How realistically can contemporary platoon-level infantry combat be simulated using First-Person Shooter (FPS) video games?

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King's College London

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How realistically can contemporary platoon-level infantry combat be simulated using First-Person Shooter (FPS) video games?

James H. Bennett

Thesis Submitted for the Degree of Doctor of Philosophy
May 2016
King’s College London
Abstract

This research thesis investigates the degree to which first-person computer games are capable of simulating tactical infantry engagements, with a view to enhancing their utility for future infantry training and informing subsequent academic and military studies. This field of research is becoming increasingly relevant within the modern military establishment, as budget cuts brought about by the general economic downturn are compelling armed forces to seek more cost effective methods of training soldiers. Because modern games are highly technologically advanced and costly to develop as stand-alone products, the usage of Commercial Off-The-Shelf (COTS) video games as training aids is becoming increasingly common. Since these games have applications in both the military and commercial spheres, developers are able to try to obtain double value by selling them concurrently to both markets. The innate tension between realism and entertainment inevitably leads to compromises in the verisimilitude of the product, and this thesis argues that achieving such double value is tenable only in relation to specific aspects of infantry training.

There has been little academic research to date examining the effectiveness of COTS game usage within the military, largely due to their recent development and acceptance as legitimate training tools. However, three main strands of related research undertaken by two distinct professions have been identified: Militaries have invested considerable resources into understanding infantry combat modelling and dynamics, and to a lesser extent how bespoke virtual environments can be employed to enhance training regimes, while social scientists have assessed the characteristics inherent to simulated environments in order to examine psychological immersion.1

This thesis will link together – and expand upon – these areas of research, which examine hitherto discrete aspects of commercial video games and military simulations. Combining these approaches will provide an evaluation of how realistic commercial game products are from a military perspective, in conjunction with an examination of their relationship to the sociological aspects of the intent of the designers and needs of the market. This will pave the way for an assessment of how

1 ‘Virtual environments are computer generated domains which create a perception of traversable space and afford the exertion of player agency. They are populated by objects and often human or AI [Artificial Intelligence] controlled entities with whom players can interact’. – Calleja (2009), p.2.
successfully COTS video games can be adapted to suit the needs of armed forces, specifically in relation to creating combat environments suitable for training infantry soldiers in particular aspects of combat. This research will bridge the gap between the professional military and simulation communities, equipping simulation professionals with an understanding of combat, and military professionals with the skills to utilise First-Person Shooter (FPS) environments effectively as training tools.
Acknowledgements

I am indebted to all of the interviewees who committed their time to participate in this research. Amongst them, I am particularly grateful to Major Tom Mouat and Nicholas Edwards, who have both made significant contributions in terms of contributing their own expertise and providing valuable further contacts from within their respective professional spheres.

There is no doubt that this thesis would not have come to fruition without the exceptional efforts proffered by my Supervisor, Professor Philip Sabin. His input across the last seven years has consistently served to guide me towards the highest of standards, and I have no doubt that the work you are about to read would not have existed in anything like its current form without his expertise to guide my efforts. I am indebted and extremely grateful to him for his patience and support.

My friends and colleagues have offered me endless encouragement across the years, and I thank each and every one of you for believing in me. In particular I would like to thank Emma Trevayne for her love, support, and proofreading abilities.

Above all, I would like to thank my parents. They have encouraged and supported me throughout every step of this research, and there is no doubt in my mind that without them this project would never have been completed (or even started!)

JHB – 25/05/2016
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<td>After Action Review</td>
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<td>ACRE</td>
<td>Advanced Combat Radio Environment</td>
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<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
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<td>API</td>
<td>Application Programming Interface</td>
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<td>ArmA</td>
<td>Armed Assault</td>
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<td>BDU</td>
<td>Battle Dress Uniform</td>
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<td>BI</td>
<td>Bohemia Interactive</td>
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<td>BISIM</td>
<td>Bohemia Interactive Simulations</td>
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<td>BST</td>
<td>Basic Skills Trainer</td>
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<td>CEV</td>
<td>Combat Effectives Values</td>
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<td>COP</td>
<td>Combat Outpost</td>
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<tr>
<td>COTS</td>
<td>Commercial Off-The-Shelf</td>
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<td>CSET</td>
<td>Convoy Skills Engagement Trainer</td>
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<tr>
<td>CTF</td>
<td>Capture the Flag</td>
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<tr>
<td>DARPA</td>
<td>Defense Advanced Research Projects Agency</td>
</tr>
<tr>
<td>DARWARS</td>
<td>DARpa’s universal, persistent, on-demand training WARS</td>
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<tr>
<td>DCDC</td>
<td>Development, Concepts and Doctrine Centre</td>
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<td>DIVE</td>
<td>Dismounted Infantry Virtual Environment</td>
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<td>DOAE</td>
<td>Defence Operational Analysis Establishment</td>
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<td>DoD</td>
<td>Department of Defense EINSTein</td>
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<td>EINSTein</td>
<td>Enhanced Neural Simulation Toolkit</td>
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<td>ESL</td>
<td>Electronic Sports League</td>
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<td>FM</td>
<td>Field Manual</td>
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<td>FoV</td>
<td>Field of View</td>
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<td>FPS</td>
<td>First-Person Shooter</td>
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<td>FSW</td>
<td>Full Spectrum Warrior</td>
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<td>GUI</td>
<td>Graphical User Interface</td>
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<td>HA</td>
<td>Historical Analysis</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>HMMWV</td>
<td>High Mobility Multipurpose Wheeled Vehicle</td>
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<tr>
<td>HP</td>
<td>Health/Hit Points</td>
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<tr>
<td>HUD</td>
<td>Heads-Up-Display</td>
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<tr>
<td>I/ITSEC</td>
<td>Interservice/Industry Training, Simulation, and Education Conference</td>
</tr>
<tr>
<td>ICT</td>
<td>Institute for Creative Technologies</td>
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<tr>
<td>IED</td>
<td>Improvised Explosive Device</td>
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<tr>
<td>IT</td>
<td>Information Technology</td>
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<tr>
<td>ITAS</td>
<td>Improved Target Acquisition System</td>
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<tr>
<td>JBTSE PT</td>
<td>Joint &amp; Battlefield Trainers, Simulations &amp; Synthetic Environments Project Team</td>
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<td>JOT</td>
<td>Job Oriented Training</td>
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<td>Kg</td>
<td>Kilogramme</td>
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<tr>
<td>LCS</td>
<td>Last Clan Standing</td>
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<tr>
<td>MEU</td>
<td>Marine Expeditionary Unit</td>
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<tr>
<td>MoD</td>
<td>Ministry of Defence</td>
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<td>MOUT</td>
<td>Military Operations in Urban Terrain</td>
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<tr>
<td>MOVES</td>
<td>Modeling, Virtual Environments and Simulation Institute</td>
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<tr>
<td>NATO</td>
<td>North Atlantic Treaty Organisation</td>
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<tr>
<td>NCO</td>
<td>Non-Commissioned Officer</td>
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<tr>
<td>NGO</td>
<td>Non-Government Organisation</td>
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<tr>
<td>NPC</td>
<td>Non-Player Character</td>
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<td>NVD</td>
<td>Night Vision Device</td>
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<td>OC</td>
<td>Officer Commanding</td>
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<td>OEMA</td>
<td>Office of Economic and Manpower Analysis</td>
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<td>OI</td>
<td>Objective Indicator</td>
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<td>OneSAF</td>
<td>One Semi-Automated Forces</td>
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<tr>
<td>Op JCOVE</td>
<td>Operational Joint Combat Operations Virtual Environment</td>
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<td>OPTAG</td>
<td>Operational Training and Advisory Group</td>
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<td>OR</td>
<td>Operational Research</td>
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<td>Abbreviation</td>
<td>Description</td>
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<td>--------------------------------------------</td>
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<tr>
<td>PC</td>
<td>Personal Computer</td>
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<tr>
<td>PEO Soldier</td>
<td>Program Executive Office Soldier</td>
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<tr>
<td>PRR</td>
<td>Personal Role Radio</td>
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<tr>
<td>RNLA</td>
<td>Royal Netherlands Army</td>
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<tr>
<td>ROE</td>
<td>Rules of Engagement</td>
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<td>ROTC</td>
<td>Reserve Officers' Training Corps</td>
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<td>RPG</td>
<td>Rocket Propelled Grenade</td>
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<td>RTFA</td>
<td>Ready-Team-Fire-Assist</td>
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<td>RTO</td>
<td>Radiotelephone Operator</td>
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<tr>
<td>QJM</td>
<td>Quantified Judgement Model</td>
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<td>QRF</td>
<td>Quick Reaction Force</td>
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<td>SAS</td>
<td>Special Air Service</td>
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<tr>
<td>SAW</td>
<td>Squad Automatic Weapon</td>
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<tr>
<td>SDK</td>
<td>Software Developer Kit</td>
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<tr>
<td>SME</td>
<td>Subject Matter Expert</td>
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<td>SSM</td>
<td>Spatial Simulation Model</td>
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<tr>
<td>TTPs</td>
<td>Tactics, Techniques and Procedures</td>
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<tr>
<td>UAV</td>
<td>Unmanned Aerial Vehicle</td>
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<tr>
<td>UI</td>
<td>User Interface</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<td>UN</td>
<td>United Nations</td>
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<tr>
<td>US</td>
<td>United States</td>
</tr>
<tr>
<td>USMC</td>
<td>United States Marine Corps</td>
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<tr>
<td>VoIP</td>
<td>Voice over Internet Protocol</td>
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<td>VBS</td>
<td>Virtual Battlespace</td>
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<tr>
<td>VIP</td>
<td>Very Important Person</td>
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<tr>
<td>VR</td>
<td>Virtual Reality</td>
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<td>EXP/XP</td>
<td>Experience Points</td>
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Introduction

In an increasingly digital age, real-time computer simulations have become a prominent feature of modern life. They are used as vehicles of entertainment by millions of people around the world, and as serious training tools by a diverse range of industries.\(^2\) This thesis will examine this phenomenon with specific reference to the simulation of contemporary infantry combat. A considerable proportion of commercial video games purport to recreate such engagements, and various militaries increasingly use these technologies to train and educate soldiers. The popularity of these simulations is extensive enough that more people are now experiencing combat vicariously than have actually fought in recent real-world conflicts.

The desire to limit the considerable costs associated with bespoke virtual solutions has led to military establishments taking advantage of COTS products available to the mass market. Whilst soldiers have traditionally been trained through field exercises, the existence of virtual alternatives raises fundamental questions in relation to their value, realism, utility and cost effectiveness, as well as how training objectives are best achieved in the context of a digital world.

Research Question

➢ How realistically can contemporary platoon-level infantry combat be simulated using First-Person Shooter (FPS) video games?

Sub-Questions

1. Which identifiable elements of combat are most significant in explaining the dynamics and observed outcomes of discrete infantry engagements, and how widely are these factors understood amongst military establishments and games developers?

In order to assess the accuracy of any simulation an understanding of the dynamics and outcomes which shape combat engagements will need to be

\(^2\) Liebl (2015).
established. Once this has been achieved, credible comparisons can be drawn between the real world and simulated combat environments. Additionally, an assessment of the extent to which military forces and games developers actually understand these dynamics will serve to illuminate whether a potentially problematic knowledge gap exists between these different spheres.

In the context of this thesis ‘combat’ will refer specifically to the timespan in which platoon level infantry forces face direct engagement with enemy infantry, with both sides chiefly employing small arms weapons. More comprehensive simulations of warfare – involving the use of armour, artillery and aircraft – will not be considered; these are no less worthy of examination, but are substantial enough to form their own distinct area of discourse which would provide an opportune focus for expanded future academic studies.

2. **How do game developers create virtual environments that players perceive to be real?**

Virtual environments are designed to mimic sensory components of human perception to delude the user’s brain into believing the experience they are undergoing is to some extent genuine. Though events are taking place in virtual environments – where the player is not subjected to the same range of physical sensations or exposed to the corporeal dangers that exist in genuine combat – the developers seek to elicit psychophysical responses that to a certain degree mirror those evidenced in real combat. An assessment of the methods developers employ to achieve these goals will uncover how virtual environments immerse players and dupe their mental faculties into accepting a false reality.

3. **Given their prior understanding of combat dynamics, do games developers accentuate or actively distort some of the previously
identified factors in order to create a commercially successful product?

In designing FPS games, developers are limited by both their understanding of combat dynamics and the needs of the commercial market. In order to create a commercially viable product they are also required to accentuate certain elements of the combat experience, and to de-emphasise or modify others. Identifying which elements overlap with those observed in real-world infantry engagements – as well as assessing how significant those specific factors are in determining dynamics and outcomes of such engagements – will be key in assessing the extent to which commercial developers willingly and/or inadvertently compromise the accuracy of their simulations to increase the product’s overall commercial appeal.

4. How do commercial games – principally designed to make money – balance the requirements of gamers and professional military users?

Whilst developers of purely commercial products only seek profit, those who create combat simulation games have an obligation to satisfy the divergent requirements of the multiple markets they serve. Their games are played by a niche section of the gaming community – who play to be entertained in a manner commensurate with their understanding of real-world combat engagements – whilst concurrently being utilised by military professionals, who require realism and an accurate simulation of the combat environment. Catering to both these audiences simultaneously requires developers to create products which are entertaining whilst still having valid applications for infantry training. The extent to which they are successful in achieving these goals will need to be evaluated.
Methodology and Chapter Outline

Part one of the thesis, chapters 1-5, generates a model of combat which seeks to explain the observed outcomes of contemporary platoon and squad level tactical infantry engagements. This model is breaking new ground in the academic sphere, as although studies across academia and the military do evaluate the effectiveness of current training systems, none provide a methodological schema through which the utility of different FPS environments can be assessed.

Chapter one provides the methodological framework for the model, which is based on the joint doctrine publication *UK Defence Doctrine*, produced by the Development, Concepts and Doctrine Centre (DCDC) – a UK Ministry of Defence think tank. *UK Defence Doctrine* defines ‘Fighting Power’ conceptually as the Armed Forces’ ability to fight. It breaks the concept down into three main components: the physical component – the means to fight, the moral component – the ability to get people to fight, and the conceptual component – the thought processes behind combat. Chapters 2-4 examine each of these components consecutively, providing a detailed breakdown of their constituent factors. They assess how these components affect the observed outcomes of contemporary infantry engagements, of which casualty levels are generally considered to be the most significant. Casualty levels provide a measurable quantitative reflection of relative combatant combat effectiveness, and increasing this effectiveness should save the lives of Western infantry. This study will also assess factors which influence a second characteristic of combat, that of engagement duration. Duration is often considered to be of subordinate importance in comparison to casualty levels, as it only indirectly influences combat effectiveness. However, it is highly relevant when generating any model of combat, as a simulation which purports to accurately recreate an environment needs to incorporate the factors which determine whether battles will last minutes, hours or days. Chapter five will then employ this analysis in order to codify the relative importance of the factors which determine casualty ratios and duration. Part one therefore generates a conceptual model of combat which will be utilised in the subsequent chapters to assess how successful different environments are in simulating the various factors.

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It is important to recognise that this model will be largely conceptual rather than mathematical. Mathematical and physical models of combat have already been the subject of considerable research amongst the Operational Research (OR) community. OR is a branch of mathematical analysis which seeks to ‘reduce the factors in military operations to numerical values’ and in doing so provide ‘problems capable of definite solution’. However, these models are highly complex and as such the utility of quantitative OR studies can be limited. Whilst a conceptual model will inevitably be less precise than a mathematical model it should retain far more real-world utility, especially for simulation professionals and game developers wishing to enhance their understanding of combat and the experiences their simulations are attempting to recreate. This research therefore shies away from a purely quantitative approach firstly, because many detailed OR studies have already been undertaken which explicitly model infantry combat using a mathematical approach, secondly, because the author is not specifically trained as a quantitative analyst, and finally, because the combat model will demonstrate that the qualitative factors are most significant in terms of determining combat outcomes. A qualitative stance which explores the impact of human soft factors is therefore more useful in this context than providing precise quantification.

Once the combat model has been constructed, part two – chapter six – provides a summary of video game theory and history. It will expand upon fundamental issues which are relevant to all virtual environments, such as how developers generate different gameplay experiences, the problems resulting from limitations inherent to the hardware interfaces through which players interact with and receive feedback from the virtual environment, and immersion – often also termed ‘presence’ – which refers to the feeling that ‘media contents are perceived as ‘real’ in the sense that media users experience a sensation of being spatially located in the mediated environment’. This will serve to ground the more detailed analysis of subsequent case study games within contextual and theoretical frameworks, and will prevent any need for repetition of core concepts relevant throughout the subsequent chapters.

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In part three, chapters 7 and 8, the model is employed to assess two commercial video game case studies which when taken together represent a cross section of genres and different intended audiences. Their selection was predicated firstly, on the fact that they were designed to simulate the asymmetrical tactical infantry platoon combat of recent conflicts, secondly, on the basis of them being triple-A titles specifically marketed as providing a highly authentic recreation of combat, and thirdly, on their noteworthy commercial success upon release, achieving sales in the tens of millions. Furthermore, many soldiers have played commercial games prior to joining the armed forces and continue to play them as a form of entertainment on bases whilst they are enlisted. The games they choose to play are represented by these case studies, rather than more realistic games that military establishments consider to have actual validity as training tools, such as those which will be discussed in part four.

The first commercial case study is Call of Duty 4: Modern Warfare (Infinity Ward; 2007), which was selected to represent single-player FPS games. Single-player games involve input only from one player, who engages with preconstructed narratives by following a predetermined path through the game world devised by the developers. The second case study is Battlefield 3 (DICE; 2011), which represents multiplayer FPS games. These do not contain narratives, but instead involve input from many players who engage dynamically with each other in an open world environment. These big-budget commercially successful FPS games demonstrate the outcome when developers design purely for commercial mass appeal, and a detailed assessment of these games will provide a platform to evaluate how successfully commercially viable virtual environments engage with the factors identified in the combat model. Further examination of the different types of users who play these games will also help to begin an exploration into factors relevant specifically to virtual environments – such as player mindset.

Although this thesis is centred on the use of games as military training tools, the

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6 Triple-A (or AAA) is a classification term used for games with the highest development budgets and levels of promotion; it is a equivalent to a movie ‘blockbuster’; Crowe (2015).
7 Parker (2012); Jsnlomberg (2012).
The employment of purely commercial case studies is justifiable for several reasons. Over the last two decades, different armed forces have attempted to employ a wide variety of commercial games as training tools. Unfortunately, whilst most of these experiments failed to realise the aspirations of their creators – frequently due to technical limitations that were not immediately obvious, and insufficiently strict selection criteria – the combat model provides a framework via which the claims of commercially successful products in regards to realism can be objectively analysed and evaluated. Applying the model to commercial case studies will thus serve to demonstrate its viability, whilst simultaneously highlighting the areas in which most games fail to meet the criteria which would qualify them for consideration in the military sector.

Part four, chapters 9-11, will primarily focus on past and present military use of COTS video games as training tools. This will begin in chapter 9 with a case study assessment of the *Armed Assault* (ArmA) series – spearheaded by its most recent release, *Armed Assault 3* (ArmA 3; Bohemia Interactive Studio; 2013). Chapter 10 will then examine the history of military games for training, and will assess how the shifting relationships between military establishments and games developers led to various initiatives aimed at creating dual purpose products to satisfy both the commercial and military markets. The failure of these endeavours eventually led the developers of the *Armed Assault* series, the Czech firm Bohemia Interactive Studio (BIS), to found a sister company, Bohemia Interactive Simulations (BISIM), to develop a series of games purely for use as training tools. This resulted in the development of the *Virtual Battlespace* (VBS) series, which is the subject of an extensive case study in chapter 11.

It is important to acknowledge that the ArmA games are fundamentally commercial products, which have not themselves been used as training tools. Their pertinence to this section stems from a number of factors. Firstly, the ArmA and VBS series’ were initially developed in tandem from the code of an earlier commercial game by BIS, *Operation Flashpoint*, and given their shared origins there are extensive parallels between the commercial and military products. The ArmA games are furnished

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8 BISIM (2015c); BISIM (2015d); BISIM (2015a).
with extensive functionalities in comparison to any other commercial product, and functionally they bear far more resemblance to military training simulations than the previously assessed commercial case studies – direct comparisons between the ArmA and VBS case studies will therefore be invaluable. Secondly, the minor functional differences between the latest iterations of the software mean that comparisons undertaken in relation to the combat model in the ArmA chapter will remain largely valid for VBS. The VBS case study will thus be free to focus less on a comparison to the combat model and more on how the military employ it as a training tool, as well as how they evaluate its performance. Finally, ArmA was designed to appeal to niche communities of gamers seeking realism and simulation. The serious mindset of ArmA gamers separates them from other commercial gamers, as they have developed their own highly innovative methodologies in order to create the most realistic gameplay experience possible. These may have valid applications for training within the military sphere, and this series can therefore provide lessons pertinent to the conduct of military training exercises. In conjunction these two series provide the only concrete example of military establishments successfully adopting a commercial video game and employing it effectively as a training tool.

Whilst numerous armed forces use VBS to train infantry it will be logistically expedient to focus on the British Army, and this will also avoid the scope of the research becoming excessively wide. Parts 3 and 4 should therefore be of particular relevance to military professionals, who should be able to obtain a better understanding of combat dynamics within virtual environments, as well as the strengths and weaknesses of FPS simulations as a whole. This case study will be used to argue that neither academics nor armed forces have managed to reach a consensus as to how to utilise VBS in a manner which maximises its potential, and the British Army needs to develop a coherent doctrine in relation to VBS usage based on the experience of officers using the software. Currently, valuable experience and understanding is going to waste when officers rotate to different positions, and this is a significant obstacle to using VBS effectively and creating a standardised set of methodologies to guide its usage.
Secondary Literature
Several main strands of existing literature have been identified which underpin the combat model and provide a firm academic grounding for analysing the case study games. The following section presents an outline of the most significant subject areas and their principal texts.

Military Wargaming
There is a growing quantity of academic literature assessing video games, and their usage within the military. Particularly pertinent in answering the research questions are Halter’s *From Sun Tzu to Xbox: War and Video Games* (2006), and Mead’s *War Play: Video Games and the Future of Armed Conflict* (2013). Halter and Mead examine the development of video games in the modern world, their usage within the military, and how armed forces have attempted to work together with games developers to create low cost but effective simulations. In particular they assess the companies which produce commercial products but also work with the military to advance training simulations. However, they approach the subject primarily from a historical viewpoint, documenting the changing nature of game usage over time rather than providing detailed analysis of any particular product. Smith’s *Military Simulation & Serious Games: Where We Came From and Where We Are Going* (2009) and his article ‘The Long History of Gaming in Military Training’ (2009) explore the development of simulation technology and the applications serious games have in training contemporary armed forces. His focus on the interconnections between the military and commercial sectors in games development – in particular, assessments of how the commercial games industry is providing the military with research that can be directly applied to training simulations – is highly relevant. However, neither of these studies focus on the particulars of tactical infantry engagements, and they do not generate any sort of combat model or assess the practical efficacy of the simulations they examine.

Various studies have been undertaken by forces themselves as part of initiatives to measure the success of knowledge transfer via game based training. The Australian Department of Defence produced ‘Evaluating the Effectiveness of Game-Based Training: A Controlled Study with Dismounted Infantry Teams’ (2013) and the
Dutch army helped to produce ‘Bloody Serious Gaming – Experiences with Job Oriented Training’ (2008). These studies are significant as they actually assess the effectiveness of video games as training tools at the tactical level. However, studies led by armed forces tend to focus purely on outcomes of current training practices, rather than assessing how best to use the simulations at their disposal. These methodological flaws need to be discussed.

Various academic articles focus on the utility of commercial games in the military sphere, including Nolan and Jones’ ‘Games for Training: Leveraging Commercial off the Shelf Multiplayer Gaming Software for Infantry Squad Collective Training’ (2005), which provides quantitative analysis as to how effectively games enhance training when employed in conjunction with traditional methods. Articles focused on the needs of the military, such as Fong’s ‘Adapting COTS Games for Military Experimentation’ (2006), examine how civilian games have already been adapted for use as conflict simulations within the military for training purposes. ‘Commercial-Off-the-Shelf-Technology in UK Military Training’ (2015) by Curry, Price and Sabin provides a British view on COTS games usage, and is particularly valuable as it affords a narrative of VBS adoption and usage in the British Armed Forces. However, whilst these articles offer detailed information pertaining to the history and development of video games and the demands of the military establishments that employ them, they do not afford a particularly detailed analysis of the games themselves, or which facets of combat they simulate.

Various academic studies have examined the general military use of wargames. Perla’s seminal work *The Art of Wargaming* (1990), and Sabin’s *Simulating War: Studying Conflict Through Simulation Games* (2012), examine the history of military and commercial wargames, as well as principles of game design. Although the primary focus of both these works is manual wargaming, with an emphasis on the operational level, many of the conclusions drawn and issues faced are relevant to computer generated simulations of combat as there are significant crossovers in the problems encountered. Their examination of the tensions between playability, realism, and abstracting real-world events in order to bring out specific combat dynamics, are both relevant and highly applicable to assessments which will be
undertaken in relation to video games.

The *Simulation and Gaming* journal has several articles which focus on virtual environment usage in education and training, and some of this literature does cross into the military sphere. Articles such as ‘Leadership in Multiplayer Online Gaming Environments’ (2012), by Lisk *et al.*, and ‘Gaming the Game: A Study of the Gamer Mode in Educational Wargaming’ (2012) by Frank, touch on some of the uses of video games as training tools within the military establishment. These articles identify some of the advantages and pitfalls of using virtual environments to train soldiers, but their focus is often limited to specific avenues of research and the authors have only a passing understanding of actual combat dynamics.

**Antecedent Combat Models and Operational Research**

In order to overcome the limitations associated with the previous literature, an assessment of infantry combat models will be required. Due to the ever increasing amount of quantitative data available, theorists have – with varying degrees of success – attempted to generate models which explain the dynamics of warfare, as well as individual engagements. One of the earliest key figures in the development of empirical formulae which could be applied to contemporary warfare was F. W. Lanchester, a pioneer in the OR field. In his article ‘The Principle of Concentration’ (1914), and his book *Aircraft in Warfare: The Dawn of the Fourth Arm* (1916), Lanchester devised two laws to ‘show the effects of force concentration upon the loss rates of two opposing sides in a simple, uncomplicated combat situation’. The lack of mathematical complexity means this research is relatively easy to comprehend, and modified versions of his laws have been used ever since to underpin many simulations of combat. Any assessment of subsequent combat models will need to engage with his work and be aware of its limitations, as significant criticisms have been levelled at the validity of the rather simplistic assumptions which underpin the laws. In *The Stress of Battle: Quantifying Human Performance in Combat* (2006), Rowland provides an in-depth examination of the impact certain factors – such as surprise and shock – have on infantry combat.

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effectiveness. Such studies will prove invaluable, as they focus on the fine details of infantry combat that broader examinations often overlook, although Rowland focuses on a small number of factors which are considered within combat model.

Retired US Colonel Trevor Dupuy was responsible for developing the Quantified Judgement Model (QJM), a mathematical model of warfare which is delineated in his books Numbers, Predictions and War (1978) and Understanding War (1986). Whilst his model is comprehensive – taking into account a staggering 73 variables in its attempt to explain every aspect of warfare – the presence of so many variables and incalculable factors introduces a considerable potential for variation into the results, meaning that the model has limited predictive powers. Stephen Biddle presented his combat model in Military Power: Explaining Victory and Defeat in Modern Battle (2004). Biddle’s research focused more on operational and tactical levels than the QJM, and this focus allowed him to reduce the sheer number of factors relevant to the calculations. Consequently, his theories are better suited to illustrating the reasons why infantry soldiers emerge victorious in specific engagements rather than explaining the overall dynamics of warfare, as they provide a more in-depth analysis of distinct combat scenarios. Samuel L. A. Marshall developed and expanded various antecedent theories based on examinations of why men fight in his renowned book Men against Fire: The Problem of Battle Command in Future War (1947). Testimonies from the individuals on the battlefield allowed him to bring to light and assess the importance of innovative factors relating to morale, but subsequent critics have raised criticisms in regards to the methodological validity of his findings, and his model of combat is largely conceptual.

Individuals in Combat: Combat Psychology, Physiology, and Group Cohesion

Whilst the previously mentioned sources provide an examination of warfare and combat dynamics, to truly appreciate the soldier’s experience requires comprehensive understanding of combat psychology. This will require an assessment of infantry training, the psychology and physiology of individuals, and the group dynamics which motivate soldiers to fight.

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Men Against Fire was one of the seminal works in this field, but others, such as Dave Grossman, have since furthered Marshall’s analysis based on additional empirical research. His works, including On Killing: The Psychological Cost of Learning to Kill in War and Society (1996), and On Combat: The Psychology and Physiology of Deadly Conflict in War and in Peace (2008), in conjunction with Anthony King’s The Combat Soldier (2013), examine how soldiers are trained to perform in combat, as well as the psychological differences between training scenarios and actual combat. These studies provide an aggregated examination of soldiers in combat via extensive analysis of battlefield physiology, group cohesion, stress inoculation, soldier motivations, and the impact of teamwork on overall combat effectiveness. They will help to ground the thesis as part of a wider theoretical framework, and prevent over reliance on an individual soldier's memoirs, which are a valuable but not entirely reliable primary resource.

Game Studies: Immersion and Virtual Environments
In order to explain how video games create immersive and engaging simulations an assessment of video game psychology will also be required. Works examining this topic include ‘The Psychology of Immersion in Video Games’ (2010) by Madigan, which identifies the characteristics of virtual environments that are used to construct a ‘theory of immersion’, as well as Possible Worlds, Artificial Intelligence, and Narrative Theory (1992) by Ryan, and Half-Real, Video Games Between Real Rules and Fictional Worlds (2011) by Juul, which examine the underlying rules that govern virtual worlds and explain how games cue the player into integrating themselves within fictional environments. These studies contribute an academic analysis of immersion in FPS games which is entirely applicable to training simulations, thus providing a platform for comparisons between video game and combat psychology.

