there's a lot of re-use of icons and positioning in the top mobile games these days as there're a few unofficial 'standards' that most companies follow now to make the UX seamless from game to game.
August 13 at 12:09pm · Like
-  **Helen Fricker** Not a strict set of guidelines here. There are design conventions that we stick to. For example, we are working for mobile platforms at the minute and tend to make sure the icons are big enough for a user to push.
August 13 at 12:09pm · Unlike · 🔄 1
-  **Helen Fricker** Its interesting **Martin** , that you mention leaving the UI design for the final process of the game , do you find this works well? Also, if left to the end of the process, how/when do you test the UI for usability issues ?
August 13 at 12:10pm · Like
-  **Martin Caine** An example would me the level select and level complete screens in Angry Birds, the format of which is copied by almost every mobile game these days for consistency as the players know what the icons mean and know how to navigate between themes or levels etc...
August 13 at 12:10pm · Like · 🔄 1
-  **Helen Fricker** Tim , Are these based on examples of other mobile games / web / other everyday design examples like **Martin** mentioned? Or are they based on guidelines from academia?...
August 13 at 12:16pm · Like
-  **Helen Fricker** Just to state, I'm studying the in-game UI , so the HUD etc, within FPS games...:)
August 13 at 12:19pm · Like
-  **Helen Fricker** Well, I think it's a mix of approaches really. Guidelines from academia can give you a good starting point and then the design can evolve from there. As **Martin Caine** mentioned, a lot of mobile games now use the angry menu system as a template for their games. It makes sense as gamers on this platform know instantly what all the iconography means.
- Weather this is a good thing is open to debate I suppose.
- If you look at the history of UI design, there are a lot of conventions that have continued. Games will expect certain things to be in a certain place i.e. a high score in a corner of the screen or a pause/menu button to be available.
August 13 at 12:29pm · Like

 **Shaun McClure** You can see the UI design here of our current title...

<https://www.facebook.com/photo.php?fbid=510299568985498&set=a.51029929898525.137618.474501569231965&type=1&theater>

We used a known convention for the pause buttons in the top right, this was also designed with a user's thumb in mind for easy access.

The letters along the bottom are swipe-able. This was designed to allow the user to have access to the letter without losing screen space to the inbuilt text input on the device.



Wall Photos
 Various promotional screens for wordy.
 By: Wordy

August 13 at 12:35pm · Edited · Like

 **Shaun McClure** i've got some examples of GUI on my site - www.shawnmcclure.com

Freelance computer game artist
www.shawnmcclure.com

August 15 at 5:46pm · Like

 **Shaun McClure** Site is old - in middle of a redo, but the examples are "sort of" up to date

August 15 at 5:46pm · Like

 **Helen Fricker** Kool I will check them out. And thanks to all who have replayed so far, some great tips and info that will can go into my research... :)

August 15 at 5:48pm via mobile · Like

APPENDIX C

Usability heuristics

The Ten Usability Heuristics by Nielsen (1994).

Visibility of system status

The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

Match between system and the real world

The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

User control and freedom

Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

Consistency and standards

Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

Error prevention

Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

Recognition rather than recall

Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

Flexibility and efficiency of use

Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

Aesthetic and minimalist design

Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

Help users recognize, diagnose, and recover from errors

Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

Help and documentation

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

Category 1: Gameplay

A. Heuristic: Enduring Play

- A1. The players finds the game fun, with no repetitive or boring tasks
- A2. The players should not experience being penalized repetitively for the same failure.
- A3. The players should not lose any hard won possessions.
- A4. Gameplay is long and enduring and keeps the players' interest.
- A5. Any fatigue or boredom was minimized by varying activities and pacing during the game play.

B. Heuristic: Challenge, Strategy and Pace

- B1. Challenge, strategy and pace are in balance.
- B2. The game is paced to apply pressure without frustrating the players. The difficulty level varies so the players experience greater challenges as they develop mastery.
- B3. Easy to learn, harder to master.
- B4. Challenges are positive game experiences, rather than negative experiences, resulting in wanting to play more, rather than quitting.
- B5. AI is balanced with the players' play.
- B6. The AI is tough enough that the players have to try different tactics against it.

C. Heuristic: Consistency in Game World

- C1. The game world reacts to the player and remembers their passage through it.
- C2. Changes the player make in the game world are persistent and noticeable if they back-track to where they have been before.

D. Heuristic: Goals

- D1. The game goals are clear. The game provides clear goals, presents overriding goals early as well as short term goals throughout game play.
- D2. The skills needed to attain goals are taught early enough to play or use later, or right before the new skill is needed.
- D3. The game gives rewards that immerse the player more deeply in the game by increasing their capabilities, capacity or for example, expanding their ability to customize.

E. Heuristic: Variety of Players and Game Styles

- E1. The game supports a variety of game styles.
- E2. The game is balanced with multiple ways to win.
- E3. The first ten minutes of play and player actions are painfully obvious and should result in immediate and positive feedback for all types of players.

F. Heuristic: Players Perception of Control

- F1. Players feel in control.
- F2. The player's have a sense of control and influence onto the game world.

Category 2: Coolness/Entertainment/Humor/Emotional Immersion

A. Heuristic: Emotional Connection

A1. There is an emotional connection between the player and the game world as well as with their “avatar.”

B. Heuristic: Coolness/Entertainment

B1. The game offers something different in terms of attracting and retaining the players’ interest.

C. Heuristic: Humor

C1. The game uses humor well.

Heuristic: Immersion

D1. The game utilizes visceral, audio and visual content to further the players’ immersion in the game.

Category 3: Usability & Game Mechanics

A. Heuristic: Documentation/Tutorial

A1. Player does not need to read the manual or documentation to play.

A2. Player does not need to access the tutorial in order to play.

B. Heuristic: Status and Score

B1. Game controls are consistent within the game and follow standard conventions.

B2. Status score Indicators are seamless, obvious, available and do not interfere with game play.

B3. Controls are intuitive, and mapped in a natural way; they are customizable and default to industry standard settings.

B4. Consistency shortens the learning curve by following the trends set by the gaming industry to meet users’ expectations. If no industry standard exists, perform usability/playability research to ascertain the best mapping for the majority of intended players.

C. Heuristic: Game Provides Feedback

C1. Game provides feedback and reacts in a consistent, immediate, challenging and exciting way to the players’ actions.

C2. Provide appropriate audio/visual/visceral feedback (music, sound effects, controller vibration).

D. Heuristic: Terminology

D1. The game goals are clear. The game provides clear goals, presents overriding goals early as well as short term goals throughout game play.

D2. The skills needed to attain goals are taught early enough to play or use later, or right before the new skill is needed.

D3. The game gives rewards that immerse the player more deeply in the game by increasing their capabilities, capacity or, for example, expanding their ability to customize.

E. Heuristic: Burden On Player

E1. The game does not put an unnecessary burden on the player.

E2. Player is given controls that are basic enough to learn quickly, yet expandable for advanced options for advanced players.

F. Heuristic: Screen Layout

F1. Screen layout is efficient, integrated, and visually pleasing.

F2. The player experiences the user interface as consistent (in controller, color, typographic, dialogue and user interface design).

F3. The players experience the user interface/HUD as a part of the game.

F4. Art is recognizable to the player and speaks to its function.

G. Heuristic: Navigation

G1. Navigation is consistent, logical and minimalist.

H. Heuristic: Error Prevention

H1. Player error is avoided.

H2. Player interruption is supported, so that players can easily turn the game on and off and be able to save the games in different states.

H3. Upon turning on the game, the player has enough information to begin play.

H4. Players should be given context sensitive help while playing so that they are not stuck and need to rely on a manual for help.

H5. All levels of players are able to play and get involved quickly and easily with tutorials, and/or progressive or adjustable difficulty levels.

I. Heuristic: Game Story Immersion

I.1 Game story encourages immersion (If game has story component).

APPENDIX D

Metacritic metascores for the games study

General Meaning of Score	Movies, TV & Music	Games
Universal Acclaim	81 - 100	90 - 100
Generally Favorable Reviews	61 - 80	75 - 89
Mixed or Average Reviews	40 - 60	50 - 74
Generally Unfavorable Reviews	20 - 39	20 - 49
Overwhelming Dislike	0 - 19	0 - 19

Chart from Metacritic gives a brief overview of the score system used on their site.