Academic studies also assess the technical challenges that developers face when designing User Interfaces (UIs), which allow players to operate the functions of any particular virtual environment. Articles such as Stonehouse’s ‘User Interface design in Video Games’ and Fagerholt and Lorentzon’s, ‘Beyond the HUD: User Interfaces for Increased Player Immersion in FPS Games’ examine how developers create
interfaces that are easy to use, efficient, and enjoyable (user friendly) in order that players can operate the environment to produce their desired outcome. Additionally, they link the concepts of effective interface design and immersion, arguing that well designed UIs directly contribute to immersion and thus are crucial in facilitating psychological acceptance of the virtual environment as real.

Given that death – and the fear that accompanies potentially being mortally wounded – are defining characteristics of infantry psychology, how they are represented within virtual environments is an area of concern. Articles such as Eva Kingsepp’s ‘Fighting Hyperreality with Hyperreality: History and Death in World War II Digital Games’ (2007) and ‘Apocalypse the Spielberg Way: Representations of Death and Ethics in Saving Private Ryan, Band of Brothers and the Videogame Medal of Honor: Frontline’ (2003), engage with this debate, highlighting the contrast between the claims of realism and authenticity advocated by developers, and the highly sanitised way in which death is often represented.

**Primary Literature**

Although the secondary literature covers significant ground, there are a variety of areas which have been either under-researched or remain entirely unrecognised in current academic circles.

**Existant Primary Literature**

Correctly determining the outcomes and observed dynamics of infantry combat requires the evaluation of numerous primary sources examining individual engagements. Studies produced by military forces will be highly significant in this respect. The US Combat Studies Institute has published numerous research papers including *Wanat: Combat Action in Afghanistan 2008* (2010), a detailed narrative of the events surrounding one particularly brutal engagement which claimed the lives of nine US soldiers, and *Vanguard of Valor, Small Unit Actions in Afghanistan* (2012) which provides accounts of various small unit actions which took place in the Afghan mountains during 2010. Such assessments are compiled from official data in conjunction with interviews of the Western soldiers who were involved in the fighting. They represent an unparalleled resource in terms of acquiring detailed narratives of events, and also provide insights and observations of military personnel
pertaining to the tactics and battlefield competence of enemy forces.

Interviews with soldiers and the slew of recent memoirs provide further insights into the mindset of infantrymen. David Bellavia’s *House to House* (2008) is the author’s account of the Battle of Fallujah in 2004. It provides detailed scrutiny of his mental state whilst engaging the enemy, and also outlines the tactical dilemmas faced by infantry in the close quarter urban combat. Various narratives have also been compiled by embedded reporters who have spent significant time experiencing life on the front lines, such as Sebastian Junger’s *War* (2010). Junger provides an overview of his experiences in Afghanistan’s Korengal Valley over a fifteen month period, and his aim was to convey what war actually feels like whilst attempting to explain the decision making processes of soldiers on the battlefield. When using such sources it is important to recognise that men on the ground are not always best placed to give an overview of the whole battle, and intense psychological stress can mean that soldiers have difficulty accurately recalling events. A large body of research will therefore be required to help eliminate inaccuracies or biases which could arise from using a small sample size.

To reach a true understanding of Western infantry tactics will also require an in-depth examination of contemporary military doctrine. Whilst many doctrinal publications are classified, US Army Field Manuals are freely available online. These represent an excellent source of knowledge in relation to current military understanding of infantry combat, and also provide specific details pertaining to the tactics, techniques, and procedures that Western soldiers are trained in prior to engaging the enemy. Furthermore, doctrinal publications are invaluable as sources of reference information for games developers and serious enthusiasts who do not have first-hand combat experience, but nevertheless endeavour to authentically recreate engagements in simulated environments. It should be noted that ‘Western infantry/soldiers’ is a term which encompasses soldiers from many different forces, and it is therefore important to recognise that their battlefield competency will inevitably vary. This research will primarily focus on the actions of US and British soldiers; the US focus is justifiable given that their soldiers have comprised the bulk of Western combatants in the recent conflicts – such as those in Iraq and Afghanistan
– and the British focus is logical given their overall centrality to the analysis which will be taking place within this thesis.

Primary research will also need to be undertaken in relation to the commercial game case studies. Gamers are well known for expounding their opinions on internet forums; these online communities provide a platform for discussion between players, and some are set up by the developers themselves in order to facilitate dialogue with consumers. Individual players or groups of players are also known to run their own websites publicising their experiences, observations, opinions, etc, and various third party websites review games and interview developers alongside their Subject Matter Experts (SMEs).\textsuperscript{11} Whilst the quality of feedback and critiques found on public platforms is wildly variable, a discerning analysis of those which are cogent will contribute greatly toward understanding the demands the commercial market places on developers. Such an assessment will also be useful in comparing aficionados of the different case study games, as it demonstrates that different groups of gamers take enjoyment from radically contrasting gameplay experiences. The author has chosen not to initiate interviews of gamers personally, as it is highly unlikely the opinions offered would significantly differ from those which are already available on forums and through extant interviews.

Whilst the majority of gamers play games purely for entertainment, groups of more serious players play together on a regular basis and form bodies known as ‘clans’ to regulate their activities. Clans strive to bring together likeminded individuals, and the majority of this research will identify and engage with clan players whose stated goal is to accurately simulate combat and/or to employ genuine military tactics. This will make sure the research remains focused on players attempting to utilise games in a realistic manner. Members of these niche communities are a valuable primary resource, as they are known to create their own combat scenarios using editors included within games. Clan gamers also frequently record battles in their entirety, uploading thousands of hours of footage onto video sharing websites such as YouTube. These videos show how players engage with and immerse themselves within virtual environments, train together to master tactics, techniques and

\textsuperscript{11} SMEs are generally ex-military personnel employed to advise game companies of military tactics and operational realities.
procedures, and work together as teams to complete mission objectives. Restricting analysis to YouTube channels which have consistently produced high quality content, or those related to established clans, will help to limit assessment to the highest quality of conduct the gaming sphere has to offer. These videos will be particularly pertinent in assessing engagement duration. The duration of virtual engagements is currently not a topic which has been the focus of any significant academic study, and the factors which determine the length of engagements in a clan setting can be analysed and compared to those which were evidenced in the combat model.

**Original Primary Research**
Research into VBS from the military perspective has required a working relationship with British army personnel and contractors. Several interviews with Major Tom Mouat – a member of the Joint & Battlefield Trainers, Simulations & Synthetic Environments Project Team (JBTSE PT), a division of the Ministry of Defence responsible for multiple projects relating to simulated combat – have been invaluable in terms of providing understanding of military requirements and VBS usage within the British Army. Major Mouat is uniquely placed to provide such an insight as he was directly responsible for the British adoption of VBS. He has also been remarkably candid in his criticisms of British Army methodologies in relation to VBS employment, and believes that the British have much to learn from other forces across the world. Interviews were also undertaken with Neville MacMillan and Alex Gwilliam, employees of NSC, one of the primary contractors employed by the British Army to run VBS training events.

To prevent a military slant, additional insight into VBS has come from visiting the UK office of BISIM and interviewing employees, including Oliver Arup – Vice President and Head of Research and Development, Jonathan Read – Head of UK Sales and Operations (who has since left the company), and Nicholas Edwards – a VBS designer who holds a Master’s Degree in War Studies from King’s College London. Interviews with BISIM employees provide a counterbalance to military opinions, as well as insight into the relationship between BISIM and their clients. Additionally, discussions with game designers contribute detailed technical understanding of how VBS was developed and where it differs from ArmA.
All interview sources can potentially suffer from partiality. Interviewees with long standing involvement within any particular sphere may well have their objectivity compromised, and employees of corporations may even intentionally distort facts in order to promote the company’s agenda. These potential biases do not invalidate the use of such sources, but the context of each interviewee must be recognised and any claims made must be rationally assessed. If required, a cross-examination with reference to other sources should take place in order to confirm their validity.

All the aforementioned sources will also be supplemented by the author’s personal experience utilising the case study games. Screenshots – images which record the visible items displayed on the monitor – taken by the author are used to provide a visual frame of reference for analysis as and when required. Where appropriate, the author has subjected environments to tests with the aim of exposing artificialities in the game world and weaknesses in the game’s mechanics.
Part 1: Modelling Contemporary Infantry Combat

Chapter 1: Combat Model Aims and Overview

In part 1 of this thesis, contemporary platoon and squad-level tactical infantry engagements will be deconstructed into the fundamental elements that determine their course and outcome.

The model will be required to explain the observed outcomes and characteristics of contemporary infantry combat engagements. Since the Gulf War, these engagements have resulted in Western infantry forces consistently either defeating their opponents or forcing them to withdraw. Although defeating the enemy in such low-level tactical engagements may not always lead to strategic victory, the model is specifically designed to examine the engagements themselves, rather than assessing the pertinence of their outcomes in terms of the prevailing operational or strategic context.

Casualty levels are the most readily identifiable quantitative result of contemporary engagements which combat models are required to dependably explain. Casualty levels encompass the ratios of men killed, alongside the absolute number of casualties inflicted in any specific engagement. The ratios of men killed in recent conflicts are decidedly asymmetrical, and Western forces also tend to suffer low numbers of casualties:

- On 21st June 2006 at Gowardesh, Afghanistan, sixteen US soldiers on a mountain ridge were assaulted by a 50-70 strong insurgent force. Insurgents assaulted the US position from three directions, but after an hour of combat the US forces suffered two dead and one wounded, in contrast to the estimated 26 insurgent dead and 17 wounded. This gives us an estimated ratio of around 13:1.
- On 10th April 2009 along the Sawtalo Sar Ridgeline in the Korengal Valley, Afghanistan, a platoon of US soldiers successfully ambushed a comparably sized Taliban force attempting to navigate the mountain passes. Employing a

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12 Wright (2012), pp.1, 15, 18.
13 Ibid., pp.1-22.
modified linear ambush the US soldiers caught the Taliban by surprise and killed twelve enemies in the first ten minutes of the firefight. Several more Taliban were killed in the aftermath, taking their total death toll to fifteen. No US soldiers were killed and only two were injured.\textsuperscript{14} This gives us an estimated ratio of around \textbf{15:0}.

- During the First Battle of Mogadishu, 3\textsuperscript{rd} – 4\textsuperscript{th} October 1993, 160 US servicemen (eventually supported by other friendly forces) were involved in a fourteen hour long firefight against Somali militiamen totalling several thousand. A total of eighteen US soldiers were killed, but conservative estimates place the number of Somali dead at around 500.\textsuperscript{15} This gives us an estimated ratio of around \textbf{28:1}.

The secondary characteristic that the model must explain is the overall duration of infantry engagements. Firefights are observed to vary greatly in length, from between five minutes to around fourteen hours; however, the average Western rifleman carries limited ammunition and can maintain continuous fire for approximately ten minutes before requiring resupply.\textsuperscript{16} In light of this, longer engagements must necessarily consist of protracted intervals where infantry weapons are not being directly employed, otherwise combatants would swiftly exhaust their available ammunition supply. The model will therefore need to explain why engagements frequently last hours, and what actions soldiers are undertaking during intervals devoid of direct engagement with the enemy.

Although casualty ratios and duration are the quantitatively measurable outcomes/characteristics of engagements, defeating the enemy in low-level firefights often does not involve their total elimination. Many engagements are won by convincing the enemy to either withdraw or surrender, potentially with very low casualty levels incurred on both sides during a brief engagement. This research will primarily focus on engagements where both sides were willing to continue commit to a potentially protracted and sustain losses, as these are the battles virtual environments attempt to simulate. Whilst training scenarios where the enemy throws

\textsuperscript{14} Ibid., pp.22, 42-43.
\textsuperscript{15} Bowden (1999), p.484.
\textsuperscript{16} Salt (2008), p.22.
down their weapons and surrenders do accurately depict some engagements, this research is aimed specifically at explaining the dynamics of infantry combat when firefights actually occur, so that increasingly accurate simulations can be generated.

The term ‘contemporary infantry combat’ will need to be defined in the context of this thesis. Biddle argues that the fundamental doctrine of ‘contemporary combat’ originated from developments that occurred during the First World War, and that this doctrine has been periodically refined during subsequent conflicts. Whilst any conflict from 1914 onwards can be considered contemporary, the model will gravitate towards conflicts from the 1991 Gulf War onwards – although this will not prohibit a circumstantiated examination of events and theories from historical conflicts if they are relevant.

The model itself will be founded upon the principles posited in *British Defence Doctrine*, which states that ‘Fighting Power’ is comprised of three components:

1. A conceptual component (the thought process) which includes the principles of war, doctrine, and conceptual innovation.
2. A moral component (the ability to get people to fight) which includes moral cohesion, motivation, and leadership.
3. A physical component (the means to fight) which includes manpower, equipment, collective performance, sustainability and readiness.

These divisions provide an ideal foundation for a combat model, and the factors which will be employed to assess the outcome of infantry engagements have been designated as subdivisions of these three overarching components, as shown below.

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18 Ministry of Defence (2014), pp.4-1 and 4-4.
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It is crucial to recognise that the quality of soldiers determines how capable they are of leveraging the aforementioned factors, and that the outcomes of engagements are by extension shaped decisively by the relative gap between the quality of participating forces. Biddle argues that ‘since real doctrines are the product of a complex interaction between military and nonmilitary influences, real doctrines… vary wildly both from state to state and within states over time as the relative balance of political, organizational, and military pressure changes’. These strategic pressures – although largely beyond the scope of the investigation taking place within this thesis – are critical in terms of understanding why the quality of contemporary forces is so wildly variable.

The bulk of part 1 will be committed to examining these factors individually, and assessing their importance in terms of determining casualty levels – and by extension increasing the combat effectiveness of Western infantry – and the overall duration of engagements. Duration, the secondary characteristic, will not require a detailed assessment in every section, as the impact of certain factors is primarily upon casualty levels. The final section will then draw conclusions relating to the relative importance of the factors in the model and elucidate the synergies between them, as in a phenomenon of this complexity it is inevitable that multiple factors will work in conjunction to produce the observed outcomes.

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The Reliability of Enemy Combatant Fatality Statistics

There are a variety of complications pertaining to the accuracy of the factual data upon which the model will be based – specifically in relation to non-Western combatant fatality statistics – and these will need to be identified and addressed before analysis utilising these figures can take place.

The US military is highly reticent when it comes to estimating enemy casualty figures. Early in the Second Gulf War General Tommy R. Franks famously stated that ‘We don’t do body counts’, a policy which stemmed from the negative press the military received during the Vietnam War.\(^{20}\) Additionally, the reliability of estimates which have found their way into the public domain are frequently called into question by historians. To illustrate the point, initial estimates of casualties in the Gulf War were hugely inflated; press reports claimed over 100,000 Iraqis had been killed, but Heidenreich argues that the true death toll was closer to only 8,000 (a figure less than ten percent of the original, and which is itself still the subject of dispute).\(^{21}\) The overestimation of enemy casualties thus poses a problem for any quantitative assessment of contemporary infantry combat, as it has the potential to distort our empirical understanding of the battlefield.

Examining casualty estimates for the 2003 Invasion of Iraq, Conetta argues that a reliable estimate for Iraqi casualties, based on directly observed and reported Iraqi combatant fatalities would be between 4,895 and 6,370, far lower than the 13,500 to 45,000 casualties estimated by the press.\(^{22}\) In order to calculate the reduced figure Conetta employed a variety of techniques in an attempt to control casualty inflation (the tendency of reports to overestimate enemy casualties), a summary of which are included below.

‘...greatest weight [was given] to observations of limited scope
made at the company, battalion, and brigade level....
Estimates by military or civil authorities above the division
level were excluded... except when they were consistent with

\(^{20}\) Broder (2003).
\(^{21}\) Rew/Scott (1993); Dispute outlined in Arkin (Summer 1993), pp.182-184.
\(^{22}\) Conetta (2003), p.2; Steele (2003).
estimates made by those closer to the actual battles and combat engagements (estimates of Iraqi fatalities made by authorities above the division level were sometimes found to exceed those made by field commanders by 100 percent to 200 percent).’

‘...estimates made by embedded journalists and by unit field commanders at the division level or below were also adjusted in many cases... larger, rounded estimates made by reporters and commanders were often meant to cover multiple engagements, multiple battalion-sized units, or several days or even weeks of activity.... Our default assumption, based on several confirming instances, was that larger, rounded estimates could overstate observed fatalities by a factor ranging from 30 percent to 275 percent. We relaxed this assumption in accord with the amount of testimony, the proximity of the observers to the events, and the presence and extent of supporting narrative detail.’ 23

Conetta also identifies further issues, such as the recurrent problem of distinguishing between combatants and non-combatants on the battlefield, and the difficulties encountered estimating numbers of enemies killed by unobserved indirect fires. 24

The effect of employing Conetta’s methodology and rejecting or maintaining a healthy scepticism over casualty estimates will be to reduce the extent of the perceived asymmetry that exists between Western forces and their enemies. However, in spite of its overall reduction in magnitude this asymmetry remains a fundamental characteristic of contemporary conflicts involving Western forces which the model will need to explain.

24 Ibid., pp.34-37.
Historical Combat Models in a Contemporary Framework

Theoreticians have been trying to systematise war for centuries, dating all the way back to Sun Tzu’s classic treatise, The Art of War. Their views have often conflicted over the extent to which maths can be directly applied to the battlefield to generate an empirical model of combat. Whilst identifying the general principles of war the renowned 19th century Prussian General Carl Von Clausewitz asserted that he ‘did not believe it was possible for these principles to provide more than general guidance for the subsequent commander’.²⁵ However, by the 20th Century various theoreticians challenged this view. This section will briefly outline the arguments of the main theoreticians who have generated models of combat, and will relate their arguments to the three components that comprise fighting power within the DCDC framework. Critiques will only be outlined at this point, and specific criticisms will be dealt with in the main combat model when the relevant factors are being discussed.

The Moral Component

‘In war, the moral is to the physical as three to one’
– Napoleon Bonaparte²⁶

‘Wars are fought with men, not weapons. It is the spirit of the men who fight, and of the man who leads, which gains the victory’
– General George S. Patton²⁷

These views, proffered by influential military minds since the 19th century, highlight the importance of morale in warfare. The principal thesis of Ardant du Picq’s seminal treatise Battle Studies (1880) is that the most powerful element in the strength of armies is ‘moral force’; he stated that ‘The mass shudders; because you cannot suppress the flesh. This trembling must be taken into account in all organization, discipline, arrangements, movements, maneuvers, mode of action’.²⁸ His argument is that increasingly destructive and terrifying modern weaponry

²⁷ Ibid.
²⁸ du Picq (1921), pp.vi, 20, 48, 123.
requires high morale to stand against, ‘A million men at maneuvers are useless, if a sane and reasoned organization does not assure their discipline, and thereby their reliability, that is, their courage in action’.29 Although he lacked the raw empirical data available to later theorists, du Picq employed various historical conflicts as case studies to support his assertions and generate a model of combat which explained the outcome of battles in the context of his time.

In the years following the end of the Second World War Samuel L. A. Marshall, an official US Army historian, conducted numerous interviews with enlisted men and officers concerning their combat experiences, eventually producing his seminal work *Men Against Fire: The Problem of Battle Command in Future War*. Marshall developed and expanded various antecedent theories based on examinations of why men fight, but testimonies from the individuals on the battlefield allowed him to bring to light and assess innovative moral factors such as combat isolation and tactical cohesion on the dispersed modern battlefield.30 His most enduring – but also most controversial – argument examined the issue of ratios and rates of fire in infantry units. Marshall argued that the majority of men on the Second World War battlefield did not fire their weapons at the enemy, and that even for well-trained troops 75 per cent of men ‘will not fire or will not persist in firing against the enemy and his works’.31 The reasoning for this is essentially moral in nature, ‘The fear of aggression has been expressed to him so deeply and pervadingly... that it is part of the normal man’s emotional make-up. This is a great handicap in battle’.32 This figure caused a great deal of debate, and later historians such as Spiller have raised serious questions as to the validity of Marshall’s empirical findings.33 Furthermore, Marshall himself reported that by the Vietnam war fire rates had been brought up to around 80% in prolonged engagements, indicating that changes to post-war infantry training regimes had helped to negate this ‘fear of aggression’.34 Despite on-going debates surrounding the validity of Marshall’s research he helped shape future analysis of the moral elements of combat through an in-depth examination of the

34 Marshall (1967).
infantry soldier on the battlefield as an individual, and many of the salient points raised in his works have had an irrefutable influence upon the ideas and methodologies of subsequent theorists.

In 2006 David Rowland brought together the results of decades of study into factors affecting combat in his book *The Stress of Battle: Quantifying Human Performance in Combat*. Rowland utilised data from live action simulations undertaken by the Field Studies Division of the Defence Operational Analysis Establishment (DOAE), a division of the British armed forces, and live testing of theories in a simulated environment allowed him ‘to make empirical estimates of effects which other techniques have been unable to quantify’. Exercises involving laser weapon simulators and quantitative Historical Analysis (HA) made it possible ‘to extend the comparisons between the levels of effectiveness in simulated and real combat and to establish basic combat degradation estimates…’; the effects of factors such as suppression and surprise and shock were also deduced. The DOAE research examined infantry combat purely at the tactical level, and used HA to apply their findings to a large number of battles in order to test their validity. The importance of Rowland’s work is that it provides a modicum of quantification to the aforementioned factors, which were previously considered as practically unquantifiable at the tactical level.

Most recently in 2013 Leo Murray, a pseudonym for a group of contemporary military analysts, released the book *Brains and Bullets: How Psychology Wins Wars*. Although not attempting to model combat the book is worth highlighting, as Murray provides in-depth contemporary assessment relating to the impact of several moral factors. Like Rowland, Murray attempts to quantify factors which have long caused analysis problems due to their qualitative nature, such as the effects of psychology, suppression and group cohesion at the squad level. His research is particularly valuable as it comments on these factors in the context of recent conflicts in Iraq and Afghanistan, and its target audience is the infantry soldier himself.

36 Rowland (2006), Back Sleeve.
The Physical Component

‘If it is true that every part of war is touched by technology, it is no less true that every part of technology affects war... Without it the conduct of armed conflict would be impossible’.

– Martin Van Creveld

It is undeniable that technological developments have completely changed the nature of combat, and various theorists argue that new technologies, such as long-range precision guided weapons, have revolutionised warfare. Perry states that ‘An army with such technology has an overwhelming advantage over an army without it, much as an army equipped with tanks would overwhelm an army with horse cavalry’. The extent to which the impact of technological advancement at the squad level – pertaining to infantry weapons, defences, and information sharing capabilities – gives a decisive edge to infantry soldiers in contemporary battles is a crucial area which will need to be assessed.

One of the key figures in the development of empirical formulae which could be applied to contemporary warfare was Frederick W. Lanchester, a polymath, engineer, and pioneer in the field of Operational Research (OR). Lanchester devised two laws, each accompanied by a differential equation; these are known as ‘Lanchester’s Square Law’ and ‘Lanchester’s Linear Law’; the equations ‘show the effects of force concentration upon the loss rates of two opposing sides in a simple, uncomplicated combat situation’.

The square law represents the rate of loss of forces when soldiers concentrate and direct their firepower against visible targets, and is shown in the following equations:

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38 Perry (Fall 1991), p.66.
39 A discipline that deals with the application of advanced analytical methods to help make better decisions. It is often considered to be a sub-field of Mathematics.
40 Lanchester (1914), pp.422-423; Lanchester (1916); Lanchester’s Laws also summarised in Dupuy (1992b), pp.19-20.
41 Lepingwell (Summer 1987), p.95.
\[
\frac{dB}{dt} = -rR
\]
\[
\frac{dR}{dt} = -bB
\]

\( R \): number of men on Red’s side
\( r \): the effectiveness of Red’s fire on Blue

[Effectiveness being defined as the rate of fire times the probability of kill of each shot]

\( B \): number of men on Blue’s side
\( b \): the effectiveness of Blue’s fire on Red

Solving these equations for the case of equally matched forces gives the equality condition:

\[ rR^2(0) = bB^2(0) \]

Therefore, ‘the square law states that the measure of combat power is a force’s effectiveness times the square of its numerical size….Thus, the square law makes the outcome of combat more sensitive to force size, the squared term, than effectiveness’; essentially, the square law advocates that the quantity of a force is more important than its quality.42 The example below illustrates the use of the square law. Two roughly division-sized forces are engaged in combat, with forces as outlined:

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42 Ibid., p.92.
Since Red has the greatest fighting strength, the square law predicts that it will win. The formula for the time to the end of the battle (when the losing side is destroyed) gives a duration of 44 days... Note that although Blue starts out with a larger force, it is gradually reduced by the more effective Red force.44

The linear law drops the assumption of concentration of fire, and thus in theory more accurately models cases of indirect fire, as fire is evenly distributed across a given area.45 Assuming homogenous forces with the same weapons and vulnerabilities the equations are thus46:

\[
\frac{dB}{dt} = -B r R
\]

\[
\frac{dR}{dt} = -R \cdot rB
\]

Which give the equality condition:

\[
rR(0) = bB(0)
\]

In the linear equation no special advantage is given to force numbers. Concentration of forces has no effect on reducing the winner’s total casualties, adding more forces increases both enemy and friendly casualties – an example is given below.47

Figure 2 - Linear Law Example

‘The battle may end sooner, but the winner will still lose the same number of troops. This is reflected in the fact that the differential casualty ratio for the linear law (dB/dR = r/b) does not depend on the force levels of the two forces’.49

Lanchester’s approach was popular because military analysts searching for a method of modelling ground combat found his equations apposite. They allowed mathematicians to speak of a ‘physics of war’, and to treat war in a quantitative

47 Lepingwell (Summer 1987), p.102.
48 Ibid.
49 Ibid., p.103.
scientific manner. Due to their simplicity, modified versions of the laws were, and still are, used as the basis for various computer simulations of combat run by the US Department of Defence.\textsuperscript{50} Lanchester’s laws are however not without their limitations. Critics such as Leppingwell argue that many of the underlying assumptions the laws are based on simply do not apply to modern combat scenarios, as the model effectively implies that soldiers shoot at each other with perfect coordination whilst the square law does not take into account factors such as dispersion. Lanchester’s laws ultimately ‘provide a framework that emphasises forces and weapons rather than strategy, organization, and operational art…’.\textsuperscript{51} However, despite their simplicity they were a seminal attempt to model combat mathematically, and had a ‘profound impact on the evolution of a theory of combat’.\textsuperscript{52}

Lanchester’s theories have subsequently been the subject of extensive exploration and adaptation by mathematicians, and recent papers such as ‘Applications of Historical Analyses in Combat Modelling’, undertaken by the Australian Department of Defence, demonstrate the continued impact of his findings on the OR landscape. In this paper Perry ‘examines how analyses of historical battles can contribute to the development of models of combat’ by comparing historical data against the expectations of both the deterministic and stochastic forms of Lanchester’s Square Law.\textsuperscript{53} Stochastic models ‘use random number generators to model chance or random events’, allowing variable states to be described by probability distributions rather than by specific parameters (as was the case in the equations presented in the previous paragraph); Kerr argues that ‘There should be a general preference for stochastic rather than deterministic attrition models. A stochastic model is more general, more flexible, more realistic, and better founded, and always provides, through expectations of its outputs, scalar characterizations of the system being modeled’.\textsuperscript{54} Kerr has written about stochastic Lanchester models extensively in papers for the Institute for Defence Analyses, including ‘Stochastic Attrition Models of Lanchester Type’ and ‘On Simulations of the Stochastic, Homogeneous,

\textsuperscript{50} Ibid., p.89.
\textsuperscript{51} Dupuy (1992b), p.18; Leppingwell (Summer 1987), p.125.
\textsuperscript{52} Dupuy (1992b), p.18; Leppingwell (Summer 1987), p.125.
\textsuperscript{53} Perry (2012), Abstract.
Lanchester Square-Law Attrition Process’, with the goal of assessing the behaviour and interactions of individual combatants on the battlefield.\textsuperscript{55} Kress and Talmor further expanded this line of analysis by using Markov Stochastic Lanchester Models – a Markov model describes a sequence of possible events where the probability of each event depends only on the state attained in the previous event – to assess the validity of the 3:1 rule, a military maxim which states that ‘in order for an attacker to win the battle, his forces should be at least three times the force of the defender’.\textsuperscript{56} Their model was built to incorporate additional data, such as a quantitative estimate of the ‘break points’ of each force – a value which indicates the attrition ratio at which a force will disengage from the battle.\textsuperscript{57} They conclude that on the modern battlefield the 3:1 rule has merit only in specific circumstances where battles are of a small size and the defending force has identifiable quantitative advantages.\textsuperscript{58}

Academics such as MacKay, Ozdemirel and Kandiller also employ adapted versions of the equations as the basis of their computerised combat models.\textsuperscript{59} In particular, Ozdemirel and Kandiller state that in order for their system, which decomposes a battle between heterogeneous forces into stages and mini battles, to function properly and produce meaningful results, the key input parameters are estimations of weapons effectiveness and attrition rates.\textsuperscript{60} The simulations run by these authors are highly mathematically complex, and the technical understanding they require is beyond both the scope of this author and the conceptual model that will be constructed in this thesis. It is however important to acknowledge the direction that operational research has taken in regards to the Lanchestrian equations.

The utility of other mathematical models of combat within the context of asymmetric platoon based infantry engagements is limited. Most mathematical combat models examine larger-scale battles and encompass traditional combined arms warfare alongside command and control issues – examples of this approach can be found in Perry’s ‘Applications of Historical Analyses in Combat Modelling’ and Chapman \textit{et al.}

\textsuperscript{55} Kerr (1974), Kerr (1975).
\textsuperscript{56} Kress/Talmor (1999), p.733.
\textsuperscript{57} \textit{Ibid.} p.734.
\textsuperscript{58} \textit{Ibid.} p.740.
\textsuperscript{60} Ozdemirel/Kandiller (2006), p.51.
Furthermore, the vast majority of mathematical combat models do not employ FPS environments as part of their simulation. The models of combat they provide are significantly more abstracted, such as the EINSTein (Enhanced Neural Simulation Toolkit) program employed in Ilachinski’s *Artificial War: Multiagent-Based Simulation of Combat* and the Sandis software for brigade level war gaming utilised by Lappi in ‘Computational Methods for Tactical Simulations’.

In agent-based simulation, the individual entities… in the model are represented directly… and possess an internal state and set of behaviors or rules that determine how the agent’s state is updated from one time-step to the next.

In his 2011 book, *Using Math to Defeat the Enemy: Modeling for Simulation*, Strickland examines the use of software designed to automate forces within virtual environments, including FPSs, such as One Semi-Automated Forces (OneSAF). OneSAF is capable of modelling unit behaviours ‘from fire team to company level for all units for both combat and non-combat operations. Intelligent, doctrinally correct behaviors… are provided to increase the span of control for workstation

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62 Ilachinski (2004); Lappi (2012).  
65 Ibid., pp.27-34.
operators’. The aim of these semi-automated forces is to provide an Artificial Intelligence (AI) which replicates the product of human decision making to allow ‘one operator to play the part of many vehicles or several platoons with the aid of embedded behavioral models’, and Fig.4, below, shows one possible architecture via which cognitive computational systems can be realised.

These cognitive models base their decision-making on mathematical concepts such as finite state machines, Markov chains, fuzzy logic, fuzzy rules, neural networks and genetic algorithms, all of which are discussed in more detail in Strickland, chapter 11.

Computational mathematical models of combat are an important area of OR research, but are not directly relevant to this thesis, the focus of which is explicitly the use of virtual training of soldiers in FPS environments. Simulations which involve simulated people operating within simulated environments remove direct human involvement from the decision making process, and thus whilst they are valuable analytical tools their training utility is limited. Although ostensibly the inclusion of AI into virtual environments alongside soldiers is of training value,

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66 Ibid., p.28.
67 Ibid., p.189.
68 Ibid., p.196.
69 Ibid., p.189-208.
throughout the video game case studies this thesis will elucidate on the many problems this AI poses given the current limitations in computer technology.

Dupuy, whose model will be assessed in the next section, also weighs in on the physical components of combat. In particular, his ideas relating to the dispersion of troops on the battlefield are highly pertinent. He provides empirical information to demonstrate the huge changes in troop density on the battlefield, and argues that the presence of fewer targets within a given area is crucial to reducing the lethality of contemporary weapons against massed targets.\(^7^0\)

The Conceptual Component

‘...what counts most is not weapons, but the ability of people to use them effectively....’

– T. N. Dupuy\(^7^1\)

In the 20\(^{th}\) century Trevor Dupuy developed the QJM, which was designed as a combat model that addressed the problems encountered by his predecessors, and it would ‘provide a framework for assuring consistency in the modeling or simulation of combat’.\(^7^2\) Central to the QJM was the idea that the product of the strength of a force, its combat effectiveness value, and its environmental operational situation could be used to generate a value for its overall combat power. It takes into consideration a total of 73 variable effects factors that can be applied to contemporary conflicts. Crucially however, it also included ‘an explicit, aggregated factor to account for those factors of combat that are generally intangible, but very identifiable, such as leadership, morale, training, experience, initiative, momentum, chance and manpower quality’.\(^7^3\) From the perspective of the DCDC framework, Dupuy’s list of behavioural factors incorporates a mix of both moral and conceptual components, but it is the conceptual components that he gives precedence. The QJM computed relative Combat Effectives Values (CEVs) of different historical forces,

\(^{7^0}\) Dupuy (1979), p.28.
\(^{7^1}\) Ibid., pp.216, 218.
\(^{7^2}\) Ibid., pp.33-56; Dupuy (1992b) pp. 56, 83-89.
\(^{7^3}\) Dupuy (1979), pp.105-106.
and found that of the factors affecting unit performances, ‘leadership, training, and experience – in other words professionalism – are probably the most important’.74

Most recently Stephen Biddle in his book *Military Power* (2004) proposed a theory of a ‘Modern System’ of warfare, based on the premise that that since the First World War effective force employment – ‘a tightly interrelated complex of cover, concealment, dispersion, suppression, small-unit independent manoeuvre, combined arms, and differential concentration’ – has been vital to performing meaningful actions on the battlefield in the face of increasingly lethal modern weaponry.75

Whilst these factors may at first appear to relate more to the physical component than the conceptual component, Biddle’s central line of argument is that victory in modern battle depends more on doctrine and tactics rather than material factors. Many of the components that form his ‘modern system’ are employed on the battlefield by both sides in contemporary conflicts, but ‘By contrast with the Napoleonic maneuver of massed formations or the 1914-17 methods of unsupported advances in thick skirmish lines, modern system offensive tactics are...much more complex. While effective if implemented properly, they demand high levels of skill from both troops and leaders’.76 He essentially argues that whilst factors such as dispersion, cover and concealment and technology are crucial for battlefield success, employing them correctly and in conjunction with each other necessitates ‘a complex doctrine that demands high levels of proficiency for proper implementation’.77

Biddle’s research is focused more on the tactical level than the QJM, and in order to substantiate the modern system theory Biddle uses 20th century battles as case studies, including Operation Desert Storm in 1991, and the conflict in Lebanon in his recent work *The 2006 Lebanon Campaign and the Future of Warfare* (2008). Biddle contends that, contrary to conventional wisdom, the effects of both technology and numerical preponderance are not decisive on the contemporary battlefield, and these arguments will be explored in detail as the combat model is constructed.78

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76 Ibid., p.39.
77 Ibid., p.46.
78 Ibid., pp.52-77.
Chapter 2: The Moral Component

a) The Psychology and Physiology of the Combatant

S.L.A. Marshall once stated that on the battlefield, ‘Fear is ever present, but it is uncontrolled fear that is the enemy of successful operation...’ 79 The underlying physiology and psychology of the infantry soldier is crucial in explaining the behaviour of men during combat, and any platoon-level combat model will therefore be underpinned by our understanding of how individuals react to the stress and fear inherent to combat. This section will argue that the training given to Western soldiers prior to combat allows them to acclimatise to the stresses they will encounter, meaning that they can to some extent overcome the physiological and psychological hurdles that are known to impede battlefield performance. It will also argue that whilst insurgent forces do not have the same level of training, the relative frequency of violence in their day-to-day lives does to some extent inure them to combat stress. There is a significant degree of overlap with factor m) of the model which examines the training of Western forces, so the different elements of this discussion will be dealt with where appropriate. Soldier psychology is a particularly pertinent topic in relation to the duration of combat engagements, as it will be argued that the primal fear of death ingrained within the human psyche leads to the vast majority of combatants displaying a considerable degree of caution on the battlefield, which greatly increases overall duration.

In On Combat, Grossman and Christensen state that in times of fear and stress brought about by an individual moving into a domain where another person will try to hurt or kill them, the heart rate of an individual increases. This leads to a number of different states of physical arousal resulting in a variety of empirically measurable bodily reactions.

Poorly trained and inexperienced soldiers who have never taken direct action against the enemy are likely to be rendered combat ineffective as their heart rates soar leading to a state of ‘condition black’, where cognitive processing deteriorates and they are unable to think properly. These extreme reactions to fear were frequently reported in the citizen armies of the Second World War. Marshall writes that ‘When the infantryman’s mind is gripped by fear, his body is captured by inertia... The man
afraid wants to do nothing; indeed, he does not care even to think of taking action’.80
It has recently been recognised that ‘condition red’ is the optimal level of arousal at
which a soldier should operate, as it leads to increased combat effectiveness given
that reaction and visual recognition times are increased without significantly
impairing bodily functions.81

In addition to these heart rate induced effects Artwohl and Christensen, in a survey
of 141 police officers who had been in what can be termed as ‘deadly force
encounters’, found that officers experienced a variety of different perceptual
distortions during combat. These included diminished and intensified sounds, tunnel
vision, automatic pilot (taking actions without conscious thought), heightened visual
clarity, slow motion time, memory loss, dissociation, and memory distortions.82
These findings have also been supported by other surveys, such as those undertaken
by Klinger.83 These distortions demonstrate that during combat soldiers can
essentially enter an altered state of consciousness. Although the exact mechanisms
that explain why these distortions occur are still unknown, Grossman theorises that
they are a side effect of vasoconstriction and other stress responses as the heart rate
increases. These distortions allow the body to ignore extraneous information, ‘…our
brains must constantly tune out sensory data or we would be overwhelmed. In
extreme stress situations, this screening process can be even more intense, as we tune
out all senses except the one we need… the brain is screening out awareness of what
it deems insignificant to the goal, and the goal is survival’.84

It is important to note that these physiological responses can be applied to any
soldier in any conflict throughout history, as they represent the natural human
reaction to the stress of combat. They also serve to expose one of the fundamental
truths of soldier psychology – individuals on the battlefield are to some extent
hardwired to take steps that promote their own survival. However, whilst in a
historical context states such as condition black provided some beneficial effects –
cavemen trying to beat each other into submission would have been able to make

81 Grossman (2008), pp.32-34.
83 Klinger (2006).
good use of elevated gross motor skills – such effects are uniformly detrimental when applied to the contemporary battlefield.

In conjunction with the effects of fear, both Grossman and Marshall recognise that across history individuals on the battlefield have also demonstrated an inherent resistance to taking the lives of other living persons. ‘Looking another human being in the eye, making an independent decision to kill him, and watching as he dies due to your action combine to form the single most basic, important, primal, and potentially traumatic occurrence of war’.85 Expanding upon previous research by Marshall and Dyer, Grossman devotes a significant portion of *On Killing* to an examination of this resistance to killing, arguing that it is directly related to the distance between the combatants.86 Whilst there are no reports of psychological stress in relation to firing indirect artillery weapons from outside of visual range, ‘the resistance to bayoneting or stabbing becomes tremendously intense, and killing with the bare hands (through such common martial arts techniques as crushing the throat with a blow or gouging a thumb through the eye and into the brain) becomes almost unthinkable’.87 To counteract this inherent resistance requires intense training prior to combat in realistic practice environments, which allow trainers to employ operant conditioning techniques to develop appropriate behaviour in soldiers.88 Murray supports this viewpoint, stating that ‘aversion to killing is considerably reduced through diffusion of responsibility, whether this is through following orders… or following drills that make behaviour robotic’.89 Having received this training soldiers often report that ‘they just carried out the correct drill and completed it before they realized that they were not in the simulator’, and this is a topic that will be examined in more detail in section m).90

Professional Western armed forces recognise that one of the key benefits of training is to provide ‘stress acclimatisation’, which inoculates soldiers against the aforementioned undesirable effects of high stress combat scenarios. The drills they

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practice help to undermine the psychological barriers which cause troops to balk when required to fire at the enemy, as ‘prior success under stressful conditions acclimatizes you to similar situations and promotes future success’. The effectiveness of this conditioning is evidenced by the testimony of Former US army Captain Smith [name changed to maintain anonymity], who when interviewed stated that many of the men he served with in Iraq were actually hoping to get confirmed kills; they saw combat as ‘their big chance’, and would not hesitate to take the opportunity to shoot at the enemy. However, even with the rigorous training undertaken by Western forces the resistance to killing still seems to remain an inherent component of combat. In *House to House* Staff Sergeant David Bellavia repeatedly demonstrates that he is willing to take life by shooting his enemies, but he was still incapable of striking the killing blow with his bare hands during a melee engagement; ‘I gouge his left eye with my index right finger... He wails like a child. It unnerves me, and I lose the stomach for this dirty trick. I withdraw my finger’. Bellavia’s encounter demonstrates just how difficult this underlying psychology is to overcome in its entirety, even amongst well-trained troops. Nevertheless, recognition of this problem in combination with the effective training methods employed by contemporary forces has greatly reduced its impact on the battlefield, even when compared to comparatively recent conflicts such as the Second World War.

On the contemporary battlefield, examples of complete psychological breakdowns and the most extreme ‘condition black’ reactions to stress are rare amongst Western soldiers. Captain Smith stated that fear more often manifests itself in a state of panic, which leads to a massive overreaction on the part of individuals to a particular situation. In his experience the small number of professional Western soldiers who panic exhibit behaviours such as losing their fire discipline and discharging large volumes of uncontrolled fire in the direction of the enemy, heedless of the drain this will place on ammunition supplies. This view is in agreement with similar observations put forward by Collins and King who examine the ‘flight to the front’ theory, which argues that for humans in pressurised situations ‘panic can take a

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91 Ibid., p.35.
92 Anonymous Interview 02 (2014).
94 Anonymous Interview 02 (2014).
95 Ibid.
different direction. It can become an uncontrolled and apparently boundless form of aggression... Instead of fleeing, individuals protect themselves, by assaulting the threat...’.\textsuperscript{96} Rather than destroying the infantryman’s ability to act, fear and panic can more subtly undermine the decision-making process itself, leading to sub-optimal battlefield performance.

Murray argues that biologists and military analysts are ‘…fairly certain that freezing is a more common response than either fighting or fleeing…The first part of freezing is the brain’s automatic response to a sudden or threatening event. This has been called a cognitive blink because, for a second or so, the brain focuses only on the threat and stops processing other information…’.\textsuperscript{97} Being under small-arms fire produces such a cognitive blink, and common sense dictates the soldier remains under cover; if the fire continues this behaviour can be reinforced until the overwhelmed soldier has no impetus to take any action at all.\textsuperscript{98}

Captain Smith also reported that some soldiers would refuse to directly follow orders by proposing alternative solutions that involve tackling the problem in a different way.\textsuperscript{99} Murray argues that when the soldier does not freeze, avoidant behaviour on the battlefield can instead lead to ‘fussing’, where soldiers under pressure ‘focus on what is manageable rather than what is important… combat has come to be full of complex tasks that are not directly involved with engaging the enemy, and these activities can often take over when men are under pressure’.\textsuperscript{100} Irrespective of how well-trained a soldier is, the complexity of his equipment increases the chances of enacting the wrong drill when under pressure, leading to getting stuck fussing with kit; ‘the last 50 years have shown an increase in the number of soldiers repeatedly conducting radio checks, changing barrels or stripping magazines when the enemy is almost on top of them’.\textsuperscript{101} Rather than simply freezing with fear these men absorb themselves with menial tasks so that they can avoid having to directly engage the enemy. Such fussing is a natural reaction to the stresses of combat, and can manifest

\begin{itemize}
  \item \textsuperscript{96} King (2013), p.11.
  \item \textsuperscript{97} Murray (2013), pp. 90-91
  \item \textsuperscript{98} Ibid., pp.94-95.
  \item \textsuperscript{99} Anonymous Interview 02 (2014).
  \item \textsuperscript{100} Murray (2013), p.105.
  \item \textsuperscript{101} Ibid., p.111.
\end{itemize}
itself in many forms; Murray cites one example from the Korean War where a soldier repeatedly busied himself foraging for machine gun ammunition despite a seemingly obvious overabundance.102 Such reactions to combat are far more likely in the contemporary context than complete psychological breakdown, and help to illustrate the more subtle ways fear can undermine combat effectiveness.

Murray also argues that at low levels the greatest benefit of strong leadership is to provide psychological compulsion for men to stick to the job; ‘When things are going well, leaders increase the chance that men keep on fighting, but when things turn bad, leaders are the ones who buck the bystander trend’ [The phenomenon which shows that the greater the number of bystanders, the less likely it is that any one of them will help].103 With a commanding figure nearby soldiers pay more attention to the adverse social consequences of not fighting; fewer than 20% of soldiers are willing to take actions which involve a high risk of violence when they are on their own, but accompanied by a leader the number rises to 40%.104 This compulsion effect works against the many degrading psychological factors which have already been discussed, and using data from Rowland’s The Stress of Battle, historical analysis, and various Milgram-style studies, Murray states that being near a respected junior officer will make a soldier six times more like to fight in daylight and open country during a moderately intense engagement.105 However, leaders can only ever be in a few places on the battlefield, and so their overall impact on combat effectiveness is extremely hard to measure.

In relation to their insurgent adversaries, Captain Smith voiced his opinion that they have ‘been killing each other for generations’ and that violence in their cultures is far more commonplace; as a result, they are used to being involved in violent conflict from a young age.106 Since expectations of survival are generally lower and insurgents are to some extent already inured to the violence of the battlefield, they also seldom react to events with uncontrolled terror. Religiously motivated insurgents in both Iraq and Afghanistan even demonstrated a willingness to take

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102 Ibid., pp.99-103.
103 Ibid., p.133.
104 Ibid., pp.138-140.
105 Ibid., p.140.
106 Anonymous Interview 02 (2014).
explicitly suicidal actions due to their convictions. The most extreme examples of this behaviour originated from a small proportion of troops that various commentators refer to as ‘martyrs’. These men were willing to give their lives to kill coalition soldiers, meaning that fear for these men was seemingly not a concern. One Western soldier described how an insurgent was willing to walk brazenly into the line of fire of his squad, in order that his death would serve to reveal the coalition positions. Others would hide in houses and initiate ambushes at extremely close ranges knowing that this would lead to their deaths, but hoping to take Western troops down with them. Whilst religion has been a powerful motivator in conflicts for centuries, the large-scale practice of actively committing suicide in order to potentially kill an enemy at the same time is a relatively new occurrence, demonstrating that religion can provide some insurgents with a motivation powerful enough to override both their fears and the innate human instinct for self-preservation. However, it must be emphasised that only a small proportion of insurgent forces should be characterised as martyrs. The majority of guerrillas fighting in both Iraq and Afghanistan seemingly did not want to die, and fought with more conventional methods. There are thus numerous examples of insurgents retreating in unfavourable tactical circumstances in order to continue fighting another day.

Individual soldier psychology and physiology is a crucial explanatory factor in terms of duration. The tactics employed by Western and the majority of insurgent soldiers abide by the underlying psychology and physiology common to all humans; engagements almost always begin with soldiers going to ground and seeking cover, measures taken by reasonable individuals to protect themselves from unnecessary harm. Extensive footage from the front lines taken via helmet cameras reveals that during battles most soldiers spend a great deal of time sheltering whilst they attempt to locate the enemy and simultaneously lay down suppressive fire.

108 Bellavia (2008), pp.149-50.
111 On reviewing a videotape of an ambush Junger notes that every man dropped into a crouch as an unconscious reaction to incoming enemy fire – Junger (2010), pp.31-33.
112 FUNKER530 (March 2012)
As an aside, it is important to note that helmet camera footage available to researchers has been chosen by the military, who edit it down into short sequences which are released to the public. Therefore, only a small proportion of the raw footage is actually available for study. This in no way invalidates the use of such sources, as such footage provides extensive and impartial evidence of events at a level of detail impossible to capture in prose, but it does show limitations which must be recognised and taken into account. Highly selective extracts are made available from the perspective of certain individuals, and these tend to focus on either direct actions against the enemy, or other issues that the military considers to be ‘of interest’ to the public, such as rescuing the wounded. These extracts often display significant volumes of fire, which would be impossible to maintain over long periods of time due to ammunition constraints (a topic which will be covered in detail when examining logistics). It is significant that even in the available footage soldiers still spend much of their time sheltering and moving cautiously, perhaps providing an indication of how they act on the battlefield when the action is less intense.

One of Captain Smith’s main contentions is that fear ‘...slows things down, because when there is legitimate chance of getting shot you’ve got to cover all your angles and cover all your corners. You’ve got to clear each room methodically, and it takes a really long time to go one hundred meters. It could take all day if you really wanted to get pedantic about it’. Such caution is sometimes justified, but is sometimes a way to fuss and avoid taking hazardous actions. It is however clear that in most circumstances when soldiers are placed under fire they are careful to not expose themselves or take unnecessary risks, which inevitably lengthens engagement duration.

Justified caution (otherwise known as common sense) helps to explain why soldiers who are brave do not necessarily dispatch enemies faster. Whilst they may be entirely willing to engage the enemy, and do not shy away from incoming fire, common sense dictates that in certain circumstances a slow, methodical and cautious approach is called for. For example, in Afghanistan advancing British forces, who

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113 See Our War (2011)
114 Anonymous Interview 02 (2014).
were wary of an ambush, were happy to spend ‘several hours recceing possible entry locations’ to a town.\textsuperscript{115} Such caution is not uncommon or unreasonable when soldiers are expecting enemy contact.

Caution also helps to explain the paucity of Western casualties when their soldiers are placed at a tactical disadvantage; unless the circumstances are truly dire tactics centre around cautious manoeuvre, seeking cover/concealment, and then defending until reinforcements arrive. The Battle of Mogadishu is a good example of this. Despite being surrounded by numerically preponderant enemies US forces successfully defended themselves until they were evacuated upon the arrival of additional US and UN (United Nations) reinforcements. Although they did sustain casualties, these were far less than would perhaps be expected given the severity of the situation.\textsuperscript{116}

In some cases, Special Forces units undertaking time critical missions are forced to forgo caution in order to complete their objectives. During Operation Larchwood 4 – April 2006 – five Special Air Service (SAS) operatives were wounded assaulting a farmhouse in the Yusufiyah township of Iraq.\textsuperscript{117} Beginning the assault at 2am the soldiers had only a few hours to subdue resistance, search the area for information, and then exit before sunrise and a predicted enemy response.\textsuperscript{118} Even a unit as illustrious as the SAS came close to losing multiple men by taking the conscious decision to fight quickly, rather than employing caution to reduce risk. It is perhaps not surprising that troops outside of such an elite fraternity are more likely to err on the side of caution, deliberately increasing duration in order to decrease the likelihood of casualties.

b) Group Cohesion

Different scholars have posited various definitions of the word cohesion within the military context. This thesis will use that put forward by Anthony King in his most recent work, \textit{The Combat Soldier}, which states that cohesion is ‘the successful\...

\textsuperscript{115} Scott (2008), p.95.
\textsuperscript{116} Bowden (1999), pp.392, 416-7.
\textsuperscript{117} Urban (2011), pp.140-144
\textsuperscript{118} \textit{Ibid.}
coordination of the activities of group members to the same goal, utilizing comparable methods. Cohesion refers ultimately to successful collective performance...". He argues that cohesion – underpinned by extensive training, the inculcation of a highly professional ethos, and comprehensive understanding of effective tactics and battle drills – directly contributes to the dominance of Western forces on the contemporary battlefield. Cohesion is an essential component in generating the prerequisite coordination required to employ complex (and highly effective) battlefield tactics, Whilst simultaneously sustaining the will of soldiers to accomplish their mission goals despite combat stress. This is an area where Western forces in recent conflicts have possessed a demonstrable advantage over both their historical counterparts and their insurgent adversaries, who have generally lacked the training and tactical understanding necessary to consistently form cohesive platoon-level groups, thereby diminishing their combat effectiveness.

Before assessing how contemporary forces have consistently assembled platoon level units with unprecedented levels of cohesion, it will first be necessary to explain why cohesion is directly related to successful performance. Historically, men on the battlefield employed mass tactics; they operated in large closely packed blocks of infantry, were always in sight of comrades, and were part of an obviously visible group. After the Second World War, Marshall recognised that increased dispersion of troops across the battlefield caused a temporary disintegration of cohesion amongst soldiers at the platoon level. Dispersion meant that when men went to ground (as they frequently did in order to take cover) they could not see friend or foe, and this led to inertia as organisation and unity vanished, ‘What has been a force becomes a scattering of individuals’. Once out of sight of their friends the soldiers of the Second World War lost all ability to function as a cohesive group, and instead became a collection of scared and bewildered individuals, despite the fact that their physical proximity to friendly forces had not changed.

Junger argues that in contemporary forces extensive pre-deployment training in tactics and battle drills counteracts the aforementioned disintegration. US infantry

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121 Ibid., p.129
doctrine states that ‘A battle drill is a collective action executed by a platoon or smaller element without the application of a deliberate decision making process. The action is vital to success in combat and critical to preserving life’. These drills ‘create self-confidence and give [soldiers] a plan of action to be carried out when in battle... battle drills have sought to standardize every aspect of infantry performance. Indeed contemporary doctrine emphasizes this aim of standardization; it deliberately seeks to reduce infantry tactics to a set of predictable and regulated practices’.123 When utilised properly drills ‘...inculcate the novice soldier with the knowledge of the experienced combat veteran... [and] the standardization of drills is important to improving the competence of the infantry since coordinated action is essential to combat performance’.124 The doctrinal publication ‘Warrior Battle Drills’ examines in meticulous detail the actions soldiers should take when engaging the enemy in drills such as ‘React to Contact’, ‘React to Ambush’ and ‘React to Indirect Fire’, and rigorously drilling these regulated practices into soldiers prior to combat means they can be executed with a high level of proficiency. Ultimately, training in effective battle drills in combination with scrupulous attention to the details of their execution has allowed infantry to overcome the debilitating effects of dispersion on the battlefield which were observed by Marshall.

In addition to increasing combat effectiveness, the changing nature of cohesion and group bonding evidenced in professional armed forces has also led to a transformation in soldiers’ motivations. Once soldiers had all been well drilled King argues that there was ‘...a moral obligation upon soldiers who were expected to perform. With tactical competency and public acknowledgement that soldiers had understood the mission came the expectation that soldiers were obliged to fulfil their duties on it’.125 Motivation within the professional armed force is thus distinctly different to the motivations of soldiers in previous large-scale twentieth century conflicts such as the Second World War. United States Marine Corps Colonel Bryan McCoy argues that ‘Our greatest fear in battle was not death or maiming. It was the fear of being a coward in the eyes of our comrades’.126 Demonstration of

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126 McCoy (2006), pp.54-55.
professional competency has thus assumed a position of acute importance. As King puts it; ‘critically, failure in combat would mean a betrayal of the group... and necessary exclusion from the bonds of fraternity within it’.\textsuperscript{127} A great deal has been made historically of soldiers fighting for their comrades, but the bonds ‘to which social scientists and soldiers themselves often appeal in explaining combat performance may not be nearly so personal as is often presumed in a professional force’.\textsuperscript{128} To exemplify this point, soldiers will go to extraordinary lengths to rescue those who are part of their group, even if the individuals involved have an active enmity towards each other, and the performance of units led by unpopular commanders has remained exemplary.\textsuperscript{129} Knowing or liking comrades in arms is now no longer a prerequisite to motivation or combat performance; ‘Soldiers who do not necessarily know each other trust each other on the basis of presumed (and proven) professional expertise’.\textsuperscript{130}

Having explained how cohesion leads to increased combat effectiveness and new motivations, the matter of how it has been actualised within the contemporary context needs to be examined in more detail. This will also serve to explain why both historical armed forces and contemporary insurgents have been unable to achieve the same levels of cohesion as contemporary Western forces, despite (in some cases) having access to the prerequisite doctrinal publications, as US field manuals are readily available via online sources. Basic training (excluding any advanced courses) in the British army is centred on an intense 26 week course, which contains multiple live fire-exercises and is structured to demand increasingly high standards from infantrymen.\textsuperscript{131} It would therefore be unreasonable to expect Second World War infantrymen – with in some cases as little as four weeks pre-deployment training of markedly lower quality than that provided to contemporary forces – to perform at anywhere near the same standard.\textsuperscript{132} The lack of training given to these men is understandable in the context of a draft citizen force attempting to mobilise large numbers of infantry during a time of conflict. However, professional forces are

\begin{thebibliography}{10}
\bibitem{King} King (2013), p.371.
\bibitem{Ibid} Ibid., p.345.
\bibitem{Ibid} Ibid., pp.357-8, 362.
\bibitem{Ibid} Ibid., p.356.
\bibitem{British Army} British Army (2015).
\bibitem{Condit et al} Condit \textit{et al} (1956), p.11.
\end{thebibliography}
inherently far smaller than citizen forces, precisely because effective training is time consuming and requires specialist expertise to be undertaken properly. It is not logistically possible for a large force to be trained to such a high degree of competency. Indeed, the continuing existence of elite Special Forces units demonstrates that even amongst professional forces only a narrow subset of soldiers perform at the absolutely highest levels.

This lack of training is a problem which has consistently bedevilled insurgent forces in most recent conflicts, allowing Western troops to far surpass them in terms of group cohesion, despite examples of competency demonstrated at the individual level.133 Whilst insurgents demonstrate a grasp of basic tactics their conduct on the battlefield displays a lack of training, discipline, organisation and doctrinal understanding. Captain Smith stated that they do not function in groups – they operate as collections of individuals rather than as a unified force.134 This is evidenced by the complete lack of any large-scale co-ordination between insurgent forces, and their inability to execute fire and manoeuvre tactics even in circumstances where they have the upper hand. The Battle of Wanat, in which over 200 Taliban soldiers were unable to defeat 48 US infantrymen despite ambushing them and causing significant casualties, is an excellent example of this.135 A significant reason for the Taliban’s inability to overrun the US forces was their lack of cohesion meaning they failed to work together as a group. Their complete lack of platoon-level organisation (they seemingly did not have designated support by fire or manoeuvre elements) is fundamental in explaining why they could not push home their assault.136

In terms of insurgent motivations, Captain Smith argues that they are often highly motivated as they perceive themselves to be protecting their homelands – to some extent their dedication to fight is thus actually greater than that of Western forces.137 However, this long-term motivation to engage with the enemy does not translate into

133 One or more insurgent snipers dubbed ‘Juba’ by Western forces caused multiple casualties to US infantry during the US occupation of Baghdad – Carroll (2005).
134 Anonymous Interview 02 (2014).
136 Anonymous Interview 02 (2014).
137 Ibid.
an understanding of combat. In contrast, Western soldiers frequently bemoan the
day-to-day conditions they find themselves in, and in many cases cannot wait to go home, but when actual combat occurs their discipline and professional pride demand that they fight to the best of their abilities. One former US army Staff Sergeant stated that ‘[this is] our job. It sucks, and we hate it, but we endure... every moment in the infantry is a test. If we measure up to the worst days, such as this one, it proves we stand a breed apart from all other men... We’re veterans now, proud that we can stomach such sights and still carry out our job. It is the mission that defines us, gives us our identity’.138

In terms of the asymmetrical outcomes observed in recent conflicts it is clear that group cohesion plays a significant role, and is an area of distinct advantage to Western forces. King believes that ‘the infantry platoon, although organized and equipped in ways which would have been recognizable to the soldiers of 1917, has attained a far higher level of cohesion...Professional soldiers are typically able to conduct the tactics which often eluded their predecessors. The tactics that were recognized from the First World War onwards are now routinely executed in combat because they have become automatic in training...’ 139

Cohesion also has an important impact on the duration of engagements. When Western squads are on the offensive, engagements have the potential to be one-sided and comparatively short, as effective application of fire and manoeuvre tactics enables rapid progress in the absence of friendly casualties. The manoeuvre component is particularly important in this context, as continuous movement enables rapid exploitation of tactical weaknesses in enemy formations. This trend holds unless offensive manoeuvring leads into Improvised Explosive Devices (IEDs), where rapid manoeuvre can conflict with the need for caution. In contrast, even when insurgents manage to pin Western troops down, poor cohesion means they do not manoeuvre effectively and fail to take advantage of their positional superiority. This leads to an inability to ram home any tactical advantages, and is a powerful explanatory factor in terms of why firefights can last for hours. Offensives such as Wanat illustrate this weakness, where despite the insurgent advantages neither side...