The following games were picked for the first part of the game study. I have included the meta-scores for the three main console types for each game:

Battlefield 3

84 Xbox 360

85 PS3

89 PC

Brink

68 Xbox 360

72 PS3

70 PC

Call of Duty: Modern Warfare 2

94 Xbox 360

94 PS3

86 PC

Call of Duty: Modern Warfare 3

88 Xbox 360

88 PS3

78 PC

Crysis 2

84 Xbox 360

85 PS3

86 PC

F.E.A.R 3

75 Xbox 360

74 PS3

74 PC

Half Life 2

90 Xbox 360

X PS3 (No score)

96 PC

Halo: Combat Evolved Anniversary

82 Xbox 360

X PS3 (Not available)

X PC (No available)

Serious Sam 3: BFE

X Xbox 360 (Not yet released)

X PS3 (Not yet released)

72 PC

APPENDIX E

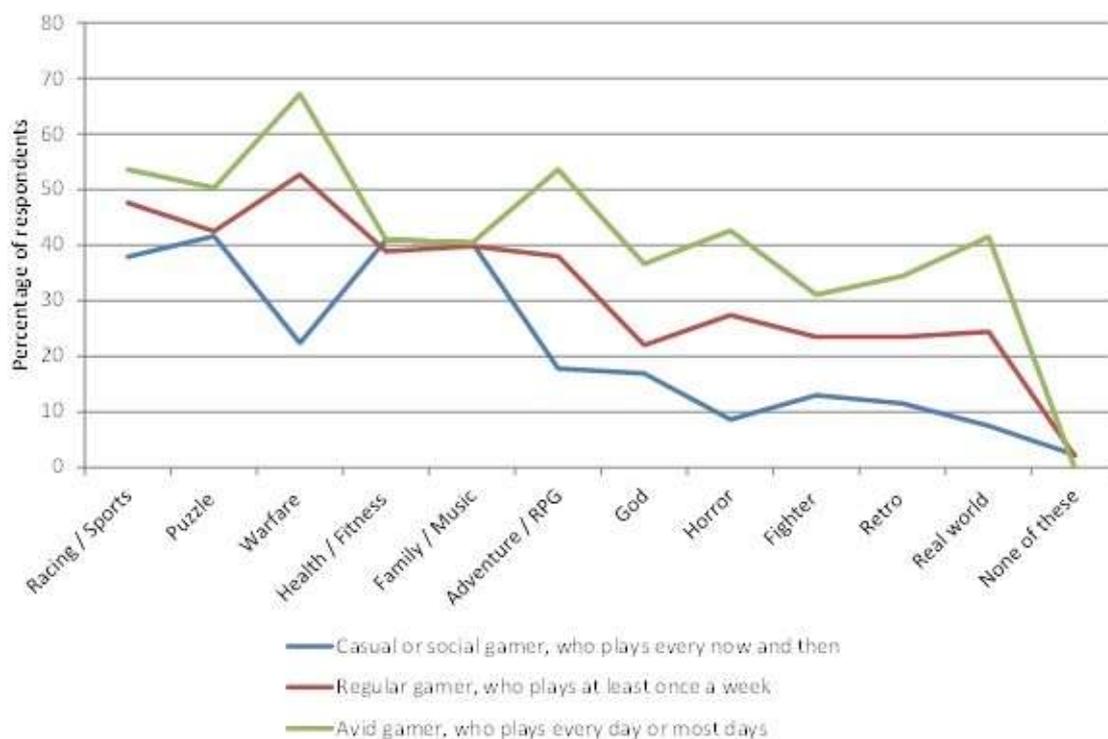
Demographic players for FPS games

Who are these players?

On average, it seems by *Mintel's* (2011) report, taken in 2011, the 'gamer type' for FPS/ warfare games seems to be that of the 'avid gamer' market (plays every day or most days), and followed shortly behind are the 'regular gamers'; who play at least once a week.

"For warfare games, there is an approximately 45 percentage point difference in response rates between casual and avid gamers, with almost seven in ten avid gamers playing warfare games, compared to only two in ten casual gamers."

(Mintel, 2011)



SOURCE: GMI/Mintel

Video games played, by gamer type, September 2011 – from a base of 1,013 Internet users aged 16+ who have played video games.

What age are they?

It seems for the most part warfare / FPS genre are played by gamer types, but mostly targeted are said to be the younger male audience.

“Games which allow for more integrated multiplayer action, such as warfare games or racing games are the most popular in houses where housemates or flat mates play video games, illustrating the popularity of these genres with traditionally younger, male crowds.”

(Mintel, 2011)

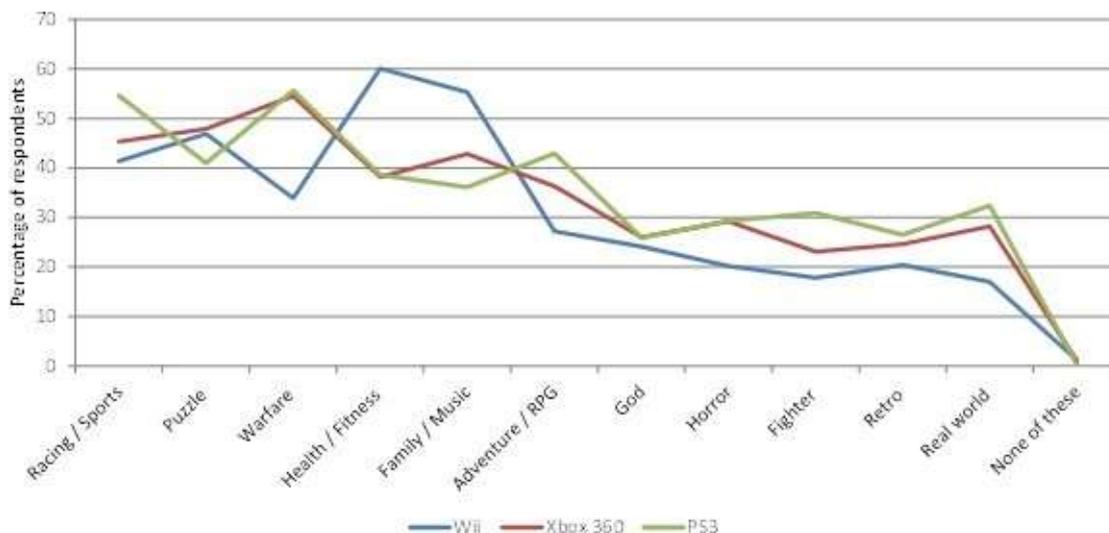
Why do they play FPS?

What are their motivations for playing this particular genre?

Taking into account previous mentions of the multiplayer motivations within a warfare game, according to the *Mintel* (2011) one of the higher factors of motivation for playing this genre may be the fact players can play with others, either online multiplayer mode, or LAN games with flatmates and friends. Competitive and co-op play.

On what platform, does the higher percentage of these games play on?

The clear platform competitors for the FPS genre are; the Playstation 3 and the Xbox 360. PC platform was not included in this report by Mintel, but it may have been excluded due to the higher popularity of both the Xbox 360 and PS3 when playing warfare/FPS titles on.



SOURCE: GMI/Mintel

Types of games played, by console ownership of those who play games, September 2011 - from a base of 1,013 Internet users aged 16+ who have played video games.

APPENDIX F

Single player survey

THE USABILITY OF FIRST-PERSON SHOOTER GAME INTERFACES

This survey seeks to identify how effective the user interface is in first-person shooter (FPS) games at providing important information and feedback to the player. Please fill out each section according to how useful you felt the user interface features were in providing you with important information throughout the game in single player mode. Where there are question boxes, please provide any further feelings you had about the game user interface.

-----This should only take 5-10 minutes of your time. -----

I would like to get as many survey responses as possible. So if you have played more than one of these games, and/or any of these games in either single player or multiplayer mode I encourage you to come back and fill it out again. All respondents will be automatically entered into a prize draw where you'll have the chance to win a free copy of a brand new FPS game. All you have to do is provide me with your name and contact details, which you'll find at the end of this survey. The more times you enter the more chance you will have of winning! Thank you for your participation and support! If you would like any further information or details of the study, please contact: u0764674@hud.ac.uk

1. SINGLEPLAYER GAME TITLE

For this section, I would like to find out which of the following game(s) you have played in singleplayer mode. Due to the way this study has been set up, you may only select one of the following games. However, if you have played more than one, you are welcome to return after completing this questionnaire and select a different game.

Please select one of the following games you have played:

Battlefield 3

Call of Duty: Modern Warfare 2/3

Half Life 2

Serious Sam 3: BFE

Crysis 2

Halo Combat Evolved Anniversary

2. PLATFORM TYPE

Please specify which platform you have played this game on:

PC

Console

3. VISUAL DISPLAY FEEDBACK

How useful was the visual feedback at providing you with important information about the following:

Avatar Status (Such as: avatar health indicator, damage or hit indicator, lives, crouched down etc).

very poor
poor
average
good
excellent
game did not provide this information

Enemy Status (Such as: enemy health indicator, clear animation showing enemy has been defeated or hit etc).

very poor
poor
average
good
excellent
game did not provide this information

Equipment Status (Such as: out of ammo visual indicator, ammo count, weapon switched, weapon damage, armour damage, available weapons, special weapons etc).

very poor
poor
average
good
excellent
game did not provide this information

Spatial Awareness (Such as: your location, map, radar, teammate's location, location of enemy gunfire, close to checkpoint etc).

very poor
poor
average
good
excellent
game did not provide this information

Mission Status & Objectives (Such as: aim of mission indicators, checkpoint reached, timer, score system, level completed or failed etc).

very poor
poor

average
good
excellent
game did not provide this information

Rewards & Achievements (Such as: level up icon, gain XP indicator, in-game achievable items, achievements, discovered easter egg etc).

very poor
poor
average
good
excellent
game did not provide this information

Help & Guides (Such as: tutorial mode, tool tips, visual prompters made basic controls easy to pick up and learn etc).

very poor
poor
average
good
excellent
game did not provide this information

Accessibility of Features (Such as: the visual display mapped controller well, easy to access all available features, efficient use of the screen space, most important features were highlighted first, customize your visual display features etc).

very poor
poor
average
good
excellent
game did not provide this information

How would you rate the overall usability of the visual user interface?

very poor
poor
average
good
excellent

Were there any key moments in game, where the use of visual display features helped you?