138 Bellavia (2008), pp.1-2.02
139 King (2013), pp.336, 421.
could eliminate the other, so the fight bogged down into an effective stalemate until Western reinforcements arrived and forced an insurgent retreat. This analysis demonstrates that taking the initiative and attempting to manoeuvre into a position to decisively defeat an enemy force is a particularly hazardous task, regardless of which side is on the offensive.

c) Rules of Engagement
The Rules of Engagement (ROE) regulate military actions on the battlefield; most significantly, they tell a soldier when he can and cannot open fire.\textsuperscript{140} This assessment will argue that because ROE place minor limitations upon the tactics that Western infantry can employ, soldiers cannot operate at their maximum potential lethality and overall combat effectiveness is slightly diminished. Furthermore, insurgent forces are aware of these restrictions and use them to their advantage. Restrictive ROE also serve to increase the duration of tactical engagements, as soldiers are required to be more discerning in the use of their weaponry so as not to cause collateral damage.

In recent conflicts the ROE have significantly affected the tactics Western soldiers employ on the battlefield. In the Second Battle of Fallujah, November 2004, ‘Initially, high-level fears about civilian casualties forced the Marines to clear houses by hand, employing machine guns and hand grenades...’\textsuperscript{141} Bangalores did provide the option of blasting some buildings rather than risking lives to clear them, but this ‘still left the Marines figuring out which buildings contained jihadis and which ones were empty, because they did not have permission to level every building on the block’\textsuperscript{142} Whilst it would have been tactically effective to level any building that was a potential threat, due to the ROE the marines were compelled to clear large numbers of buildings without explosives and risk close range engagements with insurgents – even though it was a more dangerous and time consuming approach.

Whilst operating under ‘courageous restraint’, a policy involving the use of fewer munitions to reduce collateral damage in Afghanistan, troops stated that ‘Our hands are tied… we have got people shooting at us and we are not allowed to shoot

\textsuperscript{140} Kemp (2009), p.51.
\textsuperscript{142} Ibid.
Junger writes that ROE ‘...generally forbid soldiers to target a house unless someone is shooting from it… The Taliban know this and leave everything they need hidden in the hills; when they want to launch an attack they just walk out to their firing positions empty-handed and pick up their guns. They also make children stand near them when they use their radios. The Americans don’t dare shoot…’ Such restrictions necessarily require Western forces to take extra time discerning whether people on the battlefield are enemies or civilians in order to avoid harming innocents. Insurgents in both Afghanistan and Iraq actively took advantage of the civilian populace on the battlefield, evading capture by blending in with them.

However, ROE are not static, and differ greatly depending on the context of the conflict and the situation on the ground. Whilst every effort is made to follow them, ‘...commanders have to be able to recognize when these restraints are not necessary and act primarily based on military considerations’. Months after its inception courageous restraint was reviewed and modified by General Petraeus, as Western infantry believed it was directly endangering their lives. Although it is impossible to provide a direct causal link between the policy and infantry casualties, there is correlative evidence which supports this assertion. In 2010, whilst courageous restraint was in effect, 88 and 103 coalition troops were killed in June and July respectively. The casualty rates for this period are well above the 2010 monthly average of 59, and from a coalition perspective they were the bloodiest months of the entire campaign.

The policy therefore provides a good case study demonstrating how excessively restrictive ROE hinder combat tactics and therefore reduce the combat effectiveness of Western infantry. This hampering also increases the overall length of engagements by giving soldiers more decisions to be made on the battlefield, impeding their ability to act swiftly. The extent to which ROE could change the

143 Harding (2012).
144 Junger (2010), p.46.
148 iCasualties.org (2015)
149 Ibid.
length of an engagement has the potential to vary wildly depending upon the specific context, and would therefore need to be assessed on a case by case basis.

d) Suppression

In infantry engagements the suppression of an opposing force means that combatants who are ‘…forced to duck, to cower in deep dugouts, or to reposition to an unspotted location cannot fire in the meantime, and thus their weapons, whatever their normal lethality, are temporarily harmless’. Suppressive fire is a tactic which compels the enemy to take cover by means of continuous fire, and when taking cover a force is unable to appropriately manoeuvre, meaning that the suppressing force can close to a distance ‘… where their accuracy will allow them to destroy the targets with aimed fire from point-blank range’. Suppressive fire has a powerful – if temporary – moral effect, and ‘The focus is not on killing or destroying the enemy but on using the threat of such outcomes to encourage their passivity’. Upon its cessation the assailed force usually returns to its preceding level of combat effectiveness in short order, but skilful exploitation of even a transitory reduction in combat effectiveness can lead to a position being swiftly overwhelmed, reducing the duration of engagements.

Vanguard of Valor, a collection of accounts chronicling various small-unit actions in Afghanistan, includes a number of incidents that demonstrate the tactical significance of suppressive fire in infantry squad combat. On 23rd June 2010, a platoon from the US Army’s 2d Brigade Combat Team fought a two hour long battle against insurgent forces in the Zhari District of Afghanistan. During the battle the entrenched insurgent forces poured intense fire onto the advancing US infantrymen in an attempt to pin them down (suppress them with such a large volume of fire that they would be completely unable to manoeuvre or effectively return fire).

*The squad’s attempt to maneuver served as a catalyst... the enemy responded like a stirred hornet’s nest, unleashing a torrent of machine gun fire and RPG explosions to pin the...*
Americans in place... Against the oppressive rain of fire Bartlett and his men threw smoke grenades to advance. When those ran out, they threw fragmentary grenades. Beyond the fragmentary grenades’ masking potential, the successive explosions forced the enemy to keep their heads low, decreasing their rate of machine gun and RPG fire. Additionally the grenades pinned the enemy in place, preventing them from displacing to take up better firing positions’.154

Although the Taliban had some success in suppressing the US forces, and did manage to prevent them from manoeuvring for a significant period of time, the extensive use of grenades eventually turned the tables. The insurgents themselves became suppressed, and this allowed the US soldiers to recover and begin shooting to regain fire superiority. Once this had been reasserted the Taliban were forced to retreat, and ‘the character of the fight... decidedly shifted in favour of US forces’.155

It is impossible to quantify exactly how prevalent suppressive fire is on the contemporary battlefield. According to Murray, one junior staff officer examined the numbers of rounds fired in contact and subtracted a reasonable amount for speculative fire to eventually calculate that around 3,000 rounds were fired per kill.156 When employed in conjunction with battlefield accounts, it is clear that given the sheer number of bullets fired per insurgent death the vast majority ammunition does not hit human targets, and is expended for purely temporary suppressive effect. Murray argues that soldiers frequently fire ‘just to be on the safe side’; it is difficult to find the enemy in Afghan green zones, ‘where men often fight in high crops bordered by tree-lined irrigation ditches and walled compounds. This has increased the reliance on speculative suppression fire because it is so hard to spot clear targets’.157 He further contends that excessively large amounts of suppressive fire, seen in many recent engagements, can actually be detrimental to combat

154 Ibid., pp.56-57.
155 Ibid., p.57.
157 Ibid., p.58.
effectiveness. Immediately forcing the enemy to ground before identifying their exact location makes it hard for Western infantry to effectively close and eliminate the hostile force.\textsuperscript{158} The following example illustrates this point:

\begin{quote}
‘A patrol is engaged by four insurgents from cover at 200 metres... Every man in the patrol instantly fires off a burst towards a likely firing point and then takes cover. More rounds are fired while the patrol leader tries to work out where the enemy is. The outgoing rounds make this difficult. The patrol leader eventually manages to stop all outgoing fire but by chance, some of these rounds have passed close to the enemy. The insurgents have taken cover then moved, unseen, to another firing point. With only a rough idea of where the insurgents were, and no idea where they are now, the patrol leader directs heavy fire at one or two likely firing points’\textsuperscript{159}
\end{quote}

Given that engagements are inherently more complex at ranges where soldiers cannot actually see the enemy or are not comfortable that the enemy is suppressed, canny units in Afghanistan began to wait for the enemy to get closer and reveal their exact location before using a surge of fire to suppress them. Once the enemy took cover and fire superiority had been achieved a steady rate of fire, ‘of as little as thirty rounds a minute’ was enough to keep their heads down.\textsuperscript{160} This would then allow manoeuvring into a position where direct fires could eliminate them.

The mechanics of why suppression actually works – even with surprisingly small volumes of fire – appear to revolve around the sound of a near miss.\textsuperscript{161} ‘A man under fire hears the crack of the bullet passing close to him, and then hears the thump of the round being fired. Some research suggests that hearing the crack makes all the difference, with a loud crack making more suppression and no audible crack causing almost no suppression’.\textsuperscript{162} Various Second World War field studies were used to

\textsuperscript{158} \textit{Ibid.}, pp. 58-59.
\textsuperscript{159} \textit{Ibid.}
\textsuperscript{160} \textit{Ibid.}, p.59.
\textsuperscript{161} \textit{Ibid.}, p.56.
\textsuperscript{162} \textit{Ibid.}
demonstrate that ‘one round passing within three meters every six seconds would appreciably degrade return fire from a whole fire-team, and two rounds every three seconds would prevent any return fire at all’.163 Although these numbers may vary depending on the circumstances of an engagement and the training of those receiving the fire, they undoubtedly show that in reality only small volumes of fire are required to leverage the suppressive effect, as the caution displayed by most combatants leads to them staying under cover when even a moderate amount of incoming fire is in evidence. When used in this manner suppression can allow one side to effectively achieve temporary dominance of the battlefield. Their troops are on overwatch, ready to provide aimed accurate fire on known enemy locations whilst the enemy is behind cover with no real ability to return fire, and only a small amount of fire is required by the overwatching force to maintain this situation. This explains why in some specific instances Western infantry in Afghanistan have maintained fire superiority and suppressed the enemy with far smaller ammunition expenditure than was seen on average. It may also explain why snipers are capable of suppressing entire infantry platoons despite the fact that they fire very few rounds – the fear of being hit is magnified if soldiers suspect a competent enemy with an accurate long range weapon, and this provides a strong incentive to stay under cover given that anyone looking for the sniper is likely to become a prime target.

It is worth noting that martyrs appear to be almost immune to the effects of suppression. Given that their tactics and behaviour are predicated on the assumption they are going to die anyway, they often show a remarkable disregard for incoming fire, which generally serves to hasten their demise. Although the primary aim of suppression is to keep heads down, it is inevitable that some shots will hit the target if they are not sensible enough to seek a modicum of cover and concealment.164

In Military Power Biddle provides a quantitative estimate of the reduction in combat effectiveness brought about by suppressive fire, arguing that it has the potential to reduce firing rates by a factor of seven or more.165 The impact of the suppressive

163 Ibid., p.57.
Although not quantitative, US forces have stated that enemy fire ‘fell significantly’ when suppressive fires were used against them – Wright (2012), p.61.
effect also depends on the type of weapon being employed; Murray states that ‘Afghan insurgents ignore 5.56, are wary of 7.62 but pack up and leave at once a point five joins the fight… While all of these bullets can kill, a .50 calibre bullet will hit with close to ten times the force of 5.56mm and this is reflected in their suppressive effect… A .50-calibre machine gun can push men away from fighting on its own’. Higher calibre weapons not only have a greater suppressive effect, but can even contribute to enemy forces withdrawing from the battlefield entirely. It is also generally accepted ‘that more rounds have a greater suppressive effect than more weight… This is one of the reasons the US first switched from 7.62mm to 5.56mm… [soldiers can carry more of these rounds] Yet there is still no reliable way to work out how many 5.56mm rounds are equal to one 7.62mm or one .50 calibre round’.

In terms of suppression there is thus a trade-off between the weight of the shell and the rate of fire. In an ideal world fire superiority would be achieved employing both high rates of continuous fire and the utilisation of high calibre weapons; however, practical concerns – often stemming from logistical limitations – generally necessitate a more balanced approach.

If infantrymen either do not understand how, or are not capable of, taking full advantage of the enemy’s reduction in combat effectiveness then offensive success will be comparatively limited. This explains where there are no examples of insurgent forces successfully demonstrating the ability to close distance and destroy coalition troops with direct fires even after suppressing them. The reasons for this inability will be elucidated further in sections l) and m).

In terms of duration, suppression is one of the central factors increasing overall engagement length. Given that most soldiers are cautious, suppressive fires cause them to cease manoeuvring and this leads to significant periods spent sheltering under cover. These conclusions are pertinent to both sides, as the suppressive effect is applicable to Western soldiers even though training can limit its debilitating effects. It can even be argued that Western forces are potentially easier to suppress than insurgents, as brave but untrained soldiers may not have the basic tactical understanding to realise that they should be taking cover.

\[166\] Murray (2013), pp.55-56, 175.
\[167\] Ibid., p.56.
e) Surprise & Shock

In *The Stress of Battle* David Rowland writes that, ‘...the basis of surprise is to catch the enemy unawares, so that he cannot react properly... the effect is to deny the victim the time and space for the troops to react, for meaningful firepower to be deployed, and for timely countermoves to be made’.\(^{168}\) The effect of surprise is to prevent soldiers from being able to perform, ‘while that of shock is that soldiers could have but didn’t’; shock causes a ‘stunning, paralysis or debilitating effect... on the performance of individuals in combat’.\(^{169}\) Dupuy argues that surprise substantially enhances combat power, by the order of two to five times, and Rowland states that in addition to this shock can result in a temporary further mean reduction of effectiveness of around 60%.\(^{170}\) Whilst this research is fundamentally sound, this section will use contemporary examples to argue that in the context of recent conflicts, especially from the perspective of Western soldiers, surprise and shock are less significant factors in deciding the outcome of squad level infantry engagements. Well-trained contemporary infantrymen are simply not affected by surprise and shock to the same degree as their historical counterparts.

In *War*, Sebastian Junger provides an excellent example of a Western squad being caught completely by surprise, placing them at a huge tactical disadvantage. In the Korengal valley in Afghanistan on October 25\(^{th}\) 2007, a platoon of US infantrymen walked into an L-shaped ambush set by Taliban soldiers. ‘Within seconds every man in the lead squad takes a bullet... After months of fighting an enemy that stayed hundreds of yards away, the shock of facing them at a distance of twenty feet cannot be overstated’.\(^{171}\) Despite being in a detrimental tactical position, with two men in the squad being badly wounded at the beginning of the engagement, the US infantrymen acted immediately and efficiently. Showing no symptoms of shock they managed to regroup, and then returned fire with rifles and a large number of grenades in an attempt to suppress the enemy forces and regain fire superiority. Once fully regrouped they assaulted the enemy position and drove the Taliban forces back.


\(^{169}\) Ibid., pp.169, 178.


Junger believes that when the fight started ‘An untrained civilian would have experienced those ten or fifteen seconds as a disorientating barrage of light and noise and would probably have spent most of it curled up on the ground’.\textsuperscript{172} Essentially, a civilian would have entered a complete state of shock rendering them unable to act appropriately. However, due to prior training and acclimatisation the US forces suffered none of the possible effects of shock, despite the surprise nature of the assault.

This example demonstrates that at the tactical level training serves to negate the impact of shock and surprise on infantrymen. Western infantrymen work together as a team, with each man making decisions based on what is best for the group rather than what is best for himself, and this behaviour allows them to ‘overcome enormous tactical deficits’.\textsuperscript{173} Although there are certainly examples of Western soldiers being incapacitated by shock to various degrees from recent conflicts, training and previous combat experience acclimatise soldiers meaning that they can operate effectually even when taken by complete surprise.\textsuperscript{174}

Although there are some examples of surprise and shock being used by Western forces when ambushing insurgents this does not appear to be a common occurrence. Section i), logistics, will argue that overburdened Western troops are often unable to achieve shock and surprise effects by the traditional means of assault from a flank, given that they are fighting against highly mobile and unencumbered insurgents. This only serves to further reduce the importance of surprise and shock, as they are not successfully employed by either side.

Whilst the above example is a particularly good illustration of these points, it is by no means unique. The conclusions of both Dupuy and Roland in relation to these factors are most relevant when applied to historical conflicts or instances where the defending force has not received appropriate training. Surprise and shock thus have a comparatively diminished importance in determining the outcome of infantry combat

\textsuperscript{172} Junger (2010), p.121
\textsuperscript{173} Ibid., p.120.
engagements, especially when Western forces are on the tactical defensive. Given that they are seemingly only effective when employed against insurgent forces, their overall impact on duration is necessarily limited, since dynamics in recent conflicts have largely revolved around insurgents attempting to ambush and apply them against Western troops, rather than vice versa.
Chapter 3: The Physical Component

f) Combined Arms Integration

Combined arms integration is defined as the reduction of net vulnerability by ‘teaming together weapon types with contrasting strengths and weaknesses’.\(^\text{175}\)

When employed concurrently on the battlefield different weapons systems synergise to generate what are referred to as ‘complementary effects’, which are outlined below in Fig.6.

![Diagram of combined arms integration](image)

Figure 6 – FM 3-21.8 – Example of Complementary Effects – combining ‘direct fire weapons with those of mortars or artillery’ produces ‘an overall greater effect than if each were used separately’.\(^\text{176}\)

Traditionally when considering combined arms, theorists examine the interrelationship and complementary effects associated with the employment of infantry, armour, artillery, and airpower. However, given that the combat model focuses on the tactical dynamics of platoon and squad level combat, such a methodology is largely beyond the scope of this analysis.

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Instead, it will be argued that given their basic definitions combined arms and complementary effects are still utilised even within the confines of the infantry platoon. In the ‘Soldier Weapons Primer’, a white paper published by the Program Executive Office Soldier (PEO Soldier, a US government organisation responsible for rapid prototyping, procurement, and fielding of equipment) it is stated that: ‘Soldiers operate as part of a synchronized team that employs a range of weapon systems optimized for a variety of mission requirements. A typical infantry platoon will employ a combination of individual and crew-served weapons that range from rifles and grenade launchers to heavy machine guns and shoulder-launched missiles. Each weapon system has its relative merits and dedicated roles. Small unit leaders are trained to employ unit weapon systems to maximum effect for each specific mission faced’. Therefore, even within a platoon combined arms can be evidenced in the tactical employment of different weapon systems.

The standard US Army infantry platoon, as laid out in FM 3-21.8, ‘The Infantry Rifle Platoon and Squad’, is comprised of three main elements:

1. Three infantry squads each containing nine men, divided into two four-man fire teams and commanded by a squad leader. Each fire team consists of a team leader, a rifleman, a grenadier and an automatic rifleman (a squad designated marksman may be assigned if required).
2. A nine-man weapons squad which consists of a weapons squad leader, two machine gunners, two assistant machine gunners, two AMMO handlers, and two anti-armour specialists.
3. A platoon headquarters of between three and five men, consisting of the platoon leader, the platoon sergeant, the platoon Radiotelephone Operator (RTO), and optionally a forward observer and platoon medic.

The platoon is thus formed of around 40 men, and they have access to a diverse arsenal of individual and crew served weapons. The ‘Soldier Weapons Primer’ gives an overview of weapons common to US infantry platoons, which is summarised below:

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- **M9 pistol** – Issued to machine gunners and other positions, e.g., medics

- **M4 Carbine** – Leaders, riflemen, grenadiers, and anti-armour specialists

  The rifleman uses this weapon primarily to provide precision fire for point targets. It can also be used to provide limited suppressive fires.

- **MK 14 Enhanced Battle Rifle (with 10-power scope)** – Squad designated marksman

  The designated marksman provides precision support fire, engaging enemy snipers, targets that are only partially visible, crew served weapons teams at medium ranges, and rapidly moving targets.

- **M500 Shotgun** – Procured as needed

- **M203A2 Grenade Launcher** – Grenadiers

  Provides indirect fires for both point and area targets. Can fire several types of munitions to perform functions such as suppressing and destroying infantry and lightly armoured vehicles with high-explosive rounds, providing smoke to cover the squad’s fire and movement, and employing illumination rounds to increase the squad’s visibility and mark enemy positions.

- **M249 Squad Automatic Weapon (SAW)** – Automatic rifleman

  Contributes an internal base of fire with the ability to deliver sustained suppressive small arms fire on area targets.

- **M240B/L Medium Machine Gun** – Machine gunner

  Provides the platoon with medium-range area suppression at ranges up to 1,000 meters. Can be self-contained or operate with a rifle squad to provide long-range, accurate, sustained fires against infantry, fortifications, buildings, and lightly armoured vehicles.

- **Javelin Close Combat Missile System** – Weapons squad javelin gunner

  Shoulder-launched munitions provide a direct and indirect fire capability to defeat enemies within field fortifications, bunkers, caves, masonry structures, armoured vehicles and tanks, and can engage at close and long ranges.  

Combining the strengths of this diverse array of weaponry allows a force to create dilemmas for the enemy.  

A dilemma is defined as:

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‘...a situation in which the enemy is presented with two or more equally bad alternatives. A problem is a situation in which the enemy is presented with only one bad alternative. Creative combinations allow the leader to create a dilemma for the enemy. When presented with a dilemma, an enemy has two reactions. The first reaction is not knowing what to do as he attempts to decide between equally bad options. This effect is commonly termed “fixed.” When the enemy is fixed, the leader benefits from freedom of action. The second reaction is to simply choose one of the two equally bad options. Because the enemy’s choice is an option in which the friendly force has the upper hand, the leader is able to exploit the enemy’s decision’.

The basic example of such a dilemma is shown below in Fig.7.

1. Engage enemy with direct fire.

2. Engage enemy with indirect fire.

3. Engage enemy with both direct and indirect fire.

Figure 7 – FM 3-21.8 – How infantry can use two problems to create a dilemma

FM 3-21.8 states that ‘Regardless of how lethal the effects of either direct fire or indirect fire are, by themselves they only pose problems that have solutions as their effects tend to diminish. Suppose the friendly force makes contact using both direct and indirect fire systems. What can the enemy do? He has a dilemma—if he gets up he gets shot, but if he stays down, he gets blown up. The enemy’s dilemma results from the complementary effects of direct and indirect fire. This is the essence of combined arms warfare’. In the infantry platoon a dilemma can be created by combining low-trajectory weapons (M4, M249, M240) with high-trajectory weapons (M203A2, Javelin) to achieve a similar effect. It can be argued that suppression is itself a further demonstration of combined arms usage at the squad level; fire and manoeuvre tactics are heavily reliant on soldiers utilising combined arms, and the several examples covered in the previous sections all show how Western squads used machine guns or grenades to pin the enemy down/fix them in place, whilst manoeuvring to a position where accurate rifle fire could either destroy them or force them to retreat. Essentially, these insurgents were placed in a dilemma.

Combined arms is undoubtedly an important component of infantry combat even at the squad level, but there is no quantitative means via which its importance can be represented in this context. However, the utilisation of different weapons systems to provide complementary effects has been demonstrated to be a central part of contemporary forces’ approach to infantry combat. Any simulation will thus need to show evidence of combined arms employment that combines the use of different weapons systems to provide direct, indirect, and suppressive fires in order to achieve the end result.

g) Cover and Concealment

In Military Power, Biddle argues that despite its increasingly lethality, modern weaponry still requires targets to aim at and an unblocked line of flight from barrel to target. Concealment thwarts the former, as denying defenders visible targets radically reduces the enemy’s effective range, and cover thwarts the latter, by

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physically protecting the soldier from the effects of incoming fire.\textsuperscript{184} Tuck further elucidates that ‘Understanding and manipulating ‘ground’ (the lie of the land) is often crucial to success in land warfare because terrain can provide… a means of reducing the effect of enemy firepower... Exploiting terrain gives opportunities to mitigate the effects of sensors and firepower through such techniques as using cover, concealment and dispersal to reduce the ability of the enemy either to find targets or to apply combat power against them’.\textsuperscript{185}

Early in the Afghan campaign the Taliban made little attempt to utilise cover, concealment, or dispersion. ‘They typically deployed on exposed ridgelines with little effort at camouflage or concealment... the result was a slaughter’.\textsuperscript{186} At Bishqab, Taliban targets were pinpointed at ranges of more than eight kilometres, at Cobaki, observation posts were easily spotted at 1,500-2,000 meters, and at Ać’capruk, exposed combat vehicles and heavy weapons on hillsides were spotted from some four to five kilometres distant.\textsuperscript{187} In all of these instances the Taliban forces were soon obliterated by US precision airstrikes. Despite these initial defeats the Taliban and al Qaeda adapted their tactics. Fighters dispersed, sought cover and concealment, and limited their radio transmissions in engagements.\textsuperscript{188} At Sayed Slim Kalay, December 2\textsuperscript{nd}-4\textsuperscript{th} 2001, concealed Taliban counter attackers closed to within small arms range before being detected; along Highway 4, December 6\textsuperscript{th} 2001, al Qaeda defenders remained hidden and undetected among culverts and burned-out vehicles until they launched their assault; at Operation Anaconda, 2002, fewer than half the al Qaeda positions were discovered by American intelligence before small arms combat broke out on the ground.\textsuperscript{189}

In contemporary infantry combat concealment is generally more important than cover, ‘Geometrically arranged, quasi-permanent trench lines are easily surveyed from the air and permit attackers to build plans around known locations… by contrast, irregular, camouflaged locations offer superior protection by trading the

\begin{footnotesize}
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\item \textsuperscript{184} Biddle (2004), pp. 35-36, 67.
\item \textsuperscript{185} Jorden et al (2008), pp.68-69.
\item \textsuperscript{186} Bolt et al (2005), p.372.
\item \textsuperscript{187} Ibid., p.372.
\item \textsuperscript{188} Biddle (2004), p.200.
\item \textsuperscript{189} Ibid.
\end{itemize}
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cover of formal trenches for concealment’. In relation to cover and concealment in the largely rural combat encountered in areas such as Afghanistan, Biddle argues that ‘Less than two feet of net elevation difference can conceal a prone soldier… the much less regular surfaces of rural battlefields thus offer an enormous amount of potential cover… in the North German plain, more than 65 percent of the ground within 1,000 meters is invisible to a typical weapon position; in the more rolling, broken terrain of the Fulda Gap, more than 85 percent is invisible’. The mountainous terrain in the Korengal valley in Afghanistan afforded insurgent forces so much concealment that American tactics eventually evolved into patrols being sent out to ‘walk until they got hit’, since there was no other way to reliably locate the enemy. One American soldier stated that ‘I’ve never understood how they can move in and set up on us without us knowing they were there’.

Especially in urban environments, concealment allows ambushers to catch infantrymen by surprise, engage them at close range, and reduce the effectiveness of supporting fires due to the proximity of the opposing forces and complex nature of the terrain. O’Hanlon writes that ‘…in complex environments such as cities, the majority of military targets remain small and well camouflaged amidst very complex backgrounds, and often shielded from most stand-off sensors by buildings and other objects. As a result, even high-tech U.S. units in such environments will often “find” their enemies by being shot at’. Accounts from the Second Battle of Fallujah in November 2004, such as O’Donnell’s *We Were One*, provide multiple examples of close range ambushes in urban environments causing fatalities amongst Western infantry – in some cases the Western infantry did not even have time to react before being fatally wounded. The close proximity of structures means insurgent forces often have effective cover from small arms weaponry, and supporting fires cannot be employed by Western forces due to the close proximity of friendly troops. During the fighting in Lebanon in 2006, cover and concealment allowed the defenders to

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194 Catagnus *et al* (September 2005), pp.87-88.
197 Example of insurgents effectively utilising cover in Bellavia (2008), pp.205-207.
prevent the high-tech Israeli forces from ascertaining their whereabouts. ‘Israeli infantry approached to within 50-100 meters of Hezbollah fighters without spotting them; in Aytarun, tanks passed directly beneath the windows used to fire upon them without seeing the defenders first; in Bint Jubayl, defensive positions in buildings were still invisible to infantry advancing up directly adjoining streets… Movement among alternate and supplementary positions within buildings often enabled urban defenders to remain concealed even after extended firing’.198

The tactics Western soldiers used in Afghanistan (letting themselves be ambushed) demonstrates that they considered concealment to be less important than cover. They want to engage the insurgent forces, but as a force on enemy territory tied down to static forward operating bases they are only capable of doing so on the insurgent’s terms. Junger states that ‘The enemy couldn’t hope to inflict real damage on the Americans as long as they were in their bases, and the Americans couldn’t hope to find the enemy and kill them unless they left their bases’.199 The mandate of the Western forces to be proactive meant they consciously allowed themselves to be ambushed by insurgents on enemy territory; only once an ambush commenced would they seek accessible cover and concealment from nearby terrain, whilst simultaneously returning fire and calling for fire support if appropriate.200

The urban environment is comparatively more lethal to Western infantry than the rural environment largely due to the impact of cover and concealment. O’Donnell states that in Fallujah ‘The concrete and stone buildings provided excellent cover and concealment, and the strong walls absorbed coalition ordnance… Urban fighting is extremely personnel-intensive and, in terms of casualties, one of the most expensive military operations’.201 Biddle reinforces this argument,

‘...even the heaviest tank guns still have negligible effectiveness against targets in cover... solid earth of a proper thickness can stop even the M1A2’s 120-mm depleted uranium

198 Biddle (2011), pp.63-64.
201 Biddle (2011), pp.81, 196.
ammunition; the chemical-energy warheads used on antitank missiles can be thwarted by even light cover. In fact, penetrable concealment like foliage can be as effective as solid earth if it blocks the shooter’s view of the target, denying the shooter knowledge of the target’s approach or a usable aim point for engagement... targets sheltered behind slopes or hidden among the rubble of destroyed buildings are little more vulnerable to a 2001 M1A2 tank than to a 1918 Mark IV’.202

Close range urban combat also counteracts the consequences of generally inferior insurgent marksmanship, a topic that is examined in more detail in section m).