(comment box)

4. AUDIO FEEDBACK

How useful was the audio feedback at providing you with important information about events in the game:

Audio cues / Sound effects (Such as: door creaks when opened, timed audio-cues, sound backed up any event or action taken etc).

very poor
poor
average
good
excellent
game did not provide this information

Speech / Dialogue (Such as: voice commands, avatar speech and dialog etc)

very poor
poor
average
good
excellent
game did not provide this information

Conveyed Important Messages (Such as: action event was bad or good? Instant audio feedback etc).

very poor
poor
average
good
excellent
game did not provide this information

How useful was the audio feedback at providing you with important information about the following:

Avatar Status (Such as: avatar health audio indicator, damage or hit audio indicator, lives, crouched down etc).

very poor
poor
average
good
excellent
game did not provide this information

Enemy Status (Such as: enemy health or damage audio indicator, defeated enemy sound effects, enemy defeated etc).

very poor
poor
average
good
excellent
game did not provide this information

Equipment Status (Such as: the audio indicated weapon out of ammo, ammo count, weapon switched, weapon damaged, armour damaged etc).

very poor
poor
average
good
excellent
game did not provide this information

Spatial Awareness (Such as: your location, teammate's location, voices of enemy may give away their location, location of enemy gunfire or grenades dropped, close to checkpoint etc).

very poor
poor
average
good
excellent
game did not provide this information

Mission Status & Objectives (Such as: aim of mission audio indicators, checkpoint reached, timer, score system, level completed or failed etc).

very poor
poor
average
good
excellent
game did not provide this information

Rewards & Achievements (Such as: sound effect to alert player of a in-game reward, levelled up, gained XP, in-game achievable items, discovered easter egg etc).

very poor
poor
average
good
excellent
game did not provide this information

Were there any key moments in the game where the use of audio feedback helped you?

(comment box)

5. ENTERTAINMENT VALUE

Did the game keep you entertained and keep your full attention throughout?

Yes

No

- If no, was it any aspect of the user interface that caused this?

(comment box)

6. PRIZE DRAW

If you wish to be entered into my prize draw, please provide your details as follows. The lucky winner will be contacted within the next few weeks. NOTE: Your details will be kept strictly confidential.

Full name:

(comment box)

Either your email address or mobile number:

(comment box)

7. SURVEY COMPLETE!

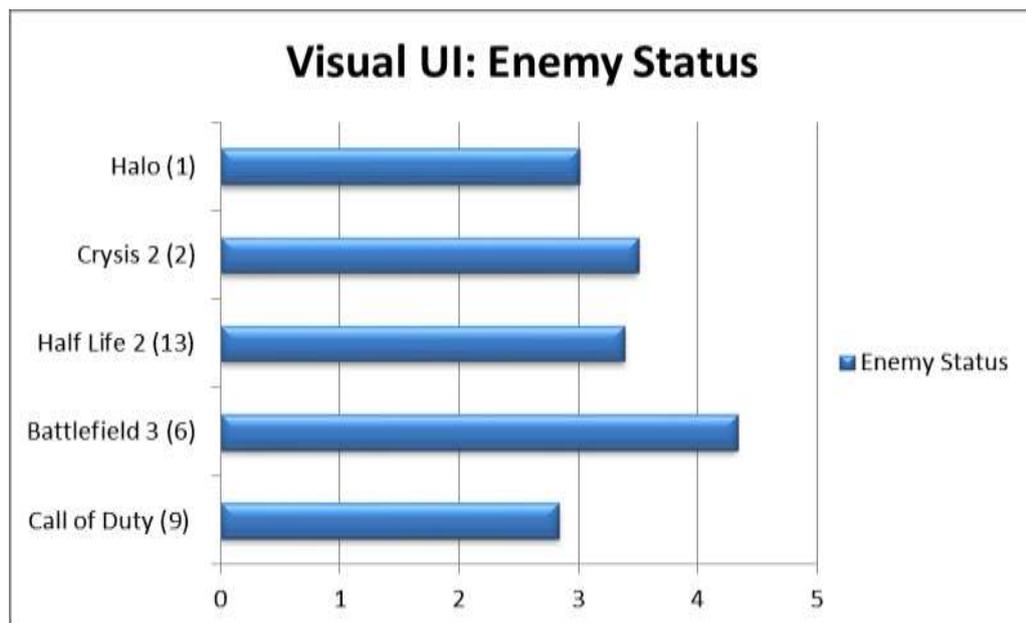
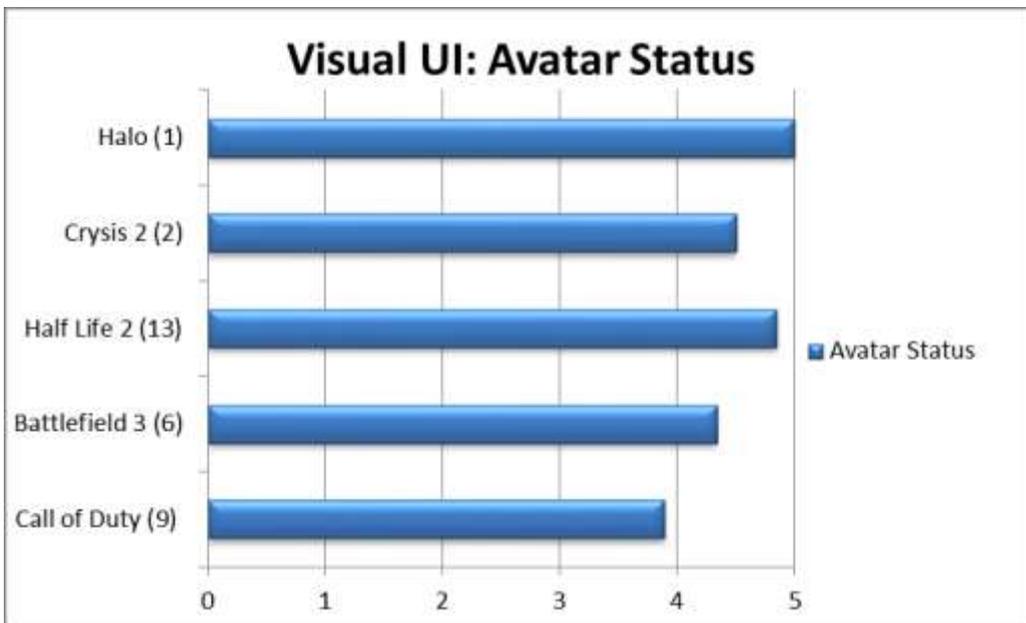
Thank you for taking the time to fill out this survey.