In terms of force multipliers the strongest tactical position would be for a Western force to engage in a pitched battle where they were not ambushed, but examples of this are essentially non-existent precisely because this would require insurgents to mount a conventional offensive and risk suffering excessive casualties. Since the Gulf War there is not a single example of a Western outpost or base being completely overrun by enemy forces, irrespective of the tactics the attackers employed whilst attempting to do so.

The vast majority of tactical infantry battles take place when Western forces are ambushed precisely because insurgents have made excellent use of concealment due to their familiarity with the terrain and area of operations. A central problem during these engagements is actually pinpointing the location the enemy, and helmet camera footage taken by Western soldiers shows they spend significant amounts of time simply attempting to identify enemy locations.203 Concealment thus contributes to the lengthening of engagements, as denying a force targets prevents the application of accurate direct fire, and leads to soldiers suppressing a general area. If a force does not employ cover, concealment, or dispersion – such as in the Battle of Mogadishu – it is liable to suffer a huge number of casualties in a brief period of time. Learning from their mistakes, insurgents have become highly proficient in

203 FUNKER530 (March 2012); FUNKER530 (June 2012); FUNKER530 (May 2012).
these areas of warfare, which has increased their combat effectiveness and the overall length of engagements.

Effective usage of cover also significantly increases the duration of engagements. Without employing cover, once locations had been identified battles would simply be a matter of leveraging accurate firepower. Such engagements would potentially have Lanchestrian outcomes, as the battlefield conditions would be closer to matching the assumptions that underpin the linear law (which simply do not hold in real-world scenarios). The use of cover means that even accurate fire can be deflected, and given the paucity of such fire cover is likely to be a significant contributor to engagement duration.

h) Dispersion

Dupuy’s research in *Understanding War* found that ‘the average density of troops in combat formations has increased from an average of about 10 square meters per man in ancient times, to about 27,500 square meters per man in World War II, and to about 35,000 square meters per man in the 1973 Arab-Israeli War’. This is an average density figure, and it is important to note that it does not take into account the fact that ‘troops in units are not distributed over ground space uniformly, but in patterns of varying concentration’. Nevertheless, his analysis aptly demonstrates the inexorable climb in the dispersion factor of infantry in contemporary conflicts, taking into account both increasing dispersion over wider fronts and increasing depth of formations. The question that must be answered is why do contemporary forces disperse to such a great degree on the battlefield, and what benefits does this dispersion afford?

Tuck answers this question succinctly. ‘The growing lethality of modern firepower posed an increasing challenge to the ability of modern armies to manoeuvre, resulting in the growing dispersal of forces in order to survive’. Biddle argues that

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204 Dupuy (1992b), p.84
205 Ibid.
206 Ibid – The DI, normalised to the average density of troops in ancient armies’ moves from an initial value of 1 up to 3,000 in the Second World War, and 5,000 in the 1980s.
when infantry are dispersed over a wider front and their formations assume greater depth, the lethality of modern weaponry is greatly reduced.

‘...weapon lethality, whilst increasing against all targets in absolute terms, has grown much faster against massed targets in the open...dispersion reduces vulnerability by putting fewer targets in the blast radius of any given shell, or in the beaten zone of any given machine gun. A 100-soldier infantry company advancing in a skirmish line on a 200-meter front, for example, can be wiped out by a single battalion volley from hostile artillery; dispersed over a 1,000 meter front and a 200-meter depth, the same unit might suffer less than 10 percent losses’.\(^{208}\)

Dispersion has therefore become increasingly important to the survival of infantry on the contemporary battlefield. It reduces casualties since ‘the actual battlefield effectiveness of weapons in producing casualties has been decreased by the presence of fewer targets within a given area’.\(^{209}\)

Whilst the previous example highlights the abilities of dispersed units to survive artillery bombardment, the theory is also applicable to infantry weapons.\(^{210}\) It can be argued that dispersion is a large part of the reason why, prior to its widespread adoption as a tactic, machine guns and artillery in combination proved so devastating in the First World War. The extensive German casualties at the Battle of Mons, where densely packed soldiers were mown down by rifle, machine gun, and artillery fire, provides a good example of what happens if infantry do not disperse in the face of the firepower modern forces can bring to bear; British rifle fire was so heavy that some Germans thought they were facing batteries of machine-guns.\(^{211}\)

\(^{208}\) Biddle (2004), pp.53, 36.
\(^{209}\) Dupuy (1979), p.28
\(^{210}\) Ibid., pp.54-55.
Biddle also argues that dispersion and independent small-unit manoeuvre enables cover to be used, by ‘breaking up large formations and allowing subunits to find their way forward by sprinting between terrain features. The small, irregular folds in the Earth that account for most cover cannot conceal thousand-soldier formations advancing in thick skirmish lines; to make the most of the potential inherent in the ground, small groups or even individuals must move separately…’\(^{212}\) Without dispersion it is simply not possible to properly utilise cover and concealment, or undertake operations involving small-unit manoeuvres. The large numbers of casualties sustained by the Somali militia during the Battle of Mogadishu illustrate just how devastating infantry fire can be if the enemy does not disperse. US soldiers, despite being heavily outnumbered, were able to scythe fire across dense enemy formations, and so estimates place Somali dead at a count of around 500 among more than 1,000 casualties from a fourteen hour long engagement.\(^{213}\) This battle provides an unusually pertinent example of the combined power of dispersion, cover, and concealment, as it is atypical to find a post-Gulf War example of a force so utterly inept at utilising them.

This facet of contemporary warfare has, however, disproportionately affected the conduct of Western enemies on the battlefield. In recent conflicts, Western forces alone have had the ability to employ highly lethal modern weaponry (including artillery and aircraft) against their enemies to greatly magnify the consequences of failing to implement dispersion.\(^{214}\) The destruction of Taliban targets early in the Afghan war demonstrate how a failure to disperse and conceal their forces left them extremely vulnerable to US precision air-strikes.\(^{215}\) After these initial defeats the Taliban forces rapidly implemented dispersion on a tactical level, and subsequent battles at Bai Beche on November 5\(^{th}\) and Sayed Slim Kalay on December 2\(^{nd}\) - 4\(^{th}\) saw them sustain a much stiffer resistance when attacked.\(^{216}\)

\(^{212}\) Biddle (2004), pp.54-55.
\(^{213}\) Bowden (1999), p.484.
\(^{215}\) Ibid., p.200; Biddle (Winter 2005/06), p.168.
i) Logistics

In the tactical context, logistics is defined as the capability of men to maintain adequate supplies of ‘…assets to provide the fuel, food, water, ammunition… and other materials or services required by a military at war’, in conjunction with being able to move themselves and these materials across the battlefield in a timely manner. Logistics is an important explanatory factor for the duration of infantry engagements, but whilst it does impact the tactics that soldiers can employ it is not decisive in terms of increasing combat effectiveness. In many cases, logistical issues can actually be used to explain a reduction in Western effectiveness due to the excess loads placed upon infantry.

Individual soldiers can only carry a relatively small amount of the supplies they require to wage war. Salt asserts that troops moving on foot generally have enough ammunition for only five to ten minutes of continuous firing. The US Army Center for Army Lessons Learned defines the combat load as, ‘the minimum mission-essential equipment, as determined by the commander responsible for carrying out the mission, required for Soldiers to fight and survive immediate combat operations’. When on operations expecting engagement with the enemy, the soldier’s march load should be limited to 72lbs (32.7kg), and his fighting load when expecting imminent engagement 48lbs (21.8kg). However, Murray asserts that in recent conflicts soldiers have often been patrolling with up to 100kg loads, and fighting with up to 60kg. He argues that Western soldiers carrying such loads have a hard time employing fire and manoeuvre tactics effectively against light-footed insurgents who carry only a rifle and a few magazines, as they struggle to catch their adversaries. This helps to explain why insurgents are so successful at disappearing once they decide to withdraw, and also feeds into the usage of large amount of ammunition for suppression which was examined in section d), as soldiers struggling under such a burden unsurprisingly tend to over-rely on volume of

219 Ibid., p.11.
220 Ibid., p.7.
221 Murray (2013), pp.277-278
222 Ibid., p.278
firepower from a fixed location, rather than swift manoeuvre.\textsuperscript{223} This ultimately leads to engagements which are frequently indecisive, despite lopsided casualty levels, as Western forces are unable to actually eradicate the enemy threat.

Such observed behaviour highlights a discrepancy between doctrine, training, and reality. Whilst the power of fire and manoeuvre is understood by Western forces, it would appear that the logistical realities of the combat environment sometimes lead to fatigued/overburdened soldiers implementing suboptimal tactics. It is important to recognise that this is not uniformly true. During Operation Serval, which took place in Mali between January 2013 and July 2014, the French military utilised small and light forces moving at pace to achieve strategic surprise and place the enemy on the back foot; they consistently acted faster and with greater audacity than their opponents expected, although their pace did strain men and machines, as well as pushing the boundaries of their logistical supply systems.\textsuperscript{224} Such examples demonstrate that different Western forces do not always take the same approach, and that the context of the conflict also impacts on the tactics used.

The fact that each individual soldier carries such a limited amount of ammunition (210 rounds for the average rifleman, and 800 rounds for the squad automatic rifleman) is a key factor in relation to the duration of infantry engagements.\textsuperscript{225} Helmet camera footage shows just how quickly soldiers can deplete their ammunition when employing suppressive fire, as in one ten minute engagement a SAW gunner shoots over 500 rounds, and then states that he will only continue shooting if the enemy location is positively identified due to his reduced capacity.\textsuperscript{226} Whilst many videos available via various media outlets do show high volumes of intense fire, most battles consist of comparatively short periods where this is the case. It is natural for videos and other subsequent accounts to focus on the periods of action against the enemy, rather than on the more mundane aspects of soldiering, as this is what the audience is interested in. Even during the aforementioned video most of the US soldiers appeared to spend their time under cover only sporadically firing

\textsuperscript{223} Ibid.
\textsuperscript{224} Shurkin (2014), p.9.
\textsuperscript{225} U.S. Army Center for Army Lessons Learned, Task Force Devil Combined Arms Assessment Team (Devil CAAT) (2003), p.7.
\textsuperscript{226} FUNKER530 (March 2012)
shots towards the general direction of the enemy, and this pattern is repeatedly demonstrated in many other videos.\textsuperscript{227} The majority of time, even in intense engagements, is spent manoeuvring, considering tactical options, and taking cover.\textsuperscript{228} When soldiers are planning and taking cover, minimal fire is necessary other than that required to maintain dominance of the nearby area. If neither side is moving or trying to accomplish a goal then any significant volume of fire essentially becomes wasted ammunition and serves no purpose.

Ammunition is clearly a matter of constant concern for soldiers, regulating both their actions on the battlefield and how long they can engage with the enemy. This is likely a contributing factor to why most engagements last a maximum of 14 hours; one side or another will run short of readily available ammunition. Smith argues that these constraints are particularly problematic for insurgents who often employ fully automatic fire whilst lacking fire discipline.\textsuperscript{229} Additionally, the less ammunition soldiers have, the more inclined they are to preserve their current supply. When defending a firebase stocked with thousands of rounds soldiers can essentially fire as much as they want, but if mounting an operation behind enemy lines usage is necessarily more conservative, as running out would render them completely combat ineffective. If both sides face the prospect of limited ammunition then this will tend to increase engagement duration, as soldiers are less inclined to go on the offensive given that it generally takes less ammunition to defend a position than to assault one. Sitting under cover in a location where you are immune to enemy fire requires minimal expenditure, and is thus a position which can be maintained for significant amounts of time (although low ammunition may not be the only reason for taking such a stance, as fear or loss of cohesion could also lead to such an outcome).

Not knowing the enemy’s level of supply is also likely to promote a defensive stance, as erring on the side of caution is preferable to making potentially fatal miscalculations based on faulty assumptions of enemy logistics. Careful conservation of ammunition when supplies begin to run low also explains why it is rare for logistical problems to be decisive; only in extraordinary circumstances do

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\textsuperscript{227} FUNKER530 (July 2013)  
\textsuperscript{228} Anonymous Interview 02 (2014)  
\textsuperscript{229} Ibid.
\end{flushleft}
forces run completely out ammunition. One example of such an occurrence took place in the Second Gulf War in 2003, when six British Royal Military Police soldiers were trapped in a police station in the town of Majar al-Kabi by an enraged mob. Surrounded by around 1,000 Iraqis and separated from their radios – meaning that they could not contact reinforcements – the soldiers were killed after a 90 minute battle when they eventually depleted their ammunition.\footnote{Burke (2003); Blair (2003).} Such examples are extremely rare, and are almost always the result of one force being entirely surrounded by another; when ammunition is low, one force will inevitably disengage rather than risk the total collapse of their combat effectiveness.

Generally, Western supply lines are based around ground based vehicular movement linked to bases that contain large stockpiles of ammunition and other resources. When they have access to their mechanised supply lines, or they are in their bases, infantry essentially do not have to worry about logistical concerns. However, if infantry stretch these lines then resupply vehicles can become viable targets for enemy attacks whether through ambushes or IEDs. If Western infantry stray completely outside these lines they can be resupplied by air, but there are a number of risks associated with this approach. At Gowardesh in Afghanistan an engagement that took place on 21st June 2006, and this was caused by a resupply drop giving away the position of American troops, who after only three days could no longer continue to operate without additional supplies of food and water.\footnote{Wright (2012), pp.4, 9, 10-11.} Aerial resupply carries the risks of enemy forces ascertaining the exact location of troops, appropriating the supplies for themselves, or attacking helicopters, which are particularly vulnerable to incoming fire when landing or taking off.\footnote{Bingham/Harding (2009).} Western forces thus have an undeniable logistical advantage if they have access to mechanised resupply and are in their bases, but when on patrol in the mountains of Afghanistan they are limited largely to what they can carry.

The basic materials needed to wage war including food, water, weapons and ammunition appear to be readily available to Western enemies even in remote
locations in Afghanistan. The enemies of Western forces in Iraq, Afghanistan, and Lebanon have relied on utilising small caches of materials that are hidden across the battlefield in predetermined locations. There are numerous examples of Western forces finding houses filled with weapons, and in one instance, a seemingly innocuous ice cream truck was filled with war material. The downside of these caches is that they contain only the most basic of equipment. On closer examination it was noted that the rifles were in poor condition, with components frequently damaged or missing, and that the ammunition was often mismatched, old, and corroding, which would compromise the accuracy of the weapons. Thus, whilst insurgents do have access to basic equipment, lack of large-scale organised resupply means that it may be abundant, but it is also low quality. There are advantages to the approaches used by both sides, but when either side is on the defensive they should have relatively easy access to their supplies.

The ability to move combat forces rapidly to where they are needed is a valuable logistical asset. In recent conflicts this advantage has been predominantly available to Western forces, as large-scale ground based vehicular movement is highly susceptible to artillery and aerial firepower, which only they have possessed. Western forces have infantry specifically tasked as a Quick Reaction Force (QRF), and advanced communications technology carried by soldiers mean that they can be summoned as soon as an engagement begins. For example, during the Battle of Wanat, the QRF platoon left their base 45 minutes after the initial call to action in four High Mobility Multipurpose Wheeled Vehicles (HMMWVs), and arrived at the scene of the engagement after 45 minutes travelling. When they arrived the battle was still in progress, and the QRF reinforcements brought extra manpower and ammunition to the beleaguered contingent of coalition soldiers who had been defending the position. The ability to transport infantry forces efficiently can

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233 Junger (2010), p.55, - Nearly 1/5 of the combat experienced by 70,000 NATO troops in Afghanistan was being fought in the Korengal Valley.
235 Chivers (2010b).
236 O’Hanlon (2013) points to ‘tank plinking’ that was developed in the Gulf War; a process of using laser guided munitions to destroy enemy ground vehicles.
239 Ibid., p.199.
feasibly confer the capacity to execute impactful manoeuvre warfare tactics, and promptly delivering soldiers to the decisive area of the battlefield has the potential to immediately change the course of an engagement, both reducing its length and increasing the effectiveness of the reinforced side.

Logistics is an aspect of contemporary infantry combat that Dupuy defines as ‘sometimes calculable’, as its impact on combat effectiveness is not easily quantified. In general, logistical issues force soldiers to measure their fire, keep track of ammunition throughout an engagement, and modify their tactics based on the current situation, which ultimately appears to lead to a reduction in combat effectiveness. Theoreticians are yet to ascribe any solid numbers to this phenomenon, but Murray highlights it as a cause of great concern for contemporary forces given its negative effects. Logistics has a far more significant contribution in terms of increasing the duration of engagements. Duration of any engagement depends on the current availability of ammunition as well as the potential for resupply, and cautious soldiers with low supplies are far more likely to adopt a defensive approach.

j) Numerical Preponderance

In Military Power, Biddle convincingly argues that numerical preponderance is not a decisive factor in contemporary infantry combat. He contends that ‘Modern weapons are so lethal that exposed, non-modern-system forces become cannon fodder. For numbers to tell requires modern-system force employment’. There are numerous examples ranging from the First World War to the Iraq war that can be employed to support this theory. The subsequent examples have been selected as they represent extreme situations in which if numerical preponderance was a decisive factor then its impact should certainly be discernible:

i. During the German defence of Mametz on July 1st 1916, a single strategically placed German machine gun directly accounted for the deaths of nearly 160

allied soldiers attempting to assault its position.242

ii. On Sunday 3rd October 1993 Task Force Ranger, consisting of 160 US soldiers, attempted to abduct two lieutenants of a Somali warlord in the city of Mogadishu.243 The mission was supposed to last an hour, but the US forces became stuck in heavy fighting as two of their MH-60 Black Hawk helicopters were shot down.244 The US forces left the city seventeen hours later having suffered casualties of 18 men killed and 84 wounded.245 Despite being surrounded by thousands of enemy troops and having limited access to supporting fires, this small US force survived a substantial length of time in a completely hostile environment whilst only suffering the loss of 18 men and inflicting far heavier casualties on the enemy.246

iii. During the War in Afghanistan, on the 21st June 2006 at Gowardesh, a small squad of 16 US soldiers on a mountain ridge were taken by surprise as an insurgent force estimated to be 50-70 strong assaulted their position.247 The insurgent forces established two support-by-fire positions, and then assaulted the US position from three directions before being eventually forced to retreat when US fire support was brought to bear.248 After 60 minutes of combat two US soldiers were dead and one was wounded, in contrast to the estimated 26 insurgent dead and 17 wounded.249 The insurgent forces, despite their advantageous numbers and tactical position, sustained much heavier casualties.

iv. Between Friday 22nd and Sunday 24th March 2013 around 200 South African soldiers fought a series of running battles outside Bangui in the Central African Republic against a well-armed Seleka force of between 4,000 and 7,000.250 The fight cost 13 killed and 27 wounded, but the force maintained cohesion and was able to fall back to its base from two separate engagement areas and hold

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243 Bowden (1999), pp. 16, 18.
244 Ibid., p.484.
245 WGBH Educational Foundation (1998)
246 Ibid.
247 Ibid., pp.1, 15.
248 Ibid., pp.13, 16, 21.
249 Ibid., p.18, pp.1-22.
out until the attackers gave up trying to overrun them; eventually a ceasefire was offered. Estimates from officers and Non-Government Organisations (NGOs) suggest the Seleka forces suffered as many as 800 killed.\textsuperscript{251}

These examples directly contradict Lanchester’s square law, which posited that numerical preponderance has more effect on the outcome of combat than combat effectiveness – this is clearly not the case in any of these engagements.\textsuperscript{252} Whilst the linear law places less emphasis on numerical preponderance it does not take into account the effect of cover, as well as being unable to deal with the employment of direct and indirect fires in concert.\textsuperscript{253} Regardless of which law is applied the huge asymmetry in observed casualty levels in these examples does not sit well with formulas underpinned by assumptions that give precedence to the size of a force. Lepingwell aggregates several historical examinations of Lanchester’s laws and argues that neither law appears to model real-world combat dynamics with any accuracy, and the above examples also appear to refute Lanchester’s overly simplistic equations.\textsuperscript{254}

Modern theoreticians argue instead that ‘In practical terms, armies that cannot reduce their exposure cannot compensate by saturating their opponent’s firepower with sheer numbers... even very preponderant forces cannot survive long enough to make their numbers tell’.\textsuperscript{255} In combination these examples show that a comparatively small force which is heavily outnumbered, at a significant tactical disadvantage, and even taken by surprise can still emerge tactically victorious and cause the enemy significantly greater casualties. Numerical superiority cannot be a decisive factor in determining the outcome of tactical infantry engagements, otherwise in extreme circumstances such as these the numerically superior forces would have prevailed.

\textbf{k) Technology}

This section will assess the impact of technology on the battlefield by examining how it enhances three fundamental aspects of infantry combat – i) weapons lethality,
ii) systems to protect combatants and reduce the lethality of enemy weapons, iii) command and control. It will argue that whilst Western forces possess undeniable technological advantages at the platoon level, this is not in itself decisive, and does not explain the one-sided nature of infantry engagements in recent conflicts.

i) Lethality
The weapons wielded by Western enemies, especially in conflicts since the Gulf War, are almost exclusively from the Soviet era. The AK-47 or AK-74, the RPK light machine gun, and RPGs, known as the Rocket Propelled Grenades, all see widespread usage and are renowned for their reliability and ease of operation.\footnote{In almost every account utilised in this chapter thus far the insurgent forces have been armed almost exclusively with the AK-47, RPK and RPG; Kahaner (2006); Chivers (2010c); Morgan (2010).}

Although there are many variants of the original AK design, which was developed after the Second World War, the weapon has remained fundamentally unaltered for over 60 years; the 7.62 calibre cartridge fired by both the AK and the Dragunov sniper rifle was first utilised at the end of the 19th century by the Russian Mosin-Nagant bolt action rifle, and has remained essentially unchanged ever since.\footnote{Terminal Ballistics Research (2011)} The Dragunov and various types of home-made IEDs are less common, but still encountered reasonably frequently; in the rare cases where it is available, fire support appears limited almost entirely to indirect fire supplied by mortars.\footnote{J. Meyerle/Malkasian (2009), pp.26-30, 54, 97-100.}

Essentially, the weaponry utilised by insurgents has seen no major technological advancement for over half a century.

Although the weapons employed by Western infantry (outlined in detail in the combined arms section) have been developed more recently, various critics argue that the general trend of employing 5.56 calibre ammunition has actually reduced overall lethality, since it has limited range and stopping power in comparison to the larger 7.62 calibre. PEO Soldier state that systems utilising 5.56mm ammunition cite ranges of 500-550 meters, whilst systems with 7.62mm cite ranges closer to 800 meters.\footnote{Defense Industry Daily Staff (2013); Bowden (1999), pp.76, 305-306; Ehrhart (2009), pp.23-32; Program Executive Office Soldier (2011), p.4.}

With the introduction of the new M855A1 Enhanced Performance Round in 2010 the US army sought to increase performance and redress some of the shortcomings identified in previous bullets, but this development was not in place.
during the Iraq or Afghan conflicts, and ‘to say that one round is better than the other depends ultimately on the target set and the range’.  

Although effective ammunition is a prerequisite for success on the battlefield, even well trained soldiers ‘…can only consistently hit a human-size target more than 300 meters away 50 percent of the time or less on a qualification range. The numbers are significantly lower when a soldier is operating in high stress environments’.

The most notable area of technological disparity in relation to weaponry is the ubiquitous usage of optical devices in Western forces. Whilst the presence of enemy snipers on the battlefield would suggest that some enemy combatants possess scoped weapons, it is clear from many front line accounts that the vast majority of enemy forces do not have scopes, and are limited to aiming via iron sights. Particularly noteworthy for their contribution to squad based combat are Night Vision Devices (NVDs), which extend soldier capacity by allowing them to continue accurately targeting enemy forces in near total darkness, providing obvious advantages in night time engagements. PEO Soldier states that ‘Though their significance is often overlooked, optics, sensors, and lasers are true combat multipliers in that they allow for quicker engagements, increased probability of a first round hit, and better accuracy to make a force more lethal’.

ii) Systems to protect combatants and reduce the lethality of enemy weapons
Most Western soldiers in recent conflicts have been equipped with body armour for their personal protection, and this can essentially be defined as ‘man-portable cover’. Although there are no solid statistics as to the number of lives body armour has saved in recent conflicts, there is a huge catalogue of circumstantial evidence substantiating its ability to save lives. One article states that by mid-2003 it was probable that body armour had saved 25 lives in Afghanistan – to give this figure some context, by June 2003 117 coalition troops had been killed in the Afghan campaign, meaning that the death rate would have potentially been over 17% higher.

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Body armour keeps infantry alive and directly reduces the lethality of enemy weapons fire. Armour and helmets protect the most vulnerable parts of human anatomy, meaning that when an armoured section of the soldier is hit he will be unscathed. In examples such as the Korengal Valley ambush, as described by Junger in section e), if ‘every man took a bullet’ then armour must have been a factor in the resultant fatality mismatch. Even if soldiers are wounded, bandages and morphine can allow them to continue fighting, given that wounds are far less likely to be critical as vulnerable areas are protected. It can potentially take many hits to actually bring down a soldier equipped with such defences. Western infantry therefore have a direct and effective method of reducing the lethality of enemy small arms fire, and enjoy a significant advantage over their deficient opponents who have extremely limited access to armour, and are thus far more likely to be badly wounded as a result of taking hits.

Advancements in medical technology serve alongside body armour in reducing weapon lethality by keeping Western soldiers alive and combat effective, even after they have been hit. Fundamental lifesaving tools such as bandages and tourniquets are readily available, meaning that minor wounds can now be dealt with quickly and effectively whilst on the field, and badly wounded soldiers are given initial care by medics then ferried by plane to more advanced facilities away from the front lines. Enemies of Western forces in recent conflicts have not had this medical technology available to them, meaning that any wounds sustained are far more likely to be fatal in both the short and long term. Although there is no statistical analysis that can verify this claim, since almost no information exists regarding wounded insurgents, logic and historical precedent dictate that a lack of proper medical care greatly increases the likelihood of fatalities once wounds have been sustained. Furthermore, advanced Western medical facilities allow gravely wounded soldiers to survive injuries that would have killed them at any other point during history, increasing the proportion of wounded to killed and reducing the overall number of observed

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263 Garamone (2003); Dawson (2007); Equipment and Logistics News (2010); Wilkinson (2009); iCasualties.org (2015).
264 There are some example of insurgents actually possessing body armour. However, these men are considered to be foreigners rather than local guerrillas due to their advanced tactics and equipment, which are both rarely encountered in Afghanistan – Naylor (2009).
fatalities.\textsuperscript{266}

\textbf{iii) Command and Control}

Each infantry squad in contemporary Western forces is equipped with a radiotelephone and a dedicated operator, and since the Iraq War there has been an increasing drive to provide each individual soldier with communications equipment such as the Personal Role Radio (PRR).\textsuperscript{267} This equipment directly enhances the ability of infantry squads to co-ordinate their actions in combat as they are no longer limited by line of sight, and also provides both junior officers and NCOs with the ability to request immediate fire support. In contrast, such equipment is scarce in enemy forces. Insurgents are usually limited to using mobile phones and Soviet era radios that Western forces can frequently eavesdrop on due to their technological superiority.\textsuperscript{268} It is essentially not possible for enemy squads to communicate effectively with each other outside of audible range, and this limitation means that they have no option but to operate independently, precluding the co-ordination of assaults (on small and large scales) and the proper implementation of tactics requiring multiple squads.\textsuperscript{269} A Canadian study on behalf of the Department of National Defence concluded that despite having some drawbacks in relation to ease of use and reliability ‘small unit radio enhanced the successful transfer of information in a timely manner, better coordinated attacks within a Section and within Platoon, increased flow of communication, increased mission tempo, improved ammunition consumption as a result of more effective fire control, improved cueing of indirect fire support resulting from the faster dissemination of information, and increased individual and collective situational awareness’.\textsuperscript{270}

Communications also allows individual squads to report their situation directly to superiors in the command chain. Whilst the effect communications have on the

\textsuperscript{266} Fischer (2015).
\textsuperscript{267} Eward (2012), pp.48-52.
\textsuperscript{268} The most effective insurgent tactic is to use word of mouth, as Western forces can spy on any other forms of communication – Anonymous Interview 01 (2012). Headquarters, Department of the Army (2007), p.1-12.
\textsuperscript{269} Memoirs such as Bellaiva (2008) and O'Donnell (2007) would support this view. There is no evidence to suggest that groups of insurgents who ambushed Western soldiers had any systematic communications other than word of mouth, and they never demonstrate the usage of squad tactics beyond the most basic level.
\textsuperscript{270} Tack/Nakaza (2005).
operational and strategic levels of warfare is largely beyond the scope of this chapter, they are a crucial tool to promote the flow of information on the battlefield, which should theoretically lead to high command being able to make effectual decisions on the operational and strategic levels.271

It is also important to recognise that even with radio communications it still takes a significant amount of time to plan and organise actions if they are to be co-ordinated properly. Significant time is spent planning prior to entering the engagement zone. Soldiers who are not directly engaged but are on the battleground are required to communicate with nearby friendly troops and high level command, so that a correct appraisal of the situation can be made if a threat were to emerge. Video footage taken during the midst of firefights shows soldiers taking cover and using a combination of voice and radio communication to organise, issue commands to, and maintain co-ordination with nearby elements.272 Since these actions cannot be taken whilst firing at the enemy soldiers frequently take cover purely to communicate with their comrades. The duration factor cannot be satisfactorily explained without an appreciation of the time spent organising and communicating during engagements.

Unfortunately, providing exact numbers to support this assertion is a difficult task. Footage from the front lines is often skewed to show engagements in the midst of combat, and this topic is not covered in detail in soldiers’ written testimonies. Accounts such as those of Corporal Jake Scott clearly show that a great deal of communication takes place between soldiers; “Contact Left!” I shouted as I took aim and squeezed off two 5-round bursts… This battle had only just begun. We had got through the second contact area, again unscathed… This was supposed to be an area where we could now slow things down, find out exactly what was going on both here and at A Company’s location and then establish a plan on what to do next’, however, the length of time these actions take is never specified.273 A close examination of Scott’s testimony shows that the soldiers spent at least several

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271 The impact of communications between units and higher command is discussed in Anderson/Garfinkel (2004), pp.1-2.
272 FUNKER530 (August 2014).
minutes attempting to establish the whereabouts of the enemy and organising their response before they were interrupted by further incoming fires.\textsuperscript{274}

iv) Conclusions

This section has demonstrated that infantry weapons lethality has not radically changed in recent years; although Western forces have an undeniable advantage there is no identifiable causal link to connect the comparatively recent changes in battlefield outcomes directly to the weapons soldiers are employing. As PEO Soldier argues, advanced weaponry and ammunition is of secondary importance when compared to whether a soldier can actually hit the target to begin with.\textsuperscript{275} Body armour reduces the lethality of enemy small arms fire, and medical technology increases the probability of wounded soldiers surviving injuries, but these fundamentally defensive advantages reduce the overall number of Western soldiers killed, and do not serve to explain the excessive numbers of casualties sustained by enemy forces. Radio communication tools allow soldiers to reach their full combat potential. Whilst advanced technology has been an important catalyst for change on the battlefield it is not a silver bullet, and extensive research into the arguments surrounding all aspects of technological advancement has not revealed any theorists who argue that technology is the primary reason for the observed asymmetry. In terms of duration, whilst a large enough technological disparity – such as swords versus machine guns – would lead to short one-sided engagements, such a disparity has not been witnessed in any recent conflicts. Therefore, similarly to the conclusions reached above, technology has not in itself decisively impacted upon the duration of infantry engagements.

\textsuperscript{274} Ibid., p.109-11.
\textsuperscript{275} Program Executive Office Soldier (2011), p.5.
Chapter 4: The Conceptual Component

I) Doctrine and Tactics

This section will argue that there has been a demonstrable disparity in the comprehension and implementation of effective doctrine and tactics between Western forces and their enemies in recent conflicts, and that this has contributed to the asymmetry of casualties reported from the battlefield. Doctrine is defined as the fundamental principles by which the military forces guide their actions in support of objectives, whilst tactics are defined as the techniques for using weapons or military units in combination for engaging and defeating an enemy in battle. The implementation of effective doctrine has also helped to reduce the length of engagements, as one of the intentions of modern tactics is to promote movement in order to defeat the enemy as quickly as possible. Whilst chapter 5 will fully evaluate the synergistic relationship between the different factors that have thus far been considered, a complete discussion of doctrine cannot take place without also referencing a number of factors already covered in the combat model. The discussion in this section will not seek to evaluate their relative importance, but will instead focus entirely on illustrating the relationship between other factors and military doctrine.

Western forces collect their information relating to doctrine and tactics in field manuals, the US army for example has over six hundred in current circulation relating to every aspect of warfare.276 FM 3-21.8 ‘The Infantry Rifle Platoon and Squad’ begins by stating that:

“The mission of the Infantry is to close with the enemy by means of fire and maneuver in order to destroy or capture him, or to repel his assault with fire, close combat, and counterattack... To perform this role, each type possesses two distinguishing qualities. First, Infantry are able to move almost anywhere under almost any condition. Second, Infantry can generate a high volume of lethal well-aimed small arms fire for a short time in any direction. Neither movement nor

fire are exclusively decisive. However, combined fire and movement win engagements.\textsuperscript{277} The proper employment of fire and manoeuvre is thus one of the central tenets of infantry combat, and Junger argues that ‘The choreography – you lay down fire whilst I run forward, then I cover you while you move your team up – is so powerful that it can overcome enormous tactical deficits’.\textsuperscript{278} To demonstrate this, the tactical nuances of an engagement referred to in section e) will be examined. Junger’s description of how the US squad in the Korengal Valley was ambushed makes clear that the enemy had the tactical advantages of surprise, concealment, and numerical preponderance. They had set up a well organised L-shaped ambush, a valid ambush tactic that can be found in FM 3-21.8, and an outline of the assault is shown below:\textsuperscript{279}

\textit{Figure 8 – Battlescape of an L-Shaped Ambush.}\textsuperscript{280}

\textbf{Legend}

\begin{itemize}
  \item U.S. Army Soldier
  \item Anti-Coalition Militia
  \item Wounded U.S. Army Soldier
  \item Movement
  \item Incapacitated Soldier
  \item HQ: Platoon Headquarters Element
\end{itemize}

\textsuperscript{277} Headquarters, Department of the Army (2007), p.1-11.
\textsuperscript{278} Junger (2010), p.120.
\textsuperscript{279} Headquarters, Department of the Army (2007), p.7-28.
\textsuperscript{280} Army.mil Features (n.d. a).
The six US infantrymen came under fire at point blank range from an enemy behind cover armed with a combination of arms including AK-47s, RPGs, and RPKs, and two soldiers were wounded almost immediately. However, despite the advantages possessed by the insurgents, the US soldiers – impervious to the potentially debilitating impact of shock and surprise – immediately attempted to suppress their attackers whilst applying fire and manoeuvre tactics. They pushed forward whilst throwing hand grenades, and sprinted through the blasts. This immediate employment of fire and manoeuvre tactics is one of the central reasons the US soldiers succeeded in overcoming this uncommonly well-implemented insurgent ambush, allowing the ambushees to drive back the ambushers. The fact that in this case the Taliban lost the engagement, although two US infantrymen were killed for only one confirmed Taliban casualty, concurrently demonstrates both the proficiency of the US soldiers as well as the ineptitude of the Taliban in terms of successfully executing assaults. The potential lethality of such an ambush was aptly demonstrated a year later in an almost exact reversal of this situation, when ‘several squads of American soldiers conducted an identical L-shaped ambush at night on the Abas Ghar and wiped out a column of Taliban fighters – nearly twenty men.’

Biddle contends that to take advantage of cover and concealment on the battlefield requires small dispersed groups of soldiers, who attempt to move forward unobserved by sprinting from cover to cover on the basis of the vagaries of the ground. Suppressive fire is then employed ‘to keep them from being annihilated by enemy fire on route. The resulting techniques... [are] a standard movement method for infantry’. It is important to identify suppression and surprise and shock as techniques used by infantry to defeat their enemies – therefore, they are in essence subdivisions of the overarching concept that is tactics.

Dilemmas are a doctrinal objective which describe how an infantry squad should manipulate their enemy’s actions, and fire and manoeuvre is the tactic then used to exploit the enemy’s decision and destroy their forces. This is fundamental to

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283 Army.mil Features (n.d. b).
284 Junger (2010), p.120.
effective ‘small unit independent maneuver’ which Biddle included as part of his force employment theory (outlined in the introduction to the combat model). He also points out that for social and political reasons in many enemy forces commanders are unwilling to allow junior officers and senior personnel the freedom of autonomous decision making required to effectively implement small unit independent manoeuvre, which can greatly impede their ability to utilise this tactic.\footnote{Biddle (2004), p.49.}

There are many cases of dilemmas being faced on the battlefield which go beyond the particular examples highlighted in the combined arms section. Bellavia describes how in the Battle of Fallujah his squad faced a serious tactical dilemma whilst clearing buildings after finding an IED. ‘If we’re to treat each house as if its booby trapped, we’ll go in cautiously. In house-clearing, confidence and quickness are absolutely vital. If we hesitate, if we methodically search for booby traps, we hand the initiative to any insurgents who may be in the house’.\footnote{Bellavia (2008), p.127.} The dilemma forced the soldiers to pick one of the two approaches when either could have proved deadly. In the same battle, O’Donnell describes a different dilemma, this time faced by the insurgent forces. Insurgents inside a building attempted to bait US Marines into entering so that they could destroy the entire structure with an IED. However, the US forces instead elected to destroy the building themselves with satchel charges; in this case insurgents faced the dilemma of either leaving the building, and being shot by the Marines, or staying inside, and dying as charges brought the house down on top of them.\footnote{O’Donnell (2007), p. 149.}

In combination, creating a dilemma and then manoeuvring to attack the enemy flank can generate considerable tactical benefits, taking advantage of a multitude of factors which have previously been discussed. Combined arms dilemmas split enemy attention and place soldiers in an untenable position, suppressive fire is employed with enhanced effect as bullets travelling along a defended line have a greater suppressive effect on more men, and soldiers have an innate psychological

\footnotetext[286]{Biddle (2004), p.49.}
\footnotetext[287]{Bellavia (2008), p.127.}
\footnotetext[288]{O’Donnell (2007), p. 149.}
dislike of being attacked from directions which increase their vulnerability.²⁸⁹

Battles which took place in the Falklands War provide good examples. When attacking Mount Longdon on 11th June, 3 Para employed a frontal assault against Argentine defenders equipped with a mix of rifles, .50 calibre and 7.62mm machine guns – 18 men were killed and 40 wounded, for the deaths of 40 defenders and another 40 being captured.²⁹⁰ Attacking Mount Harriet on the same night 42 commando successfully flanked the enemy forces, killing 20 defenders and capturing nearly 300 for the loss of only two men and 26 wounded.²⁹¹ Murray argues that when used to maximum effect flanking tactics result in offensives that are between seven and twelve times more effective than purely frontal assaults, with the attackers in general suffering one-third or less of the casualties suffered by the defenders.²⁹²

Another tool to create dilemmas on the contemporary battlefield (which is largely beyond the scope of the model, and so will only be considered briefly) is effective employment of fire support from artillery and aircraft. These supporting fires can place known enemy locations in an untenable position, as was the case for Iraqi forces in the First Gulf War. Fire support successfully suppressed Iraqi defensive positions until coalition troops could close to within 200-300 meters, meaning that they would be on top of the Iraqi positions and ready to engage with direct fires as soon as the supporting barrage ceased.²⁹³ Additionally, if soldiers remained in their easily detectable defensive emplacements they suffered from large-scale artillery bombardments which defeated them by a process of attrition, destroying a large proportion of the defending tanks and artillery.²⁹⁴ These examples demonstrate that the dilemma is a fundamental doctrine in contemporary warfare, and is utilised beyond the context of the infantry battle.

In contrast, the enemies of Western forces do not have a coherent and codified operational doctrine for soldiers to uniformly follow. Fighting styles displayed by

²⁹⁰ Ibid., pp.231-232.
²⁹¹ Ibid., pp.232-233.
²⁹² Murray (2013), pp.234-237
enemy combatants reflect their differing social and military contexts, as well as the extent of their training. Western methods of fighting are predicated on the intent to destroy enemy forces whilst keeping friendly forces alive; however, martyrs developed distinctive ambush techniques which reflected their own personal philosophy.\textsuperscript{295} In Fallujah they adopted hiding places to engage American soldiers at very close range; one Marine described them as ‘kind of like spiders: they waited for the perfect shot, our faces or necks, since our body armor and Kevlar [helmets] protected our bodies…’.\textsuperscript{296} These insurgents would ‘…wait for the last two inches of the door to open up before pulling the trigger, just to have the chance to take one or two Americans out…’.\textsuperscript{297} Effective use of cover and concealment in the urban environment allowed the insurgents to ambush them at close range. This accomplished two goals; firstly, Western forces were prevented from leveraging their technological advantages, and secondly, the negative effects of poor insurgent marksmanship (discussed in more detail in section m) were reduced.

If a large proportion of insurgent forces employed these tactics they would likely cause additional casualties to Western forces, but there would also be very few fighters left afterwards to continue a protracted campaign. The majority of insurgent forces do fight with more conventional styles, but since there is no uniformly distributed doctrine each regional force encountered conducts themselves according to their own precepts. This makes insurgent tactics difficult to categorise, since they can be extremely variable on a case by case basis. This total lack of prior doctrinal understanding is a key factor in explaining why Western enemies in recent conflicts have achieved highly variable degrees of battlefield success.

When employed effectively, fire and manoeuvre tactics serve to reduce the length of infantry engagements. First implemented on a wide scale during the First World War they were instrumental in moving battles away from the attritional mass advances which had led to such devastating casualties early in the conflict.\textsuperscript{298} Contemporary Western forces, well trained in how to employ them, have repeatedly proven them to be highly effective whilst demonstrating that an inherent part of their effectiveness is

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{295} Catagnus et al (September 2005), p.81.
\item \textsuperscript{296} O’Donnell (2007) p.87.
\item \textsuperscript{297} O’Donnell (2007) p.192.
\item \textsuperscript{298} Biddle (2004), p.30-33.
\end{itemize}
\end{footnotesize}
the capability to end an engagement quickly, reducing the likelihood of taking friendly casualties. In most recent battles their opponents have not demonstrated such proficiency.

The 2006 Lebanon campaign is employed by Biddle as an atypical example. The enemy force, Hezbollah, demonstrated sound doctrinal understanding, ‘the biggest divergence between Hezbollah’s methods and those of modern Western militaries may well be Hezbollah’s imperfect proficiency of execution rather than the doctrine they were trying to execute’.299 One of the primary reasons Hezbollah soldiers held their own against the Israelis was precisely because they had a solid grasp of military doctrine, and overall they ‘inflicted more Israeli casualties per Arab fighter in 2006 than did any of Israel’s state opponents in the 1956, 1967, 1973, or 1982 Arab-Israeli interstate wars. Hezbollah’s skills in conventional war fighting were clearly imperfect in 2006—but they were also well within the observed bounds of other state military actors in the Middle East and elsewhere, and significantly superior to many such states’ 300

Previously examined ambush examples from Afghanistan indicate that some insurgents did have a reasonable understanding of doctrine and tactics, whilst in other cases they were overwhelmed whilst mounting futile assaults on well-defended Western positions; ‘On August 8 2007… a group of approximately seventy Taliban Insurgents launched a rare frontal assault on a U.S. forward operating base known as Firebase Anaconda. In the ensuing attack, which was described as “brazen,” more than two dozen Taliban were killed while the United States sustained no casualties’.301 After the attack Combined Joint Task Force-82 spokesman, Army Major Chris Belcher, stated that ‘The questionable tactics of the extremist Taliban leaders continued today… [This] highlights their ineptitude and explains why they absorb heavy casualties each time they attack this coalition firebase and its outposts’.302

300 Ibid., pp.76-77.
301 Williams (2011), p.78.
Ultimately, constantly changing tactics demonstrate that different methods of fighting are being continually developed by soldiers; they employ ‘a toolbox of tactics and techniques’ in order to respond to the situation at hand appropriately.\textsuperscript{303} Although both Western forces and their enemies have exhibited this ability to adapt, the extent to which they have been successful has been varied. Articles such as ‘Infantry Squad Tactics’, which appeared in the Marine Corps Gazette in 2005 show that Western forces collect together and redistribute veteran’s experiences in order to pass the lessons learnt onto other serving soldiers, and this is reflected in continuous readjustments to their training regimes.\textsuperscript{304} In Afghanistan, after initial Taliban defeats in late 2001, their forces also adapted, and their subsequent actions were comparatively far more successful.\textsuperscript{305}

The importance of doctrine and tactics perhaps vindicates the old adage that knowledge is power. Success in combat is contingent upon the degree to which infantry understand them, and several of the factors considered in previous chapters are the physical manifestations of infantry endeavouring to implement them. This is also an area in which professional Western armed forces have had a distinct and identifiable advantage over almost all of their enemies in recent conflicts, and one of the few armed forces they did not have this advantage over, Hezbollah, waged what is arguably the most successful tactical ground war campaign against a Western force seen in the last two decades.

Dupuy, in \textit{Understanding War}, examines historical examples to argue that doctrine and tactics act as powerful force multipliers on the battlefield. After applying his QJM model to both World Wars he states that through the education and training of officers and men the German forces were able to achieve ‘combat effectiveness superiority over the Western Allies… of about 1.20 to 1.00 and over the Russians of over 2.00 to 1.00. In other words, with comparable equipment, 100 Germans could fight on equal terms with about 120 British or French or American troopers, and with 200 or more Russians’.\textsuperscript{306} His analysis credits the German combat

\textsuperscript{303} Catagnus \textit{et al} (September 2005), p.88.  
\textsuperscript{304} Ibid.  
\textsuperscript{305} Biddle (2004), pp. 200-201.  
effectiveness superiority largely to two factors; education in effective doctrine/tactics, and training.

**m) Training**

This section compares the training of Western forces and their enemies in recent conflicts. It argues that the capability of an infantry force to implement the majority of the previously examined factors is largely contingent upon effective training prior to combat. Thus, the success or failure of a force on the battlefield can be ascribed to the sufficiency (or insufficiency) of its infantry training.

In *The Combat Soldier* King frequently makes the point that generating group cohesion is largely dependent on training, as it underpins the development of both individual competence and group co-ordination in Western forces; ‘[training] fundamentally alters the way the members of the platoon are able to interact and to perform together. Intense training changes the very nature of the solidarity – and, therefore, the cohesiveness – of the platoon… By uniting competence and morality (skill and morale), training is crucial to combat performance and to the generation of cohesion’. The increased levels of cohesion displayed by professional troops is a product of standardised and effective training systems, which have been refined and developed since the Second World War. This explains why there is such a large gap in cohesiveness between contemporary professional soldiers and their insurgent adversaries.

In *Military Power* Biddle argues that in order to utilise cover and concealment effectively commanders must fashion their own plans based upon the immediate surroundings. Troops ‘cannot be simply laid out in standard, textbook formations and marched toward the objective, or deployed in formulaic cookie-cutter defensive layouts’.

Dispersion and independent small-unit manoeuvre increase the demands on officers to ‘…exercise independent leadership functions. At the same time, they challenge morale and combat motivation by putting more distance between the soldiers themselves, reducing the power of group reinforcement to motivate

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individual behaviour’.\(^{309}\) Additionally, combined arms tactics ‘impose very high orders of complexity’, junior officers are required to hold a great deal of knowledge for combined arms operations and high levels of skill are required from both troops and leaders in order for them to be employed effectively.\(^{310}\) Ultimately, his central point is that the aforementioned tactics are extremely complex and demand high levels of training and skill in order to be implemented properly.\(^{311}\) Poorly trained troops can attempt to employ these aspects of combat, but prior training greatly enhances the ability of soldiers to do so, particularly in regards to effective use of dispersion and combined arms.

Extensive prior training and preparation is essential for Western soldiers to utilise the technologies at their disposal effectively. Whilst there is no doubt that technology plays an important role on the contemporary battlefield, without adequate training forces simply cannot exploit its full potential. In cases involving highly advanced technology, such as aircraft, personnel lacking in adequate training would be entirely incapable of operating them. In the context of small arms weapons usage there is relatively little difference between the destructive potential of the weapons employed by Western forces and their enemies. However, enemy forces in different conflicts have been systematically unable to realise the potential of their weapons, principally because they lack the training to shoot them with any accuracy. Western forces undergo extensive marksmanship training prior to mobilisation, and these procedures are constantly revaluated to ensure their continued effectiveness.\(^{312}\) In contrast, Chivers states that in Afghanistan ‘Poor marksmanship, even abysmally poor marksmanship, is a consistent trait… We have almost always observed that a large proportion of Afghan fire, both incoming and outgoing, is undisciplined and errant, often wildly so… Some fights lasted several hours. At least one lasted a full day and into the night. How many of the company’s Marines and Afghan soldiers who accompanied them had been shot? Zero’.\(^{313}\) He argues that these problems are symptomatic of ‘the difficulties faced by a scattered force in organizing quality

\(^{309}\) Ibid.
\(^{310}\) Ibid., pp.38-39.
\(^{311}\) Ibid., p.38.
\(^{312}\) James/Dyer (2011).
\(^{313}\) Bowden (1999), p.81; Cristian (2011); Chivers (2010a).
The primary goal of training is to provide soldiers with focused understanding of what will benefit them most on the battlefield, as being in combat does not necessarily mean that pertinent lessons will be learnt. While many Taliban soldiers are veterans and have a solid understanding of fieldcraft, they still are incapable of leveraging effective weapons fire. Furthermore, it is possible that their prior experience against other opponents of lower quality may even be detrimental to them, as lessons learnt against poor quality foes may not be applicable in the context of fighting professional soldiers – this may explain why early battles in the Afghan war involved heavy Afghan casualties until they abandoned frontal assault tactics. Lacking the rigid training structures employed by professional Western forces, insurgent troops are far more variable in terms of their quality and experience; whilst some are veteran al Qaida fighters, others are local teenagers paid a few dollars to sporadically fire at Western outposts.

In contrast to insurgents, sophisticated battlefield doctrine and a high level of competence when using equipment (irrespective of how technologically advanced it may be) are ubiquitous in Western forces. In the build up to the Battle of Fallujah one junior officer stated that ‘…we cross-train on different weapons systems. Every man in the platoon is now intimately familiar with everything in our arsenal. Every man can drive a Bradley and work a radio. Every man in my squad goes through combat lifesaver medical classes… We rehearse our breaching roles, refine our room clearing fundamentals. Every mission into Muqdadiyah serves as an operational training exercise. We polish our tactics’. The inability of enemy forces to either employ advanced tactics or use the most basic of battlefield technologies is therefore a testament to the importance of training in terms of its impact on overall combat effectiveness.

Even in the comparatively successful 2006 Lebanon campaign ‘Hezbollah direct fire marksmanship was very uneven. Small arms fire, for example, was systematically

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314 Chivers (2010b).
315 Gordan/Filkinsm (2006); Junger (2010), pp.82-83.
inaccurate and caused few casualties’. Biddle argues that a key reason for Hezbollah’s military deficiencies during the campaign can be explained by ‘the proficiency with which Hezbollah executed its doctrine, rather than the doctrine it was trying to execute... there is a difference between trying and achieving, and in 2006 at least, Hezbollah’s reach in some ways exceeded its grasp’. Lack of proficiency in small arms tactics, techniques and procedures due to inadequate training is a stumbling block that has caused problems for many forces that have attempted to battle Western troops. In two different wars Saddam’s “elite” Iraqi state Republican Guard ‘proved systematically incapable of integrating movement and indirect fire support... reacting flexibly to changing conditions, and consistently hitting targets with small or large calibre weapons’. Ultimately, ‘...what still counts most is not weapons, but the ability of people to use them effectively’.

Recent US army publications substantiate this assessment. PEO Soldier’s ‘Dual Path Strategy Series: Part III – Soldier Battlefield Effectiveness’ proposes the framework ‘Soldier + Weapon + Ammo + Optic + Training = Battlefield Effectiveness’, although it would have perhaps been more accurate to suggest that the relationship is fundamentally multiplicative, as removal of any of these factors – other than optics – would result in a total collapse of combat effectiveness. Within this framework it is stated that ‘training represents the greatest variable in the soldier effectiveness equation’, and in a multiplicative framework it would thus have the most significant impact on overall effectiveness. A US Staff Sergeant stated that ‘training forms the basis and the muscle memory of shooting, when things go hot, soldiers don’t have to think, they go into automatic mode – battle drill shooting’. The result of effective training is that ‘whatever is drilled in during training comes out the other end in combat’. Previous training and exposure to high stress situations is an explanation as to why Western soldiers being ambushed react calmly, effectively, and immediately employ the correct tactics to defeat the enemy forces, often via

318 Ibid., p.75.
319 Ibid., p.71.
322 Ibid.
launching their own counter-attack. Specialist Giunta, who was awarded the Medal of Honor for his actions during the Korengal ambush, stated that ‘I did what I did because that’s what I was trained to do’.\textsuperscript{325} In this engagement Giunta, without hesitation and arguably even conscious thought, enacted his training of US army ‘Battle Drill 07-3-D9502 - React to Ambush (Near)’, and in doing so saved both his own life and the lives of his comrades.\textsuperscript{326}

It is however important to recognise that in real war soldiers do not perform as well as they do in training scenarios. Murray estimates that units are roughly six times less effective in a real battle than they are during training exercises, and that most of this difference can be put down to the psychology of combat; ‘…men are much more likely to stop fighting when bullets pass near them, when their mates stop fighting, when their mates are killed or injured’ and when they find themselves in close proximity to the enemy.\textsuperscript{327} When running training scenarios with laser simulation equipment it was found that in training men are not pinned down as easily, with neither attackers or defenders being fazed by incoming fire – the attackers continued marching into enemy fire until casualties of up to 20 percent had been sustained, and most rounds were aimed short bursts rather than the rushed firing and sprays of bullets seen in real battles.\textsuperscript{328} This gap from training to reality explains why even soldiers who have demonstrated superb accuracy in training still fire so many rounds in reality.

It can be argued that training also has a direct relationship to the effectiveness of suppressive fire. When employed against well-trained infantry suppressive fire is generally less effective as it is less disruptive to their operations. Regardless of the severity of the tactical situation, well-trained infantrymen continue to follow their doctrine and can work together to in order to regain fire superiority. The ambush in the Korengal is once again a good example of this. Despite over a dozen Taliban opening up with rockets and belt fed machine guns to create what was described as ‘a wall of lead’, US soldiers disregarded the incoming fire in order to enact the battle

\textsuperscript{325} Junger (2010), p.121.
\textsuperscript{327} Murray (2013), p.18.
\textsuperscript{328} Ibid., pp.18-19.
drill which saved their lives. At the Battle of Wanat, despite coming under intense and continuous enemy fire from multiple covered and concealed locations, the American forces fired their weapons at the maximum rate of fire almost constantly (even when the barrels of their weapons began to overheat) in order to compromise the enemy’s ability to manœuvre. In these cases incoming suppressive fire was not as effective in compromising the ability of Western troops to act, although these are both scenarios where the defenders had little choice but to expose themselves to immediate danger otherwise they were in real danger of being overrun.

Overall, it is clear that training has a significant, although hard to directly quantify, effect on the outcome of infantry engagements. Superior training regimes allow a force to execute its doctrine proficiently, and ingrain within soldiers the appropriate responses to battlefield events without them ever having to see combat. King argues that in teaching lessons to soldiers who have never actually been in combat, effective training can create veteran soldiers despite a lack of direct experience. Prior to even setting foot on the battlefield Western soldiers can be taught how to effectively employ suppressive fires, cover and concealment, dispersion and how to use technology to its maximum potential. As Brian McCoy, commander of 3/4 Marines in Iraq in 2003 observed, ‘Focus on the basics and become brilliant at them...Great units do the basics with a high degree of proficiency and as habit’. 

329 Junger (2010), pp.118-121.
331 King (2012).
332 McCoy (2006), pp.36-37.
**Chapter 5: Conclusions and the Comparative Importance of Factors in the Combat Model**

The combat model has thus far put forward 13 individual factors. This section will provide an evaluation of the relative importance of these factors, expand upon their synergistic relationships, and use this analysis to generate tables outlining their relative importance in relation to casualty levels and duration. Since many of the factors considered are qualitative in nature the tables are to some extent speculative, with the exact ordering being open to debate.

**The Relative Importance of Individual Factors: Casualty Levels**
The table below provides a précis of the conclusions this chapter will reach, in relation to the relative importance of factors contributing to asymmetric casualty levels. The subsequent analysis will substantiate this framework.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Importance</th>
<th>Component</th>
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<tbody>
<tr>
<td>Doctrine and Tactics</td>
<td>Primary</td>
<td>Conceptual</td>
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<td>Training</td>
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<td>Group Cohesion</td>
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<td>Combined Arms Integration</td>
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<td>Rules of Engagement</td>
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<td>Numerical Preponderance</td>
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a) The Conceptual Component
The two conceptual factors are of paramount importance in explaining the observed outcomes. Doctrine and tactics is hugely significant, as effective training is reliant upon proper doctrinal understanding. Grossman asserts that ‘We can teach warriors to perform a specific action required for survival… but, if we are not careful, we can also teach them to do the wrong thing’.\(^{333}\) If taught erroneous doctrine and tactics then training can actually prove to be detrimental to combat effectiveness. Doctrinal publications represent an ongoing iterative process to refine the conceptual component of war by identifying and propagating effective tactics whilst purging those deemed to be ineffective or outdated. This body of knowledge allows Western forces to concentrate their training regimes on the tactics that have been proven to be the most effective. Doctrine and tactics accordingly are a key reason why Western forces have enjoyed such a significant advantage over their adversaries in recent conflicts.

British doctrine states in no uncertain terms that ‘Collective performance is only achieved through an understanding of common doctrine combined with collective training and exercising to rehearse and sharpen the ability to apply it… There can be no compromise on this, for the ability to deploy fully prepared for combat is at the core of fighting power’.\(^{334}\) King concurs, arguing that ‘There is, in a sense, no mystery to the cohesiveness displayed by professional troops. It is a product of training’, and even the soldiers themselves believe this to be true, ‘If you train people properly, they won’t be able to tell a drill from the real thing. If anything, the real thing will be easier’.\(^{335}\) Doctrine, tactics, and training thus have a reciprocal relationship. Only soldiers who have the correct understanding of appropriate doctrine and tactics in addition to being well-trained in their implementation will be able to operate at the highest levels of combat effectiveness – both of these factors are thus of crucial importance. In the context of contemporary engagements, the conceptual component is incontrovertibly the single most important area of combat in explaining why the observed outcomes are so asymmetric. For any force to reach the highest levels of combat effectiveness, they must master the conceptual

\(^{333}\) Grossman (2008), p.75.
b) The Moral Component
This section assesses why moral factors are spread throughout the list, with some being highly significant whilst others are largely irrelevant.