APPENDIX G

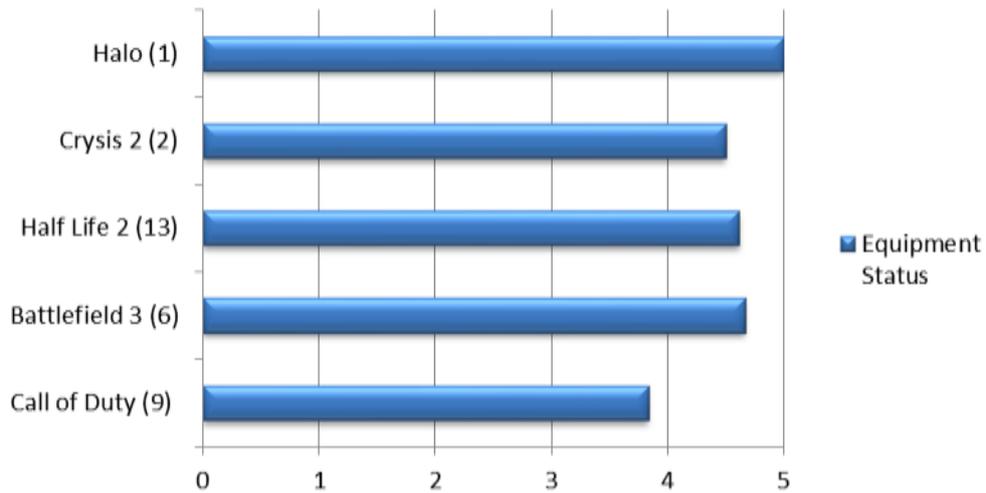
Detailed survey response results

Visual UI Feature Ratings

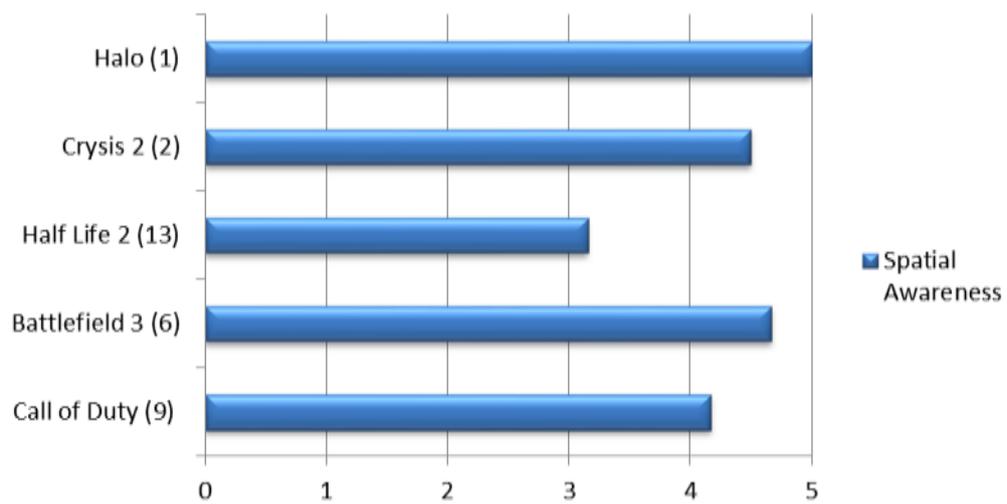
Statistical results from the survey responses for the visual UI features ratings. Each bar chart has been made to compare the separate ratings for each visual UI feature within each game title and compares each on a scale of 1 to 5.



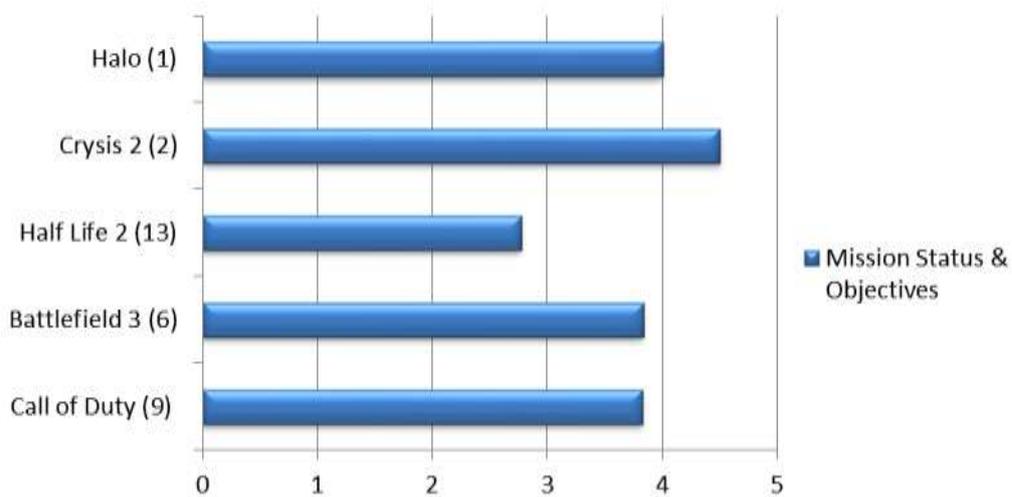
Visual UI: Equipment Status

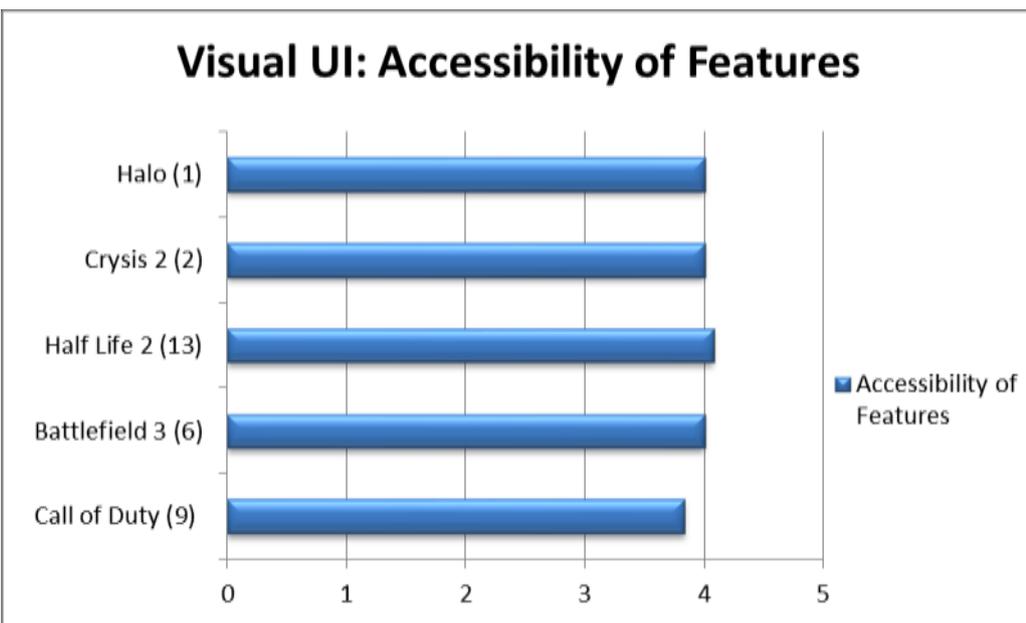
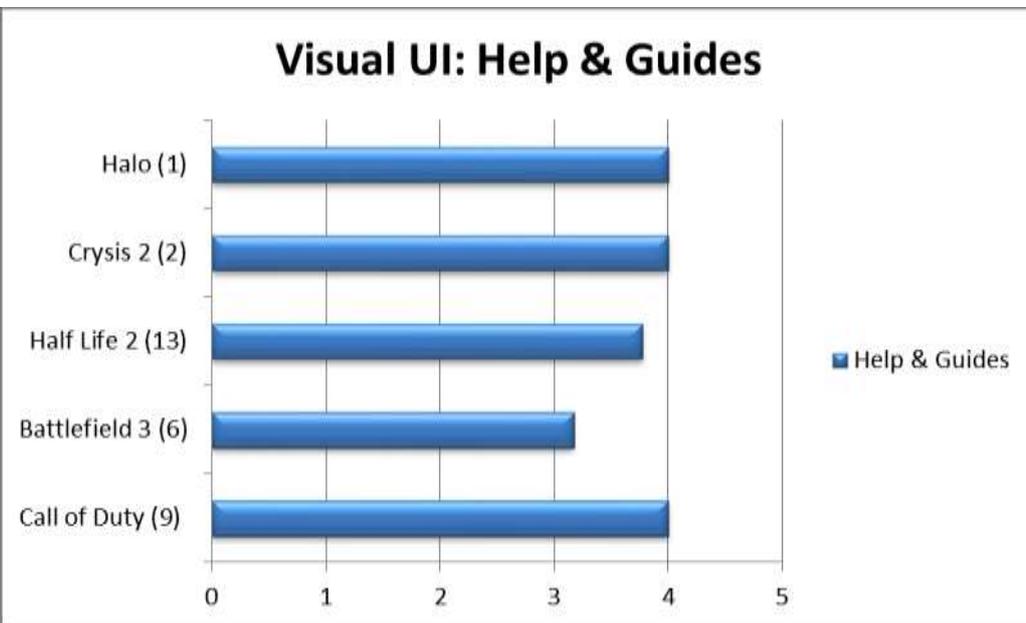
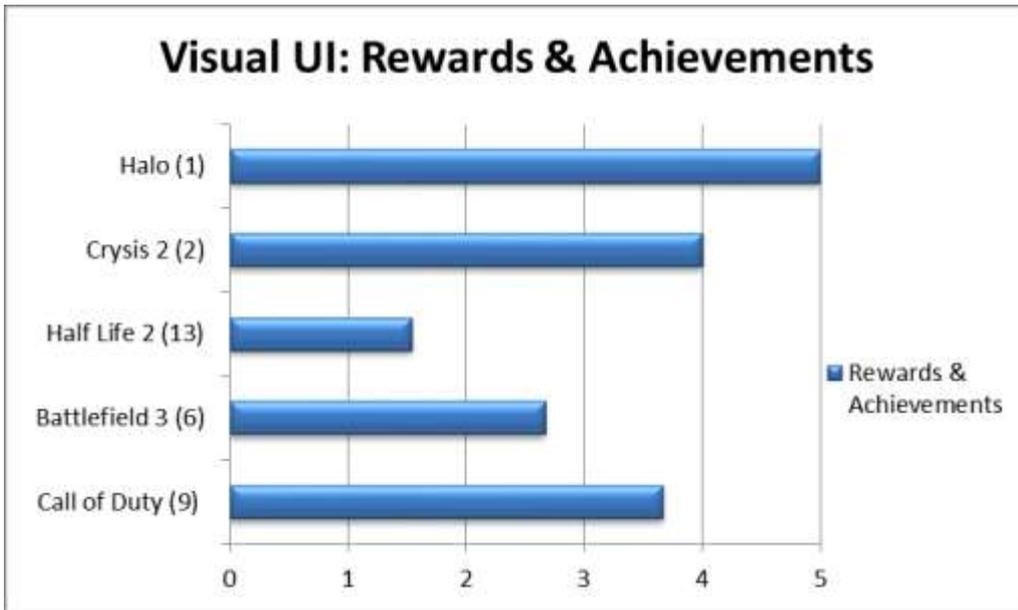


Visual UI: Spatial Awareness



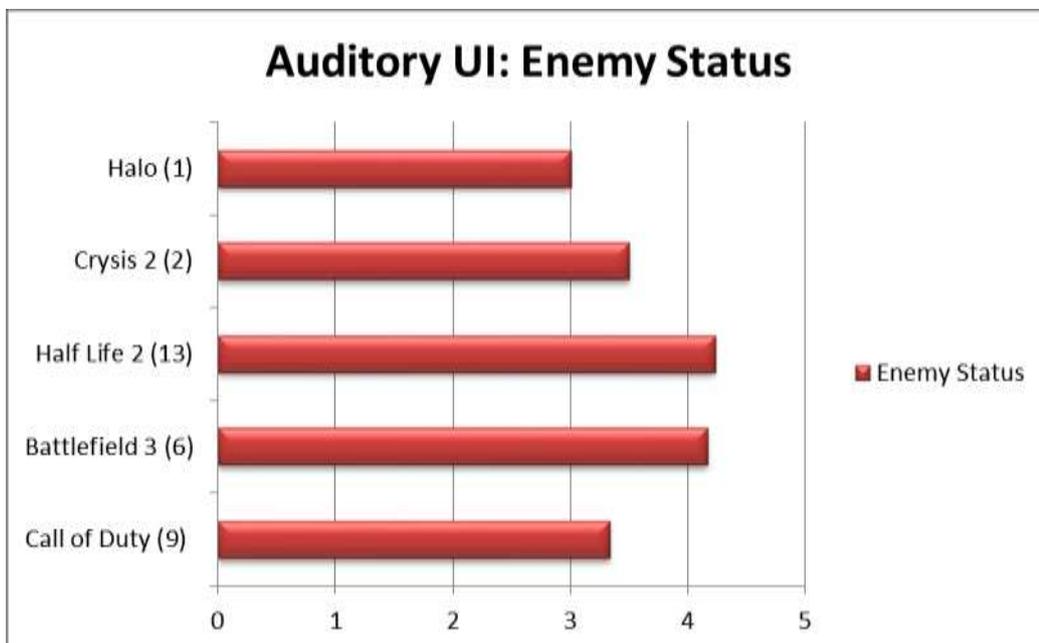
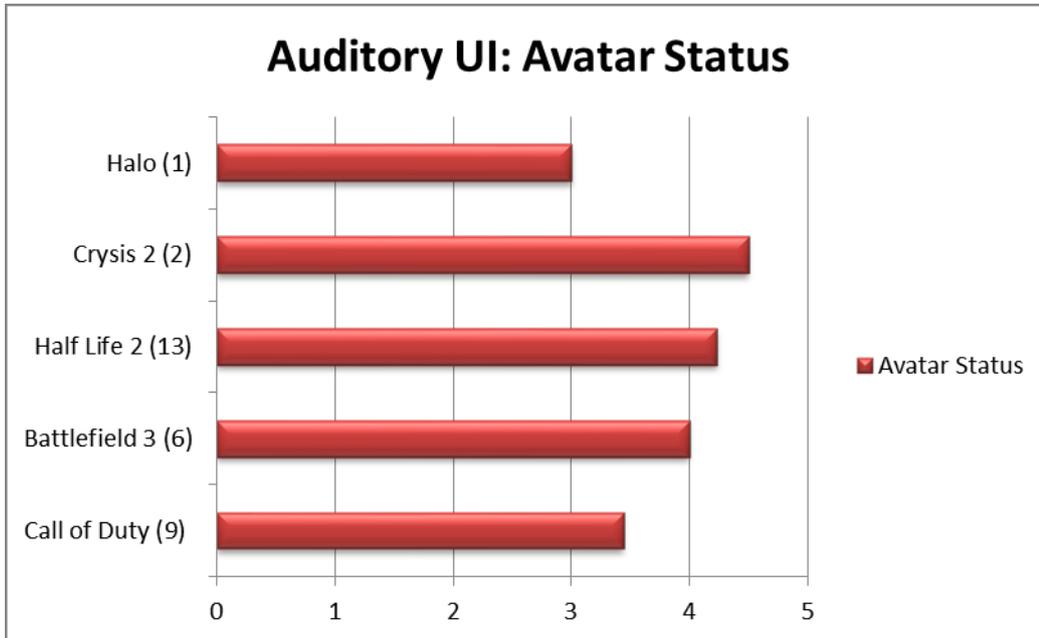
Visual UI: Mission Status & Objectives



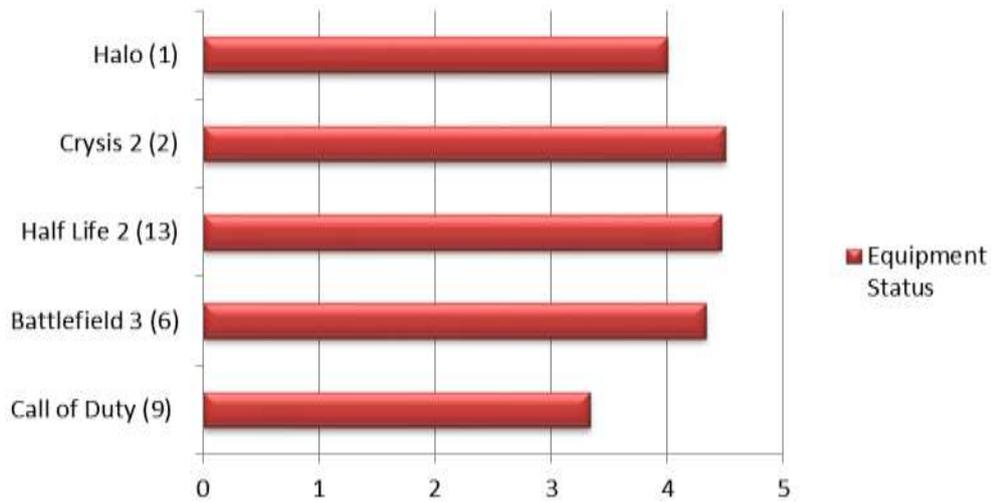


Auditory UI Feature Ratings

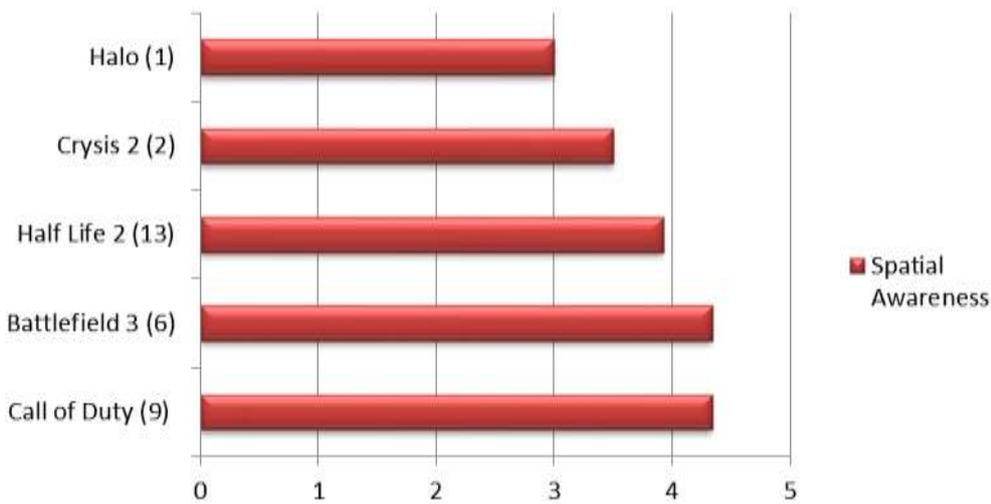
Statistical results from the survey responses for the auditory UI features ratings. Each bar chart has been made to compare the separate ratings for each auditory UI feature within each game title compares each on a scale of 1 to 5.