Cohesion is an aspect of combat where Western forces have a significant advantage that greatly contributes towards the observed combat effectiveness differential. Soldiers capable of dealing with stress and working in cohesive groups will be combat effective, and Western professional forces debatably have some of the best trained and most cohesive platoons in history. Cohesion is also an important prerequisite to effectively employing combined arms. Well-trained cohesive platoons are capable of leveraging the different strengths of their various weapons and communication systems to utilise complex fire and manoeuvre tactics, and insurgents have repeatedly failed to mimic these achievements. Strong cohesion also counterbalances the inertia and degradation of combat performance observed when soldiers cannot visually locate dispersed and concealed friendly forces, meaning that even outside visually identifiable range cohesive forces can work together to accomplish mission goals. Psychology and physiology resilience, alongside group cohesion, are engendered via effective training, and King argues that such training ‘has colonized every aspect of combat performance in an attempt to increase individual competence and group co-ordination... training normalizes the battlefield, not simply reducing its terrors but investing it with shared professional and technical significance’.

The effect of suppression is greatly reduced against troops that are cohesive, dispersed, and covered/concealed, which explains why insurgent forces generally find it hard to pin down Western forces employing these countermeasures properly. Even in the rare cases insurgents manage to achieve this, their lack of cohesion and training renders them unable to push home their advantage and convert it into a decisive victory. Suppression is therefore an important battlefield tactic, but is one of

337 Ibid., p.337
several which must all be correctly employed in order to reach the highest levels of combat effectiveness.

Within the factors that comprise the moral component of warfare it can be argued that group cohesion is the most significant. Cohesion is crucial in explaining Western dominance of the contemporary battlefield, as well as being an area where Western forces have a demonstrable advantage. Suppressive fires used to their full effectiveness then provide cohesive forces with a powerful moral weapon that is integral to the effective execution of their basic infantry tactics. The psychology and physiology of combatants is central to defining how soldiers will react to the stress of combat, and it is arguable that integrating understanding of this factor into training regimes is a key reason why contemporary soldiers are able to overcome the degrading effects of combat stress.

Both the rules of engagement and surprise and shock have little influence on the observed casualty levels. These factors can be largely discounted, as they have only a minimal impact outside of edge cases.

c) The Physical Component
Finally, it will be instructive to examine why the physical factors are generally of only secondary and tertiary significance.

Whilst there is a perception that the lethality of technology is a decisive factor, this is generally overstated. ‘When kill rates are compared across history, it is clear that a musket was actually more likely to hit a crowd of redcoats at thirty metres than an assault rifle is to hit a camouflaged man crawling at 100 metres’.338 Cover, concealment and dispersion are the most important of the physical factors precisely because they are employed to counteract the destructive potential of modern weapons. In combination, they have reduced effective weapon range and lethality, and this explains the aforementioned fall in kill rates.339 As Murray states, ‘Each improvement in ease of use or engagement range is countered by soldiers firing more

338 Murray (2013), p.71
quickly at more distant targets; the gun gets better so the man fires at harder
targets… weapon improvements also encourage the enemy to make better use of
camouflage, cover and dispersal. People adapt. Sometimes it takes an initial
bloodbath or two but, when weapons improve, soldiers improve their tactics too.\textsuperscript{340} Despite complete Western technological superiority in major conflicts since the Gulf
War, enemy forces have used cover, concealment and dispersion to survive on the
battlefield in meaningful numbers and engage Western forces in consequential
ground battles.\textsuperscript{341} Furthermore, Biddle contends that without correct modern system
force employment forces on the ground are simply unable to exploit technological
advantages they may possess.\textsuperscript{342} Dupuy ultimately concludes that ‘no conventional
weapon has been as important to battlefield success as have been the troops
employing the weapons’.\textsuperscript{343}

However, it is important to recognise that technology does greatly enhance the
strengths of well-trained infantry. Conflicts such as the First Gulf War demonstrate
that professional soldiers with a significant technological advantage can ruthlessly
exploit deficiencies in their opponent’s tactical conduct; the potential lethality of
modern weapons is great enough that ‘…militaries not getting the fundamentals of
warfare right open themselves up to the likelihood of rapid and overwhelming
defeat’.\textsuperscript{344}

Arming soldiers with combined arms enhances their capability to place enemies in
meaningful dilemmas. However, the failure of insurgent offensives where they
successfully employed combined arms precludes this factor from being decisive. The
effective usage of combined arms is still reliant on pre-existing proficiency in other
aspects of warfare, including doctrine and tactics, training, and group cohesion.

At the platoon level, logistical concerns are frequently to the detriment of Western
soldiers, and therefore cannot be used to explain their battlefield dominance.
Similarly, numerical preponderance is also not decisive, as there are numerous

\textsuperscript{340} Murray (2013), p.71.
\textsuperscript{341} Biddle (2004), p.142
\textsuperscript{342} Ibid., pp.68, 201.
\textsuperscript{343} Dupuy (19992b), p.218.
examples of small forces defeating those possessing a significant numerical advantage whilst concurrently maintaining asymmetrical casualty levels.

The physical component of warfare therefore has a less significant impact on infantry combat than the moral component. Major differences between professional Western forces and their insurgent adversaries have become evident, and although insurgents have demonstrated that they can proficiently employ physical factors – such as cover, concealment and dispersion – they have not been able to develop any real degree of group cohesion. This is incredibly important in any force which aims to operate at high levels of combat effectiveness whilst maintaining asymmetric casualty levels.

**The Relative Importance of Individual Factors: Duration**

Since duration is an area theorists have not thus far focussed on, the conclusions reached hitherto have been far more speculative than those reached in relation to casualty levels. This section will assess factors in terms of whether or not they elongate engagements. The factors will be divided into three main categories; firstly, those which decrease duration, secondly, those which do not have a major impact on duration or those which have variable effects depending on the specific circumstances of an engagement, and thirdly, those which increase duration. It will be argued that the factors which increase duration generally outweigh those which decrease, and this explains why engagements last longer than would be expected.
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Unlike the previous table, the relative importance of the three components of warfare is less distinct. The most significant conclusion that can be drawn in relation to the components is that the conceptual factors decrease engagement length.

a) Factors responsible for reducing engagement duration
The factors which contribute towards reducing engagement length are doctrine and tactics, group cohesion, training, and combined arms. It is immediately worth highlighting that three of these were considered to be fundamental in increasing combat effectiveness. This makes logical sense, as it is axiomatic that a highly combat effective force should end engagements quickly and decisively by taking full advantage of deficiencies in enemy battlefield conduct. One of the basic tactical principles put forward in Field manual 3-21.8 is that ‘close combat demands flexible tactics, quick decisions, and swift manoeuvres to create a tempo that overwhelms the enemy’. The speed at which tactics are executed is in many cases fundamental to their success, and numerous examples already cited in the combat model have illustrated the potency of swiftly executing drills ingrained during training.

Historically, examples from the Second World War showed that infantry would go to

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ground upon encountering an enemy line, becoming a scattering of dispersed individuals without cohesion, which resulted in delaying advances for up to an hour. However, cohesive Western forces are no longer subject to such breakdowns, and thus they avoid this impediment; cohesion thus directly contributes to reducing the length of engagements.

Training helps to counteract the debilitating effects of various factors which increase duration, in particular, suppression, and psychology and physiology. Well-trained troops should be able to maintain clarity and awareness during combat, allowing them to make correct decisions, enact effective drills based on their doctrinal understanding, and defeat the enemy. Training also helps troops to reduce the severity of the suppressive effect. When under fire Western troops do seek cover and are clearly still cautious, but they are also capable of continuing to take constructive actions. Acclimatisation to incoming fires instilled via training means that they are incredibly hard to disrupt, even while under suppressive fire, as they know which drills to execute and take proactive measures in an attempt to reclaim fire superiority. The same cannot be said for insurgent forces, who are suppressed by lower volumes of fire – although the greater accuracy of Western fire is likely to further enhance its suppressive effects. Even comparatively light return fire will stall insurgent advances, and eventually their only viable option becomes withdrawal.

At the squad level, the impact of combined arms integration is to marginally reduce engagement duration. A hypothetical scenario will serve to illustrate its impact. Given that at the tactical level combined arms is mainly used to generate dilemmas, how would this capacity be reduced if every member of a squad was armed with an M4 Carbine? The ability of the squad to carry out fire and manoeuvre tactics would be to some extent compromised, and it would be harder to place enemy forces in consequential dilemmas. However, even though the M4 has a more limited ability to suppress an enemy position in comparison to the M249, the suppression section demonstrated that surprisingly small volumes of fire are actually required to keep enemy heads down whilst friendly forces manoeuvre, and these can be provided by most weapons systems. Therefore, although depriving a squad of their combined

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arms would lead to a reduction in their ability to operate effectively, it would not fundamentally compromise their ability to employ the tactics they have been trained in. The inclusion of combined arms at the squad level thus increases combat effectiveness and by extension reduces duration. However, its overall impact is less than the other factors already addressed within this section.

b) Factors which do not have a major impact on duration/factors which have variable circumstantial effects
In recent conflicts the factors of surprise and shock, numerical preponderance, and technology have had relatively little direct impact on the duration of engagements at the squad level, outside of edge case scenarios.

For example, if a single soldier faced an entire platoon of enemies then preponderance would likely play a role in reducing the overall length of the engagement, but it has been shown repeatedly that small groups of Western soldiers are capable of holding out for substantial lengths of time whilst significantly outnumbered. Similarly, technology only significantly impacts upon the duration of tactical engagements if either there is a substantial disparity between the weapons employed by the participating forces, or if one side is so inept at military tactics that they mass their forces in the open. In relation to surprise and shock, the combat model has previously demonstrated that this factor has a minor impact on Western soldiers, and only effects insurgents in the highly unusual instances where they are on the receiving end of an ambush. Thus, all of the factors discussed in this paragraph have little to no impact on the vast majority of infantry engagements.

c) Factors responsible for increasing engagement duration
The factors which contribute towards increasing engagement length are logistics, dispersion, cover and concealment, ROE, suppression and psychology and physiology. In combination, these factors explain why even soldiers armed with highly lethal modern weapons still find it difficult to locate the enemy and deal with them efficiently. Forces that do not employ these factors properly will not only be combat ineffective, but they open themselves to the prospect of rapid defeat.

The logistics section highlighted a multitude of logistical problems faced by soldiers
on both sides of any conflict such as ammunition limitations, resupply, the increased volume of ammunition required to mount offensive actions, and reduced soldier mobility due to being overburdened with kit. These problems all ultimately lead to less chance of decisive action taking place, and by extension an increase in engagement duration. Logistics also serves to explain the outer boundaries observed in engagements, as when Western soldiers patrol into enemy territory they do not have easy access to more ammunition. It can be conjectured that around twelve to fourteen hours is the greatest length of time that even a disciplined force expending minimal ammunition can engage an enemy effectively without substantive resupply. Longer battles utilising considerably more firepower occur only when Western forces are defending forward operating bases, as they no longer have to worry about logistical resupply (however this also fixes them in place, which means that whilst they can defend effectively, their ability to decisively assault the enemy is weakened).

Dispersion and cover and concealment are intimately connected, and will be assessed concurrently given that in combination they are fundamental to explaining engagement length. Forces that are not dispersed run the risk of coming under fire from weapons which could rapidly destroy their formations, thereby greatly accelerating their defeat. Soldiers can also only make effective use of cover and concealment when they are dispersed, as it is almost impossible to conceal a large grouped force; when employed together they are crucial to the combat effectiveness of a force, as they allow it survive on the battlefield for a meaningful length of time.

Dispersion combined with cover and concealment are central to explaining why engagements can last any significant length of time without either side sustaining crippling casualties. Biddle argues that a key reason for the swift defeat of Iraqi infantry in the First Gulf War was due to their ‘total inability to employ concealment effectively; their use of exposed trench lines meant that long-range Western artillery and aerial fire guided by Western Special Forces on the ground devastated the Iraqi fixed positions.347 Exposure fundamentally leaves infantrymen vulnerable, and it is clear from Marshall’s assessment of the empty battlefield that even in the Second

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World War soldiers were willing to sacrifice the cohesion of their unit in order to disperse, take cover, and conceal themselves from incoming enemy fire (although this behaviour is also related to infantry psychology). Furthermore, engagements where cover and concealment are employed successfully are also lengthened as simply finding the enemy requires time, and soldiers are far more likely to proceed with caution if they are aware that a threat exists but are unable to pinpoint its location.

ROE have a relatively minor impact on engagement duration, but overall they do increase it due to their constraining effect on Western forces. Insurgent forces attempt to take advantage of ROE by using tactics such as integrating with the civilian population. Their goal is to place additional burdens on the decision-making cycle by requiring correct target identification before engagement can take place. However, the large numbers of documented civilian casualties from the wars in both Iraq and Afghanistan would suggest that the extent to which ROE actually hamper Western tactics and willingness to engage is comparatively minor; in the field, ROE are clearly of secondary importance to Western infantry in comparison to saving their own lives. Only in specific circumstances where ROE are truly restrictive to infantry operations does this factor seem to have any significant impact.348

Suppression is a powerful explanatory factor for increasing engagement duration, as its inherent effects inhibit both manoeuvre and the employment of accurate direct fires on enemy positions. Whilst it can be argued that suppression actually reduces duration when it is used as an effective part of fire and manoeuvre assaults (thereby allowing one force to destroy the other) this is more due to good tactics and training rather than being an inherent property of the suppressive effect itself. A suppressed force operates at greatly reduced combat effectiveness; although technically safe from harm, their ability to engage the enemy with accurate fires and take decisive action is lost. Given that relatively small volumes of fire are actually required to suppress soldiers, it is not surprising that battles such as Wanat involving large amount of fire from both sides quickly bogged down and lasted a number of hours. Suppression defined the duration of this battle, as without it the Western forces

348 Iraqbodycount.org (2015); Rasmussen (2015).
would have been unable to stymie the insurgent advance, and would have almost
certainly been overrun in short order.

The impact of fear and the psychological and physiological responses it engenders in
individuals during combat serves to substantially increase the duration of infantry of
engagements, and this has been the case throughout the history of warfare. The
psychological and physiological response to fear in the individual explains the inertia
that gripped untrained forces during the Second World War, as fear promotes
inactivity and the desire for self-preservation. \footnote{Marshall (1978), p.71.} Fear, in all its forms, consistently
undermines the actions of the individual on the battlefield, degrading his ability to
think and act appropriately in response to events taking place, and promoting actions
such as freezing and fussing. Repeated personal accounts of battle written by
veterans state that overcoming and controlling their fears was key to their ability to
remain combat effective and carry out the mission. O’Donnell states that men were
trained to stay alive and not fear combat, and that ‘a mindset of strength and
solidarity keeps them from crawling inside of themselves in horror when bullets start
flying’. \footnote{O’Donnell (2007), p.16.} Indeed, even in the comparative safety of the infantry training school fear
could manifest itself, as sometimes men would hesitate before entering rooms after a
practice grenade had been thrown into them. \footnote{Ibid., p.55.} If even entering a room during a
comparatively safe training exercise can provoke such a response this underscores
why overcoming fear is such an important prerequisite in reducing battlefield inertia.

In addition to fear, basic self-preservation ingrains most soldiers on the battlefield
with a sense of caution, meaning that they do not generally take actions that would
needlessly jeopardise their own safety, or the safety of their comrades. This
requirement to preserve life underpins the decision-making cycle that soldiers go
through when engaging the enemy, meaning that before taking action they spend
time considering tactical options in order to assess both the likelihood of success and
the potential risks to the soldiers involved.

Ultimately, fear leads to delayed actions and thus increases the overall length of

\footnote{Marshall (1978), p.71.}
\footnote{O’Donnell (2007), p.16.}
\footnote{Ibid., p.55.}
engagements. Whilst the extensive training and stress acclimatisation provided to Western soldiers prior to combat goes a long way towards combating the negative effects of fear, it is impossible to ever truly negate its psychological and physiological impact. Thus, the extent to which a force succumbs to the effects of fear will greatly impact upon both its combat effectiveness, and its ability to react swiftly when faced with rapidly developing tactical scenarios.

Overall, the factors which increase combat duration outweigh those which decrease it, and this explains why engagements are generally longer than would perhaps be expected. Although it is understood that tempo and decisive action are intimately linked, simply understanding this does not allow soldiers to overcome basic human psychology. Whilst training can mitigate the impact of the elongating factors, a considerable amount of time on the battlefield is still spent cautiously taking cover from incoming fire. In times of dire circumstances, such as ambushes, Western soldiers have demonstrated that they are capable of throwing all caution to the wind and taking rapid decisive actions. Although this inevitably leads to some friendly casualties due to a lack of caution, these actions often result in some of their greatest tactical victories, as was the case in the Korengal ambush.

The Central Determinants of Both Casualty Levels and Duration
Two factors overlap as central determinants, being of primary importance in terms of casualty levels as well as increasing engagement duration. These are psychology and physiology, and group cohesion. It is noteworthy that both these factors are part of the moral component as well as being fundamentally qualitative in nature. Simulating these factors will be essential to any simulation of combat attempting to accurately depict the outcomes and characteristics observed in contemporary engagements.
Part 2: Virtual Environments, A Primer

Chapter 6: Understanding Simulated Worlds

This chapter will provide an introductory overview of FPS virtual environments prior to the detailed analysis of specific games which will be undertaken in subsequent chapters. This overview will establish the basic principles of virtual environments, examine how games developers construct them, demonstrate how the interface allows players to interact with them, and assess the perceptual convergence that leads to player immersion as well as the proclivities of players themselves – specifically in regards to the adoption of gaming as a competitive sport. Most of these issues are common to all the case studies which will be employed, so examining them at the outset provides a framework for further understanding and eliminates any onus to repeat analogous lines of argument. General limitations inherent to simulated environments will also be discussed, although criticism of real-world attributes which FPS games are obviously incapable of recreating – such as wounding or death by bringing actual physical harm to players – are largely superfluous.

Part of the remit of the games under consideration in this thesis is that they can all be played on PCs, as opposed to games consoles or bespoke hardware solutions. PCs provide a greater scope for end users to customise the gameplay experience and support a variety of different hardware devices which are used to interface with the environment. These advantages will be discussed in this chapter and within pertinent case studies.

Constructing a Virtual World: The Developer’s Toolbox

All of the games that will be employed as case studies in this thesis were created using a game engine. Game engines are pieces of software which provide developers with the constituent components required to generate a virtual environment, including graphics (otherwise known as rendering) and sound engines. Rendering in this context is the name given to the process of generating a 3D visual image which
is viewed by the player on a computer monitor. Visual images are complemented by vast libraries of sound effects, which are positioned within the 3D world and modified depending on the avatar’s physical location relative to any object which would generate such a response.

In conjunction with a monitor and speakers/headphones, the rendering and sound engines attempt to mimic the ocular and auditory sensory input received by a person in the real world. However, it is conspicuous that the virtual environment does not provide as rich an experience as physical reality; there is simply no way that these pieces of hardware can provide an equal depth of experience in comparison to the eyes and ears of a person in the real world – this is a significant limitation of video game hardware. The average monitor setup – usually consisting of a single screen measuring between 17 and 32 inches diagonally – can only provide a condensed partial representation of the Field of View (FoV) a soldier would have in actuality, as shown below in Fig.10. The level of visual acuity provided by a monitor is also lower than that of the human eye, meaning that unless the game provides zoom

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352 Princeton University (n.d.).
353 Enger (2013).
functionality the player cannot see as much detail in the virtual environment as they would be able to in the real world. The zoom functionality is provided to allow the player to reduce the overall field of vision in order to increase the level of detail of objects that remain within sight, as shown in Fig.11.

Figure 10 – The default FoV shown on a monitor in ArmA 3, without zoom.

Figure 11 - The same view, with zoom enabled.

The limited ‘resolution’ of computer monitor hardware – resolution determines the sharpness of the image, and is dependent on the number of individual points of colour (known as pixels) contained on the display – means that these limitations
cannot simply be overcome by increasing the physical size of the display. Increasing display size does not increase the resolution beyond a certain point, and so images begin to blur and become less distinct.

Speakers/headphones generally have only a limited capacity to recreate the volume and concussive nature of sounds present on the battlefield. Since these and the monitor are the only devices which provide feedback from the virtual environment, none of the other forms of sensory stimuli are directly recreated. Given that the hardware of a PC is best suited to simulating these elements, games developers tend to focus on recreating the visual and auditory components of combat.

Due to these limitations most games also employ the Heads-Up-Display (HUD) as an abstraction to present other information. Conspicuous visual and auditory clues act as substitutes to provide the player with crucial information which would normally be acquired by other human senses, as well as additional visual and aural clues which are too subtle for the hardware setup to accurately represent. Individual games approach these abstractions differently, and so HUDs will be examined in detail as part of the individual case studies.

Graphics give games visual appeal, ‘but it’s the internal physics engine that gives the game’s world life. A physics engine is a software component that provides a simulation of a physical system. This simulation can include soft- and rigid-body dynamics, fluid dynamics, and collision detection’.\textsuperscript{355} Physics engines are mathematical models which manage the interactions between physical bodies in the virtual environment, making sure that interactions between objects resolve in a manner akin to those in the real world.\textsuperscript{356} Physics engines rely on what Ryan would term, the ‘principle of minimal departure’; when contrary evidence is not provided to the player their natural response is to use their understanding of the real world ‘to fill in the blanks’.\textsuperscript{357} Even the most complex mathematical models employed in video games cannot hope to capture the intricacies of real-world physical dynamics. However, as long as interactions between objects are accurate enough to fall in line

\textsuperscript{355} Jones (2011).
\textsuperscript{356} Enger (2013).
\textsuperscript{357} Ryan (1992), p.47-60.
with player’s preconceived expectations, the principle of minimal departure elicits a suspension of disbelief and minor inconsistencies between events in the game world and the real world essentially become irrelevant. The suspension of disbelief can however be broken if physics engines allow players to take actions that have no real-world precedent.

Games involving Non-Player Characters (NPCs) also make extensive usage of scripts; scripts can perform many different functions, but most pertinently they are used to trigger certain events when a player enters an area, control the behaviours of events such as explosions, and provide the ability to implement AI. AI controls the behaviour of NPCs, dictating how they react to events and their responses to player actions.\textsuperscript{358} Scripts are particularly relevant to single-player FPS games, which theorists such as Juul would on the whole define as ‘progression games’. In progression games ‘the player has to perform a predefined set of actions in order to complete the game… it yields strong control to the game designer; since the designer controls the sequence of events, progression games are where we find most games with storytelling ambitions’.\textsuperscript{359} Due to its control over NPC actions, scripting allows the developers to create a sequence of events which form a preconceived narrative. Games primarily involving interactions between multiple player controlled avatars generally do not seek to construct a narrative, and less scripting is required given that NPCs are scarce.

Game engines also provide tools to network environments. Networking allows multiple computers to interact ‘so that they can communicate with each other and thereby exchange commands and share data, hardware and other resources’.\textsuperscript{360} Integrating discrete inputs from different computers permits numerous player controlled avatars to exist within the same virtual environment. Network functionality is essential to any multiplayer game, but is largely irrelevant to single-player games involving only one avatar.

\textsuperscript{358} Enger (2013).
\textsuperscript{359} Juul (2005), p.5.
\textsuperscript{360} Linfo.org (2006)
Constructing a Virtual World: Generating FPS Environments

Together, the aforementioned functionalities provide the tools necessary to construct a FPS virtual environment. They are employed by the developers – or in some cases where they possess the prerequisite skills, the players themselves – to create various maps (otherwise known as levels) which are the space available to the player during the course of completing a set of discrete objectives. In designing these maps the creator/s specify the fundamental properties of the environment, such as; the ‘lay out of large map features, buildings, hills, cities, rooms and tunnels for game entities to move around in’; environmental conditions such as day, night, and the weather; the initial locations of entities such as avatars and NPCs; and ‘certain map regions where specific gameplay features occur’, known as pre-scripted events.

Predesigned maps allow their creators to present player(s) with an intended gameplay and/or narrative experience. In Brookey’s words, ‘…the player is rarely given the agency to change the game’s structure or design. Game manufacturers have a vested interest in creating and marketing a specific game experience; by disrupting this experience such player agency would actively undermine the purpose of mass producing and marketing a uniform product. Limitations must therefore be imposed on the choices a player can make…’. Players do have freedom to explore the virtual environment, but they are always operating within the constraints imposed by the design and layout of the map itself. Effective map design is thus crucially important to any virtual environment, ‘with the ultimate goal of ensuring that all of the strategies which the game intends to support are viable’.

Developers of single-player and multiplayer games have differing perspectives on level design due to their contrasting goals; ‘Single-player levels tend to be a linear sequence of challenges the player must overcome to reach the final goal, whereas multiplayer levels are designed to create areas for player-vs.-player combat to occur’. Since single-player games have extensive player interaction with NPCs, the developers have a much greater direct control over the gameplay experience; if

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364 Griesemer (2010).
the player restarted the game, exactly the same linear challenges would take place at the same points. Ultimately, in single-player games what appears to be a dynamic battlefield is merely a multitude of pre-scripted events triggered as the avatar reaches certain locations, with the aim of providing a challenge to the player as they attempt to complete the stated objectives.

Single-player games also include autosave points (also known as checkpoints) – a feature that upon the ‘death’ of the avatar allows play to resume at a prior point in time, which is often mere seconds before the actions which resulted in the avatar’s elimination. Most FPS games have autosave points at regular intervals so that when the avatar is eliminated the player does not have to repeat large sections of the game, as this is seen as an undesirable quality; ‘wider checkpointing tests patience and memory as much as it does skill, which can frustrate and put off players’.366

Rather than constructing a narrative, most multiplayer environments focus on providing players with a locale within which they can do battle. G4TV.com interviewed a number of map designers from large development studios, and they stated that ‘players demand variety, but also want consistency’.367 The lead level designer at Epic games (known for long running FPS series Unreal) indicated that a well-designed map allows two evenly skilled teams to have ‘equal chances of doing well when matched against each other in ideal conditions’.368 Maps need to be well balanced to provide ‘symmetry in opportunities to win (not necessarily symmetry in map layout)… map advantages for one team, such as an elevated position, should be offset by similar advantages or opportunities for counter-tactics. Localized “imbalances” can create great tension and encourage players to alter tactics to defeat the other team. The key is to ensure appropriate counter tactics are available and that imbalances are not unevenly distributed in the rest of the map’.369 Given that gamers will often do battle on the same maps repeatedly, developers argue that ‘layout familiarity helps players formulate strategies, plan for contingencies and take advantage of opportunities that less familiar players may not even realize exist…

367 Scimeca (2011a).
368 Ibid.
want all players, from those that have been playing for months to first timers, to have a fun and fair experience… obviously those that have been playing for some time will have a slight advantage due to knowing where the best defensible areas are, sniping locations… etc., but when our design and art teams do their jobs well, new players are able to quickly learn the layout of the map … at the end of the day, we want the outcome of a fight to come down to player skill and team tactics, not the layout of the level’.370

Developers design multiplayer environments specifically to generate engagements that do not inherently favour either side; ‘We try to ensure that every strong position on the map has a counter to it. If we have a strong sniper location, we either create another sniper location that has line of sight to the first, and/or create a back path that is protected from the sniper so players with mid-range and close-range weapons can outflank the sniper’.371 Unlike real-world combat engagements, multiplayer environments need to be fair; this promotes a balanced competitive environment that players will endorse.372

The aforementioned constraints do not apply to the small number of players who are capable of creating their own customised maps. Since they are not creating their products for profit, individuals can design scenarios which simulate ambushes or other inherently one-sided battlefield events. Niche groups of players wishing to create their own in-game experience use map editors to construct their own levels, and this will be discussed in more detail during the case study of Armed Assault.

One essential technique developers employ to promote a fair experience is controlling the spawn locations of avatars, NPCs, and other usable objects (such as weapons and ammunition). Spawn locations are areas of the level where avatars/objects are initially created, and respawning is the term given to recreating them in a particular location after their death or destruction.373 Spawn locations are crucial to balancing gameplay, as they determine the fundamental dynamics of an

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370 Scimeca (2011b).
371 Scimeca (2011a).
372 Ibid.
373 Wikipedia.org (2015e).
engagement; if players spawn/respawn close to enemy forces then engagements are likely to follow predictable patterns, whereas distance between them allows players to spend time setting up engagements in different locations, potentially employing a wider variety of tactics. Ill-considered spawning locations – such as having two opposing teams spawn in exactly the same location – could completely destroy the intended gameplay experience, so whilst designing the map developers need to seriously consider the interactions these locations will foster.

Though different games handle the respawning mechanic in a diverse variety of ways, it is obvious that this mechanic creates an absurd reduction in the penalties for being shot; in many games when players are killed a new avatar simply reappears on the map seconds later. However, it should be noted that some of the more realistic environments do not allow respawning, and once the avatar is eliminated that player is removed from the game until the scenario has ended.

Given that they have a predetermined narrative, most single-player games lock the player into following preconstructed paths. Attempts to deviate are met with a series of locked doors, impassable objects and, in some cases, invisible barriers that simply prevent the avatar from moving any further.\textsuperscript{374} Such artificialities are also sometimes evidenced in multiplayer games. For example, avatars attempting to move within a certain distance of the enemy team’s spawn locations in \textit{Battlefield 3} can be unceremoniously slain by the game itself, despite not receiving any physical damage; a new avatar then respawns at a friendly spawn point, so the player can continue playing. This demonstrates that whilst all games employ mechanics to constrain the player within certain locations, some are more intrusive and patently artificial than others.