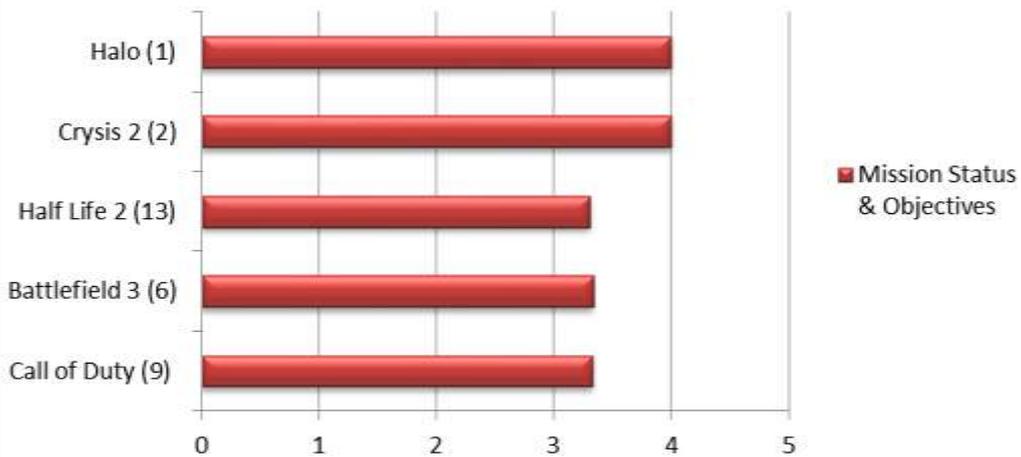
Auditory UI: Equipment Status



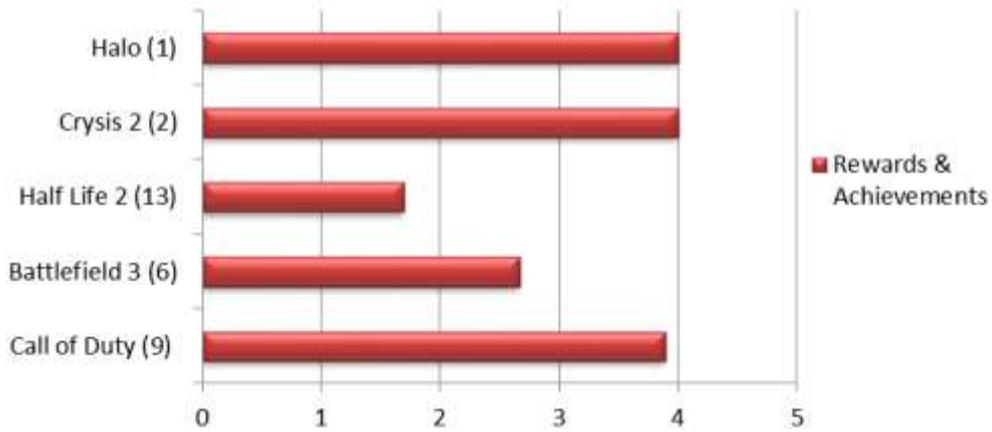
Auditory UI: Spatial Awareness



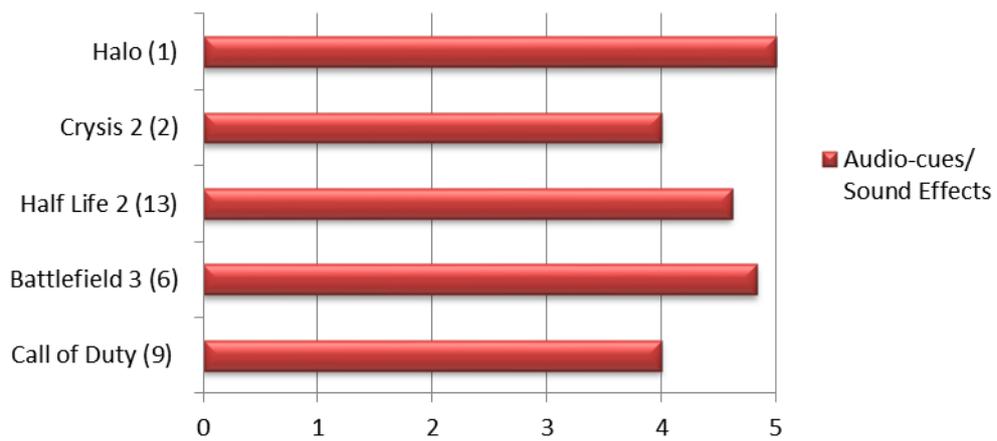
Auditory UI: Mission Status & Objectives



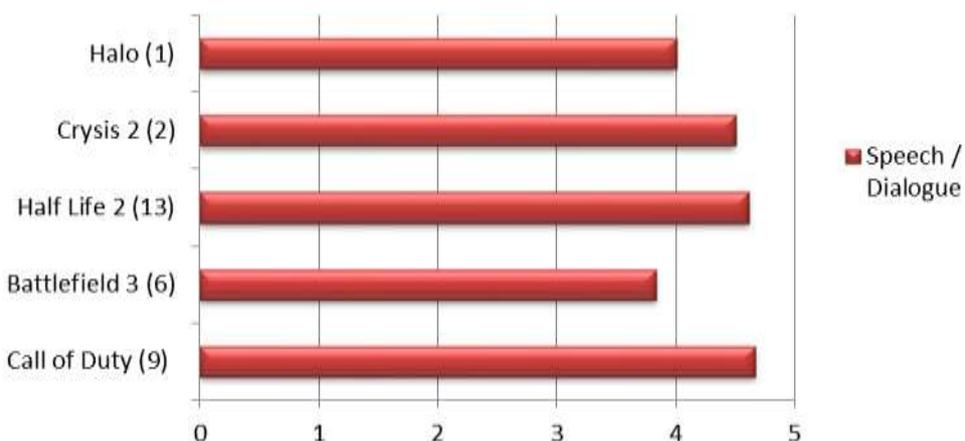
Auditory UI: Rewards & Achievements



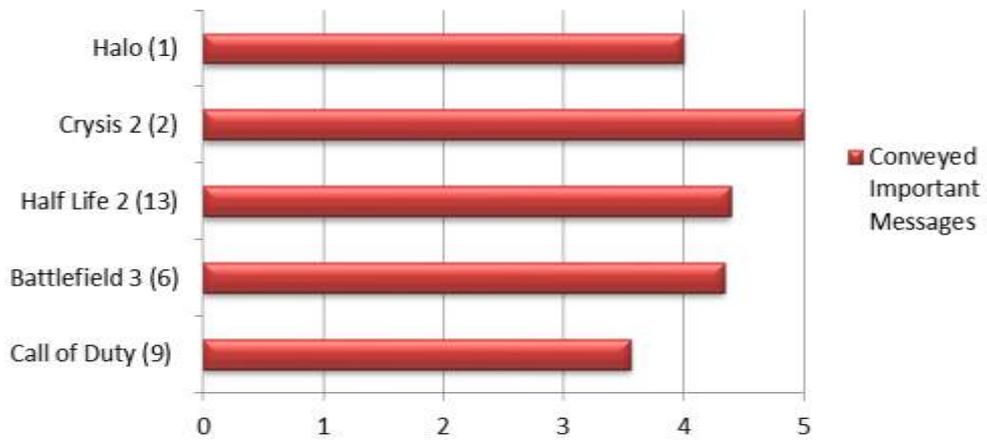
Auditory UI: Audio-cues / Sound Effects



Auditory UI: Speech / Dialogue



Auditory UI: Conveyed Important Messages



APPENDIX H

Open format question responses.

Conclusive data

The data shows the detailed analysis and responses that were briefly mentioned within section 4.3. These were useful in contributing towards the final usability guidelines. The data for the visual UI is listed first, followed by data for the auditory UI.

Markers used within 3D environment helped identify allied troops, enemies, pick-ups and objectives, mapped out these within the spatial surroundings.

- **Call of Duty - visual markers helped reach objectives**

This respondent commented on the use of visual markers, which appeared above the heads of your teammates. These visual markers helped this respondent identify certain objectives and kept them focused on the current task.

“There are also moments in the game where you have to follow members of your team as well as reach specific objectives, which are highlighted with markers. If these markers were not present I believe that in a lot of cases I personally would have gotten lost or become unaware to what the objective of that particular level would have been”.

(Call of Duty)

- **Crysis 2 and Battlefield 3 - visual markers helped reach objectives, identify threats and good advantage points within map.**

In *Crysis 2* the respondents described the use of the tactical visor mode, to be as of great use. The tactical visor used floating visual indicators within the 3D game environment. This provided useful information about opportunities and obstacles, such as; ammo picks, good advantage points (sniper positions, places of infiltration), and hazards or threats (explosive objects and enemies).

(Note: The term 'map' in these following responses is referring to the; game environment and surroundings).

“The game has an emphasis on planning your attack at various points in the game. You get to a vantage point over the map and press a button, and the HUD is filled with information regarding various obstacles

and opportunities in the map, such as ammo crates, a good sniper position, a place for you to sneak in undetected, something that will explode, etc”.

“There are certain areas in the game where you can gain a vantage point and use binoculars to spot points on the map, such as where to pick up ammo, places of infiltration and also enemy positions. This helps you plan your method of attack effectively”.

(Crysis 2)

“Markers for enemies when they are spotted so that you can have an easier time seeing them”.

“When unit/players were signalling places of importance on the battlefield”.

(Battlefield 3)

Radar was good for identifying locations of objectives and enemy target before going out into battlefield.

There were a few responses that described how useful the map/radar was in providing crucial information about the enemy whereabouts. Two respondents explain, without this visual feedback, their player avatar would have been put at more risk, which may have resulted in a higher damage, or to be killed.

“When hiding behind rocks the maps will display the general direction of enemies making it easier to line up a general shot before putting your character at risk”.

“In veteran mode the use of cover becomes very important. The ability to use the map/radar to identify the location of enemy targets therefore becomes an essential tool in order to optimise speed and precision whilst avoiding damage.

(Call of Duty)

Spatial hit marker (centre of screen) provided spatial awareness by showing the player the direction the hit came from

There were also visual hit markers to indicate when the avatar player encountered a hit. One respondent commented this, and explained the indicator would move around with the player as they moved, pointing out the direction of whereabouts the shot came from.

“When shot, the indicator will move around the screen as you turn, helping you to work out where the shot came from”. (Battlefield 3)



Shows Battlefield 3 campaign mode, spatial (red) hit marker appears in the centre of players screen when player has taken a damage hit.

Hit crosshair marker indicated when player successfully hit an enemy

The visual crosshair hit marker used within BF3 provided the player with a clear indication they had hit their target. One respondent mentioned this to be of a very helpful and important visual feature.

“Hit markers to let you know you had hit the enemy with gunfire/ explosions, this was always helpful I'd been crying out for this for some time. It usually appears in MP, but not SP and this was a welcome change in BF3”.

(Battlefield 3)

Icons for grenades would appear as an on screen 2D graphic, mapping the spatial awareness of explosive threats

A few respondents commented on the use of visual icons used to indicate dangers nearby. These icons indicated such dangers as; grenades and enemy players.

“HUD Icons for when dangers are near such as grenades.

(Battlefield 3)

Use of minimal visual features helped player keep track of feedback information.

One respondent stated they liked the use of minimalist HUD visuals. Important information such as; health and ammo count, would only appear when necessary. Ammunition counter would only appear when player had collected enough ammo, which the respondent claimed to find appealing and useful.

“The game was very minimalist in its presentation of visual display features which I believe added to the quality of the experience. Rather than be lumbered down through reading multiple indicators and needing to keep track of the numbers, the indicators were hidden until health or ammunition was collected. The enemies health indicator was never displayed either but the player learnt a feel for when an enemy was close to death through playing the game”.

(Half Life 2)

Health HUD visual was used to show player a clear indication their health had decreased

Respondents pointed out particular aspects of the HUD visuals which were of great use. A decrease in health and damage from exposure to dangerous substance such as; poison or radiation were indicated clearly through the visual HUD.

“Times when you were affected by things such as poison or radiation; the HUD changed to notify you that the decrease in your health was due to these factors”.

(Half Life 2)

Surround sound effects provided information about location of gunfire and other threats.

- **Effective sounds effects used to signal danger.**

A respondent commented on the use of sound effects for the gunfire and dropped grenades. The sound effects identified the location of gunfire/grenades in order for player to recognise danger around them. Interestingly, the respondent explains that this information was provided by both, visual and audio, and suggests the audio was the more effective and useful feedback feature.

“The sound of gun fire and the dropping of grenades I think is the most effective in this game in identifying the location of said sounds. Particularly with grenades the sound of it dropping makes you aware of the area around you in order to avoid the blast and resulting effect of death or damage to health on the player. While a logo does come up to identify the location of the grenade, the sound is the first thing the player hears. In a lot of cases this sound may have prevented my death/damage many times throughout the game”.

(Call of Duty)

- **Crysis 2 - surround sound helped locate enemy gunfire.**

One respondent explained when experiencing fire from the enemy, surround sound was useful in helping pinpoint the location of the enemy.

“The surround sound helps to pinpoint enemy locations when being fired upon, which is good”.

(Crysis 2)

- **Battlefield 3 surround sound effects used to inform player how close they were to getting hit in the head.**

Sound effects were used to signal how close bullets were at hitting the player avatar, commented by this respondent.

“The closer a bullet is the louder the "whizzing" sound of the bullet, this helps you know if someone almost hit your or not.

(Battlefield 3)

- **Realistic explosion sounds used to make player hearing difficult.**

This respondent pointed out the use of realistic surround sound provided a good feedback when explosions went off.

“When an explosion has gone off nearby, hearing becomes difficult. This could be considered a good thing as it is realistic and a nice feature, but could also be considered bad as it makes the game harder temporarily”.

(Battlefield 3)

Sound effects used to inform players of weapons status

Sound effects were also used to indicate gunfire shots and provided useful information about the player's weapon status. This was mentioned by one of the respondents.

"Listening to the gun fire and the noise your weapon makes. For instance a cracking noise means the fire was near you. Or, your gun over heating can be heard".

(Battlefield 3)

Sound effects were used to inform player of an enemy death.

The respondent also comments on the useful sound effects indicating an enemy's death.

"Enemies make clear distinctive noises when defeated".

(Half Life 2)

Inconclusive data

Responses that did not produce any useful information for the goals of this part of the study are included within this section. These responses were taken out because they referred to other modes of the games i.e. multiplayer or were considered as unusable.

"Markers for allies who are in need to healing / resupplying / repairing (for vehicles)".

(Battlefield 3)

"None I can think of, but Battlefield 3 is a straight forward fps, similar to a lot of other fps games in that respect so there isn't much in the way of helping the player as the player is likely to know what to do... if that makes sense".

(Battlefield 3)

"When you first put on the HEV suit, the avatar's hands are shown to the camera (for the first and only time in the game) to illustrate what happened.

(Half Life 2)

"Most of the time it wasn't really needed, as Half-Life has awesome UI and it is very easy to get used to it".

(Half Life 2)

Entertainment Value

"The only reason I wasn't entertained by MW3 is purely down to the fact that there was nothing new in terms of gameplay. While aspects of the game were interesting to play it didn't compare to the freshness and surprise of the first game".

(Call of Duty: Modern Warfare2/3).

"Wasn't so much the user interface, was more an awful story and lack luster gameplay".

(Battlefield 3).

REFERENCES

- Apple, Inc. (2012). iOS Human Interface Guidelines (Online Database Library). from Apple Inc
- Barr, P., Noble, J., & Biddle, R. (2007). Video game values: Human-computer interaction and games. *Interacting with Computers*, 19(2), 180-195. doi: 10.1016/j.intcom.2006.08.008
- Bernhaupt, R., Eckschlagner, M., & Tscheligi, M. (2007). *Methods of Evaluating Games - How to Measure Usability and User Experience in Games?* Paper presented at the ACE'07 : International Conference on Advances in Computer Entertainment Technology.
- Bevan, N. (1995). *Usability is Quality of Use*. Paper presented at the 6th International Conference of Human Computer Interaction, Yokohama.
- Bevan, N., Kirkowski, J., & Maissel, J. (1991). *What is Usability?* Paper presented at the 4th International Conference HCI, Stuttgart.
- Blythe, M. A., Overbeeke, K., Monk, A. F., & Wright, P. C. (2004). *Funology: From Usability To Enjoyment*. Kluwer Academic Publishers.
- Cameron, E. (2011). opinion: the Illusion of Immersion. *News: Console/PC, Design*. Retrieved from
- Christou, G. (2012). Usability Evaluation For Video Games: Formal evaluation methods
- from http://www.gamasutra.com/view/news/39633/Usability_evaluation_for_video_games_Formal_evaluation_methods.php
- Conyer, M. (1995). User and usability testing - how it should be undertaken? *Australian Journal of Educational Technology*, Volume 11(Issue 2).
- Clanton, C. (1998). *An interpreted demonstration of computer game design*. Paper presented at the CHI 98 conference summary on Human factors in computing systems, Los Angeles, California, United States.
- Croteam. (2001). Serious Sam: The First Encounter.
- Croteam. (2011). Serious Sam 3: BFE Devolver Digital.
- CrytekStudios. (2011). Crysis 2: Electronic Arts.
- Csikszentmihalyi, M., Harper, & Row. (1990). FLOW: The Psychology of Optimal Experience
- Davies, M. B. (2007). *Doing a Successful Research Project : Using Qualitative or Quantitative Methods*.
- Day1Studios. (2011). F.E.A.R 3: Warner Bros. Interactive.
- Desurvire, H., Caplan, M., & Toth, J. A. (2004). *Using Heuristics to Evaluate the Playability of Games*. Paper presented at the CHI 2004.
- Desurvire, H., & Wiberg, C. (2009). *Game Usability Heuristics (PLAY) for Evaluating and Designing Better Games: The Next Iteration*. Paper presented at the Proceedings of the 3d International Conference on Online Communities and Social Computing: Held as Part of HCI International 2009, San Diego, CA
- Desurvire, H. W. (1994). Faster, cheaper!! Are usability inspection methods as effective as empirical testing? *Usability inspection methods* (pp. 173-202): John Wiley & Sons, Inc..
- DICE. (2011a). Battlefield 3: Electronic Arts.
- DICE. (2011b). Battlefield 3: Electronic Arts (EA).
- Duvall, H. (2001). It's All in Your Mind: Visual Psychology and Perception in Game Design. *Design*, 1-3. Retrieved from http://www.gamasutra.com/view/feature/3097/its_all_in_your_mind_visual_.php
- EdgeStaff, McAllister, G., Viggers, C., Avent, J., & Hopson, J. (2011). The Science Of Usability Testing. *Features*.
- Emery, D. (2010). Jason Bradbury: Video games are 'bigger than Hollywood'. *BBC News Technology* [Video News Report]. London: BBC (News).
- Erm, L., & Mäyrä, F. (2005). *Fundamental components of the gameplay experience: Analysing immersion*. Paper presented at the 2005 DiGRA Second International Conference.
- Fagerholt, E., & Lorentzon, M. (2009). *Beyond the HUD: User Interfaces for Increased Player Immersion in FPS Games*. Master of Science, Chalmers University of Technology, Goteborg, Sweden.
- Federoff, M. A. (2002). *Heuristics and usability guidelines for the creation and evaluation of fun in video games*. Master of Science, Indiana University.
- Fox, B. (2005). *Game Interface Design*: Thomson Course Technology.
- Frokjaer, E., Hertzum, M., & Hornb, K. (2000). *Measuring usability: are effectiveness, efficiency, and satisfaction really correlated?* Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems, The Hague, The Netherlands.
- Garland, R. (1991). The Mid-Point on a Rating Scale: Is it Desirable?

- Gregory, E. (2008). Understanding Video Gaming's Engagement: Flow and Its Application to Interactive Media.
- IGN (Producer). (2001). Serious Sam Images. Retrieved from <http://www.ign.com/images/games/serious-sam-the-first-encounter-pc-15156/4fa6c9a2cdc388ed13e5cefc>
- IGN (Producer). (2008, August, 2012.). Dead Space Images. *Dead Space*. Retrieved from <http://uk.ign.com/images/games/dead-space-xbox-360-850402/4fa6cb01cdc388ed13f126ab>
- InfinityWard. (2009). Call of Duty: Modern Warfare 2: Activision.
- InfinityWard, & SledgehammerGames. (2011). Call of Duty: Modern Warfare 3: Activision.
- ISO:9241-11. (1998). ISO 9241-11 Ergonomic requirements for office work with visual display terminals (VDTs) *Part 11: Guidance on usability*.
- Johnson, D. M., & Wiles, J. (2003). Effective affective user interface design in games. doi: 10.1080/00140130310001610865
- Jokela, T., Livari, N., Matero, J., & Karukka, M. (2003). The Standard of User-Centered Design and the Standard Definition of Usability: Analyzing ISO 13407 against ISO 9241-11.
- Jorgenson, K. (2011). The User Interface Continuum: A Study Of Player Preference. Retrieved from http://www.gamasutra.com/view/feature/6346/the_user_interface_continuum_a_php
- Laitinen, S. (2005). Better Games Through Usability Evaluation and Testing. Retrieved from http://www.gamasutra.com/view/feature/130745/better_games_through_usability_php
- Lee, S. H. (1999). Usability Testing for Developing Effective Interactive Multimedia Software: Concepts, Dimensions, and Procedures, from http://www.ifets.info/journals/2_2/sung_heum_lee.html
- Llanos, S. C., & Jorgenson, K. (2011). *Do Players Prefer Intergrated User Interfaces? A Qualitative Study of Game UI Design Issues*. Paper presented at the DiGRA 2001 Conference: Think Design Play.
- Malone, T. W. (1981). Heuristics for designing Enjoyable User Interfaces: Lessons from Computer Games (pp. 63-68): ACM.
- Malone, T. W. (1982). *Heuristics for designing enjoyable user interfaces: Lessons from computer games*. Paper presented at the Proceedings of the 1982 conference on Human factors in computing systems, Gaithersburg, Maryland, United States.
- Mayer, R. E. (2001). *Multimedia Learning*.
- McAllister, G., & Long, S. (2012). [Interview with 'Player Research'].
- Mechner, J. (2009). Tips for Game Designers. Retrieved from <http://jordanmechner.com/blog/2009/12/tips-for-game-designers/>
- Metacritic. (2012). <http://www.metacritic.com/>
- Microsoft. (2012). Heuristic Evaluation Process (Dev centre - website help.). <http://msdn.microsoft.com/en-us/library/windows/desktop/bb189150.aspx>
- Miller, G. A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological Review*, *Volume 63*(Issue 2).
- Mintel. (2011). Types of Games Played *Video Games - UK - November 2011*.
- Monk, A. F. (2002). *Fun, communication and dependability: extending the concept of usability*. Paper presented at the 16th British HCI Group Annual Conference, London, UK.
- Mullet, K., & Sano, D. (1995). *Designing Visual Interfaces: Communication oriented techniques*.
- Nielsen, J., & Molich, R. (1990). *Heuristic evaluation of user interfaces*. Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems: Empowering people, Seattle, Washington, United States.
- Nielson, J. (2005). How to Conduct a Heuristic Evaluation, 2012, from http://www.useit.com/papers/heuristic/heuristic_evaluation.html
- Nielson, J., & Mack, R. L. (1994). *Usability Inspection Methods*: John Wiley & Sons, Inc.
- Niles, R. (2012). Survey Sample Sizes. *RobertNiles.com*, from <http://www.robertniles.com/stats/sample.shtml>
- Nokia, F. (2006). Mobile Game Playability Heuristics. from Nokia
- Norman, D. A. (2002). *The Design of Everyday Things*. New York: BasicBooks.
- Pagulayan, R. J., Keeker, K., Wixon, D., Romero, R. L., & Fuller, T. (2003). User-centered design in games. In A. J. Julie & S. Andrew (Eds.), *The human-computer interaction handbook* (pp. 883-906): L. Erlbaum Associates Inc.
- Pinelle, D., Wong, N., & Stach, T. (2008a). *Heuristic evaluation for games: usability principles for video game design*. Paper presented at the Proceedings of the twenty-sixth annual SIGCHI conference on Human factors in computing systems, Florence, Italy.
- Pinelle, D., Wong, N., & Stach, T. (2008b). *Using Genres to Customize Usability Evaluations of Video Games*. Paper presented at the FuturePlay 2008, Toronto, Ontario, Canada.

- Quesenbery, W. (2001). *What Does Usability Mean: Looking Beyond 'Ease of Use'* Paper presented at the 48th Annual Conference, Society for Technical Communication, 2001.
- SaberInteractive, & 343Industries. (2011). Halo: Combat Evolved Anniversary: Microsoft Games Studios.
- Saunders, K., & Novak, J. (2007). *Games development essentials: Game interface design*. New York: Thomson Delmar Learning.
- Saunders, K. D., & Novak, J. (2012). *Game Design Essentials: Game Interface Design* (2nd ed.): Delmar Cengage Learning.
- Schell, J. (2008). *The art of game design: a book of lenses*. Massachusetts: Morgan Kaufmann.
- Schmitt, B. (1999). *Experiential Marketing: How to Get Customers to Sense, Feel, Think, Act, and Relate to Your Company and Brands*.
- Shelley, B. (2001). Guidelines for Developing Successful Games *Interface Goals: Intuitive, Easy to Use, & Minimize Frustration*, 3. Retrieved from
- SplashDamage. (2011). Brink: Bethesda Softworks.
- Sweetser, P., & Wyeth, P. (2005). GameFlow: A Model for Evaluating Player Enjoyment in Games. *Vo.3* (No.3).
- Valve. (2004). Half Life 2: Vivendi Games.
- Weinschenk, S. (2010). Engagement, Entertainment, or Get The Task Done : Cognitive, visual, and motor loads in UX design Retrieved from <http://uxmag.com/articles/engagement-entertainment-or-get-the-task-done>
- Wilson, G. (2006). Off With Their HUDs!: Rethinking the Heads-Up Display in Console Game Design. from Gamasutra http://www.gamasutra.com/view/feature/130948/off_with_their_huds_rethinking_.php
- Zammitto, V. (2008). *Visualization Techniques in Video Games*. Paper presented at the EVA 2008 London Conference, London.
- Ziegler, J., & Burmester, M. (1995). Structured Human Interface Validation Technique - SHIVA. In K. O. Yuichiro Anzai & M. Hirohiko (Eds.), *Advances in Human Factors/Ergonomics* (Vol. Volume 20, pp. 899-906): Elsevier.