Abstractions and unrealisms, both intentional and unintentional, are unavoidable when creating a virtual environment. Some renowned FPS series’ – such as \textit{Quake} and \textit{Unreal} (1998) – are infamous for their excessive depictions of gore and hyper-violent content.\textsuperscript{375} These games were specifically designed to bring an almost perverse delight in the carnage they purvey, as avatars explode into sprays of blood

\textsuperscript{374} Giantbomb.com (2015b).
\textsuperscript{375} Gore is defined as the depiction of the physical results of violent actions.
and limbs are ripped off and literally bounce across the level. However, throughout all of the FPS titles which will be employed as case studies the act of killing has been highly sanitised. Even if killed by explosives bodies will remain intact despite being thrown around by the force of the explosion, with only a small volume of blood appearing to depict any physical bodily harm. The developers of all the case study games have specifically eschewed depictions of gore. This sanitisation of killing, whilst unrealistic – as gore is an undeniable part of real-world violent encounters – allows the gameplay to maintain a serious tone that in no way glorifies or revels in death, promoting the perception that these games are realistic rather than fantastical. Such avoidance attempts to sidestep a variety of potential issues, such as associations with unrealistic ultra-violent fantasy games, social quandaries arising from the depiction of gory sights, and also moral qualms resulting from the brutal slaughter of avatars and NPCs which represent real people. Video games thus deliberately try to remove the moral context of killing; in reality, a soldier is killing another person, in the game, the player is knocking down a target. Kingsepp states that the process of eliminating the enemy must be simple, easy, and not require any need for reflection.376

The inclusion of gore within virtual environments introduces the very real possibility of detracting from the intended gameplay experience, as players could potentially fixate upon the act of killing itself. Killing without reflection, remorse, or moral qualms is made easier in a world where the consequences of player actions are largely removed from the genuine horrors soldiers witness on real-world battlefields. Adherence to this philosophy is uniformly demonstrated across the case study games, and so its impact on realism will not be discussed further.

It is important to note that developers do not aspire to create accurate simulations of wounding as – similarly to the inclusion of gore – this detracts from the focus on combat. However, all FPS games are required to engage with the issues of physical damage and healing to some extent. Since the player suffers no ill effects in the real world from playing FPS games there is a necessary requirement to abstract the effects of injuries. Most games assign the avatar Health/Hit Points (HP) as ‘an

indication of the amount of damage a character can sustain in game’. 377 Hits are converted into a numerical damage value, and when the avatar receives more cumulative damage than they have HP, they are killed. In many games the location of bullet impacts is only reflected by hits to vital locations removing larger amounts of HP – there are often no attempts to simulate the debilitating effects of wounds to different physical locations. 378 Some games allow wounded avatars to recover HP via automatic regeneration if the avatar does not receive additional damage within a certain amount of time, often only seconds. 379 Others require interaction with a designated medic in order to heal wounds, and these mechanics will be discussed in more detail when they are relevant to individual case studies. However, as a generalisation, interacting with a medic takes a few seconds and achieves a similar result to the regenerating health mechanic. Neither of these methods even vaguely represents reality as these abstractions deal with an issue that virtual environments are not well suited to simulating, and which developers have no desire to engage with.

Finally, in terms of capability modelling, there are many actions soldiers can plausibly take which are not portrayed within the case study environments. Avatars cannot move objects or take any actions which would artificially increase their cover and concealment. Creating barricades and digging holes are tactics commonly employed by soldiers in different conflicts throughout history, but these virtual environments do not allow avatars the freedom to interact with the objects or the map in such a manner. Level designers will often create maps which contain pre-constructed barricades in order to alleviate this problem, but fundamentally this highlights a general lack of interactivity between avatars and the game world. Avatars also have limited capabilities; they lack the versatility to take actions such as climbing buildings. Ultimately, virtual environments have limited capabilities in order to reduce their complexity and to prevent deviation from the intended gameplay experience. Therefore, there are a considerable number of actions players cannot take in virtual environments, as well as occasionally even some actions that they can take which would be impossible in the real world. The developers have

378 Symthic.com (n.d. a).
attempted to focus avatar capabilities on those actions which are most relevant to the combat environment, with varying degrees of success.

**Interacting with Virtual Worlds**

As briefly discussed in the previous section, in order to interact with the virtual environment the player is required to utilise a variety of hardware devices to control their avatar. The vast majority of COTS FPS games employ the mouse and keyboard as their primary input device. The conventional setup involves using the mouse and W, A, S, and D keys on the keyboard to control basic avatar movement. The mouse detects motion and translates this into manipulation of the avatar’s visual perspective in order to simulate how people change their visual perspective by moving their heads. The keys are used then used to traverse the avatar around the virtual environment, with W and S controlling forwards and backwards movement whilst A and D control moving to the left and right. This setup was popularised in 1996 in FPS game *Quake*, and has remained in use ever since.\(^{380}\) A variety of other input devices exist that can be used to enhance the realism of FPS games; for example, the ‘TrackIR’ motion tracking sensor directly links head movement in three-dimensional space to the avatar’s in-game visual perspective.\(^{381}\) However, the ubiquity and flexibility of the mouse and keyboard means that they remain the primary input devices used by most PC games. Whilst other input devices can enhance the realism of certain gameplay aspects, the amount of configurations a keyboard interface supports provides a level of flexibility that no other commercial-off-the-shelf device has been able to match. More complex games take full advantage of such an extensive range of available input keys to control different aspects of the environment, employing many more keys than a controller possesses in order to effectively manipulate the avatars’ faculties.\(^{382}\) This also explains why all the games employed as case studies are primarily played on the PC; the default console input devices are far less versatile and many players also feel that the joysticks used to control movement are not as responsive as the mouse and keyboard.\(^{383}\)

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\(^{380}\) ABC Television (2010).

\(^{381}\) NaturalPoint (2010a).

\(^{382}\) Dunn (2014); Default ARMA keyboard layout: [http://i87.photobucket.com/albums/k139/radar19/Funnys/armacontrols2vh3_zps521e95d9.jpg](http://i87.photobucket.com/albums/k139/radar19/Funnys/armacontrols2vh3_zps521e95d9.jpg)

\(^{383}\) Dunn (2014).
Interaction with virtual environments also encompasses how developers employ Graphical User Interfaces (GUIs) to output pertinent information to the player. Theorists classify the different elements of GUIs as diegetic, meta and non-diegetic. ‘Diegetic user interface elements exist within the game world (fiction and geometry) so the player and avatar can interact with them through visual, audible or haptic means’.384 An example would be the avatar examining a clock in the game world, the actual purpose of which is to provide information to the player. Meta GUI elements ‘don’t fit within the geometry of the game world. They can still maintain the game’s narrative but sit on the 2D hub plane ...a common example of a Meta UI element is blood splatters on the screen…’.385

Non-diegetic elements are visible and audible to the player, but are rendered entirely outside of the game world. These elements can be completely removed from the game’s internal geometry, ‘...many non-diegetic UI elements [are used] in order to inform the player of the character’s selected weapon and power — among other things’.387 There are several examples of such elements in Fig.12, as across the screenshot a variety of metagame information pertaining to the current game state is being communicated to the player such as their current ammunition level, which can

384 Stonehouse (2010).
385 Ibid.
386 Ibid.
387 Andrews (2010); Stonehouse (2010).
be seen in the bottom right corner.

Throughout the FPS games which will be used as case studies the most important GUI elements are non-diegetic and part of the HUD. The HUD displays real-time information – such as the amount of ammunition the avatar possesses for the currently equipped weapon(s) – and also often includes an Objective Indicator (OI), which visually displays real-time information as to the location of the next in-game objective(s), if any are currently mandated.

Figure 13 - The HUD in Call of Duty 4: Modern Warfare, elements of the HUD are present at the bottom of the screen on the centre and right sides.

Jørgensen argues that since video games provide feedback exclusively to the visual and auditory senses, the HUD abstracts information which in the real world would be perceived via sensory organs and the somatosensory system. The HUD is ‘an abstraction of something that… may be interpreted as real in the universe of the game. Abstractions are important in players’ acceptance of game system features in the gameworld…’ 388 The HUD is often employed as a method of offsetting the player’s lack of spatial awareness within the virtual environment; for example, it is used to inform the player if the avatar is standing, lying prone, or wounded – things

that would be immediately obvious to an actual person in the corporeal world.

Whilst the focus of this thesis is on first-person games, a brief digression examining the use of the third-person perspective is required. This is because some sections of FPS games do require players to employ the third-person perspective, and also because some FPS games allow players to switch between the perspectives depending on their personal preferences. Fig.14 shows the third-person perspective and how it allows the player to view the avatar’s physical form from a distance.

![Figure 14 - The third-person perspective in Armed Assault 3.](image)

Some gamers argue that certain liberties must be taken in order to negate some of the problems which stem from a lack of peripheral vision as well as spatial and bodily awareness in the virtual environment.\(^{389}\) Knowing whether the avatar is prone or standing is no longer an issue in this perspective, as the player can now see the avatar’s physical form. Additionally, the field of vision is slightly increased as the player has greater lateral visibility, and this helps to make up for a lack of peripheral vision. These advantages make the third-person perspective popular with games which are not shooters, such as recent games in the critically acclaimed *Grand Theft*  

\(^{389}\) Dslyecxi, (August 2013).
However, whilst this perspective does solve some issues it also creates others. Fig.14 shows that whilst the field of vision is increased, it extends to areas behind the avatar. This means that the player can see objects which would be entirely outside the view of an actual person. The position of the camera also allows the players to see over or around objects without needing to expose themselves. Enemy soldiers walking down the road in Fig.14 are clearly visible to the player, despite the fact that from the avatar’s first-person perspective all that would be seen is the wall, which completely blocks any line of sight. Therefore, whilst the third-person perspective does have some advantages it creates as many problems as it solves, and so all further assessment will avoid the use of this perspective.

Almost all FPS games have crosshairs enabled by default as part of the HUD, as shown below in Fig.13. Crosshairs are a non-diegetic mechanism that visually displays the impact location of bullets if the player were to shoot their weapon.

Figure 15 - Crosshairs can be seen at the centre of the screen in Call of Duty 4: Modern Warfare.

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390 GTA Wiki (2016).
Crosshairs are not mandatory, and many FPS games allow the player to disable them. Gamers generally consider this style of gameplay to be more realistic, as without crosshairs there is reduced accuracy unless the player aims using the weapon’s iron sights. Removing this visual indicator presents no technical challenge to the developers, but many gamers appreciate crosshairs, as they make the game easier to play. Arguing on behalf of crosshairs, one player writes that the developer’s goals are ‘…not to make the most realistic gun firing experience … it's clear that a crosshair makes a game far easier to get into’. The crosshairs represent a design choice to include a non-diegetic element into the game for purely mechanical gameplay reasons – they make it easier to aim the weapon.

Many games also superimpose a grenade indicator onto the HUD to provide the player with information as to the location of a grenade within the game world, even though it is outside the avatar’s field of vision.

*Figure 16 - The Grenade indicator in Modern Warfare is highlighted in the centre of the screen, and is only present when the game detects that a grenade has landed near to the avatar’s location. The arrow, in this case pointing forwards, indicates the rough location of the grenade to the player.*

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391 ‘mountainforest’ (2009).
Since the player is only provided with visual feedback via the monitor they would be otherwise incapable of knowing about such imminent danger, putting them at a disadvantage when compared to soldiers in the real world, who employ other bodily senses and peripheral vision to ascertain the location of such threats. Grenades are undeniably an ever-present threat in both virtual and real-world combat environments. Whilst being killed by a potentially imperceptible danger is realistic and does happen in the real world, if this were to become a frequent occurrence in the virtual environment it would inevitably lead to a frustrating gameplay experience. Thus, the developers employ this feature of the HUD to provide the player with additional information – more than a soldier would actually possess in reality – so that they can react appropriately to the threat. Whilst such indicators are undeniably unrealistic, they are a necessary compromise given the inherent limitations of virtual environments in providing feedback to the player; without them grenades would be far more dangerous than they are in the real world, thereby warping the outcomes of engagements and also promoting frustrating gameplay.

These different uses of the HUD are attempts to mitigate the lack of intuitiveness which is fundamental to exploring a virtual environment whilst being subject to the limitations of computer hardware interfaces. Games take different approaches to tackling this problem – some more successfully than others – but these limitations will, to different degrees, be present across all the case study games.

Immersion within Virtual Worlds

Immersion, otherwise known as ‘spatial presence’, is defined as existing when

‘media contents are perceived as ‘real’ in the sense that media users experience a sensation of being spatially located in the mediated environment ... The idea is just that a game (or any other media from books to movies) creates spatial presence when the user starts to feel like he is “there” in the world that the game creates. People who experience immersion tend to only consider choices that make sense in the context of the imaginary world... perceived self-location and, in most cases,
perceived action possibilities are connected to a mediated spatial environment, and mental capacities are bound by the mediated environment instead of reality...’.\textsuperscript{392}

Jørgensen asserts that immersion is deepened by employing the first person perspective; games create what can termed as ‘perceptual convergence’, where ‘Seeing the gameworld through the eyes of the avatar creates the feeling that the player becomes the avatar’.\textsuperscript{393} The first person perspective is thus fundamental to creating immersion within FPS virtual environments by allowing the player to imagine that they, rather than the avatar, are holding the weapon.

Madigan identifies a variety of in-game characteristics that help to facilitate immersion, dividing them into two general categories of ‘those that create a rich mental model of the game environment and those that create consistency between the things in that environment’\textsuperscript{394} Below is a summary of Madigan’s article, ‘The Psychology of Immersion in Video Games’, where he argues that to create a rich mental model of the environment requires a combination of:\textsuperscript{395}

- Multiple channels of sensory information
  The more senses that work in tandem to process the virtual environment, the more immersive it will become to the player as its representation of the real world is more comprehensive.

- Completeness of sensory information
  ‘The fewer blanks about the mental model of the game world that the player has to fill in, the better…. Abstractions and contrivances are the enemy of immersion... Dealing in a familiar environment also allows the player to comfortably make assumptions about those blank spaces without being pulled out of the world to think about it’.

- Cognitively demanding environments
  ‘players have to focus on what’s going on and getting by in the game will tie

\textsuperscript{393} Jørgensen (2009), p.2.
\textsuperscript{394} Madigan (2010).
\textsuperscript{395} \textit{Ibid.}
up mental resources. This is good for immersion, because if brain power is allocated to understanding or navigating the world, it’s not free to notice all its problems or shortcomings that would otherwise remind them that they’re playing a game’.

- A strong and interesting narrative, plot, or story
  Books have used narratives to generate immersion for centuries, and ‘Good stories attract attention to the game and make the world seem more believable. They also tie up those mental resources’.

In terms of consistency Madigan points to:

- Lack of incongruous visual cues in the game world
- Consistent behaviour from things in the game world
- An unbroken presentation of the game world
- Interactivity with NPCs/avatars/items in the game world.396

Wirth et. al. encapsulate these points by stating that ‘media offerings that display a variety of concise spatial cues (preferably within different perceptual channels), which are linked in a consistent and plausible manner, should evoke both richer and more internally consistent SSMs [Spatial Simulation Models] than those presenting only a few, diffuse or inconsistent cues’.397

How the player interacts with their avatar within the game world also relates to immersion and perceptual convergence; input devices are an important gateway to an immersive environment, as they directly link actions taken across the real and virtual worlds. Since input devices function ‘as an extended part of the player’s body, video games may be seen as a subset of the player’s experienced reality’.398 Merleau-Ponty writes in Phenomenology of Perception (2002), that tools (such as input devices) function as extensions of the human body, once the body has mastered the tool. He employs the example of a blind man using a cane to argue that,

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396 Ibid.
'The experience of a tool we are using differs substantially from the experience of an object in the world. It ceases to be an external object and instead becomes part of the experience of the body-subject. The blind man is not aware of his cane’s position in physical space; instead the cane is his transparent access to other objects.'

Jørgensen believes that ‘...the immediate connection between the player’s keyboard and the avatar’s weapon provides a strong sense of perceptual convergence between the player and the avatar...’. The input device can be transformed from an object that is, ‘present-at-hand’ to an object that is ‘ready-to-hand’, a concept proposed by Heidegger who reasoned that a tool being used becomes ‘invisible’ to the user, who focuses purely on the work the tool is doing. Thus, mastering the use of the keyboard and mouse means that these devices can provide a transparent gateway to the virtual world. In effect they become ‘invisible’ to the player during play – when players control the avatar and interact with objects they cease to perceive the intermediate processes. This theory holds as long as the tools are suitably implemented; if the implementation is clumsy, unintuitive, limited, or unsuitable for the game’s requirements then users will have trouble creating the perceptual convergence, and so immersion will likely be impeded as a result.

To fully immerse an audience within any medium also requires a degree of direct and willing engagement from the consumer(s), which manifests itself as suspension of disbelief. This is defined as ‘not paying attention to external stimuli and internal cognitions that (might) distract from the enjoyment of the mediated story and environment. Such distractions may be of technological kind or of the contents’.

‘For example, technologically they may stem from the weight of the head-mounted display or sweaty gloves ([Virtual Reality] VR), the experiences of feeling paper pages or a book wrapper (book), surrounding noises and voices or a smell of popcorn (cinema), the sight of a keyboard, a mouse or the

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399 Ibid.
401 Heidegger’s argument can be found in Heidegger (1979), pp.98-189.
bounds of the monitor (websites, computer games). Content distractions can arise from bad, unrealistic, or implausible narrative plots... In many cases users suspend disbelief if they want to be entertained or simply to let themselves sink in the story... In general, suspending one’s disbelief allows the user to weaken or even delete factors from his/ her focus of attention that might contradict the medium... '403

‘When users are highly involved with media content, their concentration and mental capacity are primarily devoted to the media and not to reality. Thus, very few real-world cues are processed and mentally represented. Conversely, the majority of the users’ information processes are media-related and enriching for the SSM’.404

Ultimately, immersion and suspension of disbelief lead to an environment where, in the words of one player, ‘If my actions render the expected result, I feel in control of the game and experience the game as real. The world on the screen in front of me is imaginary, yet my actions within it are real... ’.405

Engaging with FPS Games: Determining the Gameplay Experience

Prior to commencing the game, player(s) have to make a number of decisions which will define the gameplay experience. In the case of single-player games it is a requirement to choose a difficulty level, whilst in multiplayer games the game mode needs to be selected. Although each play-through of any single-player campaign will encompass the same scenarios, the difficulty level can be changed to customise the gameplay experience. It is chosen when the game is commenced, generally from an ascending scale ranging from easiest to hardest. The effects of changing this setting vary across different games, but one of the main outcomes is to artificially manipulate the competency and lethality of NPCs. At higher difficulties the accuracy of NPC weapons fire is increased, and the amount of HP possessed by the player’s avatar is reduced in order to make weapons fire more lethal. AI aggression is also increased, inevitably forcing the player into action by giving them less time to consider the available options, and placing them in dilemmas which demand

403 Ibid., pp.514-515.
404 Ibid., p.513.
immediate action. Resources available to the player are also likely to be restricted, and reducing the availability of ammunition for example will have a significant impact on how the player reacts to different scenarios.\textsuperscript{406} Changing the difficulty level thus alters the tactics which are viable, and in assessing any single-player game the most realistic difficulty setting will need to be determined and then employed in order to draw the most pertinent conclusions. It should be noted that the most realistic setting may not actually be the most challenging for the player, as highly competent enemies are not frequently encountered by Western forces on the contemporary battlefield.

In multiplayer games, players are required to select one of the premade maps upon which they wish to engage the enemy. The maps vary widely in size and locale; some are comparatively small-scale close quarter urban assaults which take place within a single building, whilst others encompass a multitude of villages, bases, and outposts. For the purposes of assessing these games as case studies it will be pragmatic to limit the maps examined to those focusing on smaller-scale engagements involving forces numbering up to platoon size, as well as those devoid of vehicles. The purpose of this is twofold. Firstly, this should encourage in-game engagements similar to those examined within the combat model, allowing for a pertinent comparison. Secondly, eliminating vehicles removes one of the most blatantly unrealistic aspects of video game recreations of combat; videos taken by players demonstrate multiple absurd actions that can be undertaken with vehicles due to deficiencies in physics engines, even going so far as, ‘jumping out of a jet in mid-dogfight, twisting in the air to shoot the aggressor plane down with an RPG and then returning to the plane as pilot’.\textsuperscript{407}

As well as selecting the map, players are also required to choose a game mode. Game modes set the victory conditions that will be used to determine when the game will end, and which side will emerge victorious. Games offer a huge variety of different modes, ranging from free-for-all battles – where players pit themselves as individuals against all others – to large-scale objective based encounters such as Capture The Flag (CTF), where each team is given one flag to guard in their base,\textsuperscript{406} Boutros (2008). \textsuperscript{407} Crecente (2011a).
and the objective is to steal the other team's flag and take it back to the friendly flag in order to score points. However, the focus of the case study analysis will be on the mode most commonly known as ‘team deathmatch’. This mode pits two teams against each other with the goal of eliminating enemy avatars, and this is generally constrained either by a predetermined number of enemies to be eliminated and/or the imposition of specific time restrictions. Such a framework is likely to mimic the conditions of the contemporary battlefield more closely than contrived modes such as CTF, as recent engagements have been fought with the specific goal of eliminating enemy troops rather than taking objectives or territory.

After selecting the game map, mode, and any additional gameplay options, individuals or groups of players can join a game server that matches their desired settings – the server is the computer that receives and transmits each player’s actions as inputs into its system, transmitting data to allow the players who are connected to maintain an up-to-date version of the game environment, which is displayed on their computers.408 Gamers in serious clans engage with multiplayer games as competitive sportsmen, and organisations such as the Electronic Sports League (ESL) are responsible for arranging large-scale tournaments for their 4.5 million registered users, offering prize pools of over £90,000 to winning teams.409 This provides motivation for players to work together and participate in extensive daily practice schedules in order to reach the pinnacle of their skills so that they can qualify for – and find success in – such tournaments.410 The impact of clans will be discussed in detail when comparing various games to specific factors of the combat model, but it is important to note that the team based training they engage in allows them to perform far more proficiently than individuals who select one of the many available servers at random. In the context of multiplayer environments players who are skilled, competitive, and have iteratively refined their in-game tactics in order to achieve a high degree of combat effectiveness are the closest analogue for professional Western soldiers. They are also likely to represent the pinnacle of skill within the player community.

408 Claranet (2011).
Another group of serious gamers – who may or may not also belong to clans – are known as ‘modders’. These individuals are known for their skills in modifying video game environments – explaining the origin of the term – and ‘they do this by adding or manipulating content and code, typically via an API [Application Programming Interface] provided by the game's developers. These modifications can be as simple as altering the mechanics of a weapon in an FPS… or as complex as turning one game into an entirely different one’. Modders are responsible for community generated content, as few other players possess the dedication and prerequisite skillset to create functional maps and game modes. They generate a large volume of content – one ArmA forum lists over 150 new maps which are available for download – covering a wide variety of scenarios, ranging from defending a position against ever increasing enemy assaults, to playing civilians during a military occupation. Whilst some of these efforts are patently unrealistic – such as one map requiring the player to flee an island while it is sinking – others are designed specifically to enhance the realism of gameplay, aiming to ‘create the most realistic and demanding virtual combat environment for PC gamers possible… which focuses on encouraging teamwork through game play’. An assessment of how realistic these efforts are will be made in the relevant case studies of the games they are designed to modify.

The Psychology of Simulated Environments
Whilst psychology will be examined in each of the individual case studies there are a number of general points which will be made at this juncture, as they are relevant to all the case studies and to some extent live training as well. The single greatest difference in comparing real combat to simulated environments – both live and virtual – is that simulations are largely devoid of fear. Fear on the battlefield is primarily related to the survival of the individual as well as the innate resistance to taking life, and neither of these concerns are pertinent within simulations. Participants know that outside of some kind of freak accident simulations are extremely unlikely to result in injury or death to themselves or anyone else, and in

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virtual environments they are well aware that avatars and NPCs shot on screen are only representations of people – nobody is actually being hurt. Furthermore, in virtual simulations the physiological responses of individuals to fear, such as a considerably elevated heart rate, do not exist, and so there is no requirement for stress acclimatisation. Participants in simulations are therefore rarely prone to hesitating or taking suboptimal actions due to the effects of fear, and a developer of VBS and long-time player of the ArmA series stated that ‘The fear is the element that cannot be captured. People’s motivations and fears are completely different in the combat environment as opposed to sitting in a lab moving a computer mouse around’.414

This is not to say that the visual and aural verisimilitude of the virtual environment completely fails to dupe players’ faculties, as a certain level of immersion does succeed in eliciting certain emotion responses from players. Developers aim to make commercial video games which immerse players in a combat environment where they feel the excitement and thrill of taking part in military actions, without any of the associated negative consequences; one forum user stated that ‘you are immersed in a largely atmospheric world of action and excitement’.415 In these worlds the visual and aural verisimilitude is realistic and immersive enough to make a player jump and cause a certain level of adrenaline to be released, but this is due to excitement rather than fear. Developers are therefore required to tread a line between keeping their games realistic enough to lay claim to being authentic recreations of combat, whilst also being palatable to casual audiences seeking short term entertainment value. The careful use of phrases such as ‘cinematic intensity’ and ‘photo-realistic gaming’ [emphasis added] in marketing materials show that the developers are well aware that the audience are playing to be entertained, and the extent to which the need to provide entertainment value compromises the claims of realism will need to be assessed in each individual case study.416

This lack of psychology has a particularly pronounced impact on other moral factors; specifically suppression, which is far less effective in simulated environments than it

416 Activision (2010b); Aspyr (2015); Aspyr (2010).
is in the real world. This particular deficiency appears to be a characteristic of simulated environments as a whole, given that Rowland observed that the effectiveness of suppression was also minimal in live training events. Essentially, when not faced with the fear of death, soldiers training with lasers and gamers playing FPS games do not react to incoming fire in the same manner as soldiers in the real world. As the case studies will show, the vast majority of gamers simply ignore proximate enemy fires in order to complete their mission objectives, even if this regularly puts their avatar at extreme risk. Different games attempt to overcome this deficiency using different means; however, irrespective of any measures employed, suppression remains comparatively ineffective in comparison to the real world.

There is nevertheless evidence to suggest that the mindset of players – the attitudes that different groups of players take towards their games of choice – can make an observable difference in terms of simulating the suppressive effect. Nicholas Edwards, a developer of the VBS series states that:

‘I believe the effectiveness of suppressive fire in an FPS is dictated mostly by the attitude of the players themselves to the game. You can never recreate the fear that allows suppressive fire to be effective in reality, but if the player is taking the game seriously, or if there are enough negative outcomes for being killed, then it can still be used to keep players suppressed, albeit at a gradually decreasing level of effectiveness based on the attitude of the player under that suppressive fire…

[clan players] will certainly be taking the game extremely seriously and so as a result take the threat of being killed far more seriously as well, again nowhere near the same extent as reality, but they have a clear motivation to avoid death because success is so important to them. Such a player I would feel could be affected by suppressive fire to an extent. In

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417 Rowland (2006), pp.70, 72, 82-83.
comparison, a player who is only playing for fun and for whom being killed is just a minor annoyance, suppressive fire is far less likely to be effective because being killed doesn't have the same consequences for them.\(^{418}\)

Suppressive fire can therefore be granted a comparatively greater degree of effectiveness according to player mindset.\(^{419}\) The mindset of players can impact combat outcomes, leading to an increased level of realism even if the underlying reasons for their actions are not the same as soldiers in the real world; suppression is consequently more likely to have an impact in environments where players are actively attempting to recreate infantry combat as it is seen in the real world. Although its effectiveness relative to reality is always diminished, across the case study games the impact of suppression does vary, and this factor will still be addressed within each individual case study.

Finally, whilst it is inevitable that virtual environments do not pose any actual risks to the safety of participants, this is also a desirable outcome in a training context. It is beneficial to instruct and train people in environments where the consequences of failure or mistakes are mitigated, as learning in low-stress low-risk environments is a key characteristic of training. Trainees would not be able to repeat actions enough times to ingrain them in an environment which approximated the real risks of combat.

**Conclusions**
The topics covered throughout this chapter have provided a generic framework for understanding how games are constructed, as well as how players manipulate and engage with virtual environments. The introduction of these elements prior to commencing the case studies will allow the latter to focus on comparisons relating to the combat model as well as aspects that are unique to the respective virtual environments in question, rather than tackling generic issues relevant to most FPS games.

\(^{418}\) Edwards (2015b).
\(^{419}\) Gluck (2013), pp.41, 74, 140.
Understanding how virtual combat environments are constructed is crucial to recognising their limitations and identifying the constraints imposed by developers; such understanding is a prerequisite in order to assess whether these limitations can be overcome, or whether they are simply inherent to the medium. Although developers are constrained by the capabilities of the game engine, their philosophy in relation to map design is particularly revealing in this regard. The restrictions they place upon themselves are informed by the prospective marketability of the product, and it remains to be seen whether player generated maps will prove more realistic given the freedom these individuals have when generating custom scenarios.

Undertaking an in-depth assessment of topics such as immersion within the individual case studies would dilute their focus on the key research objectives. However, the concepts examined within this chapter are crucial in terms of understanding player cognitive engagement with virtual environments. Immersion in particular will thus be highly relevant in assessing the psychology of engagements within virtual combat environments. It provides an important comparison to the psychology of the combat soldier – as observed in the combat model – and will allow explanatory judgments to be drawn in relation to key factors such as fear and stress.
Part 3: Commercial Video Game Case Studies

Chapter 7: Single-player FPS, Call of Duty 4: Modern Warfare

Introduction and Background to Call of Duty 4: Modern Warfare

Released in 2007, Call of Duty 4: Modern Warfare sold over 13 million copies by mid-2009 across all platforms. The impressive sales figures for the game illustrate its wide appeal amongst gamers, with research suggesting a particular affinity amongst the primary target market, males between the ages of 15 and 25. Developers Infinity Ward contextualised Modern Warfare in a fictional conflict set in the near future, and used claims of realism alongside the creation of an ostensibly authentic infantry combat environment as major selling points for the title. They stated that the game would allow players to be ‘enlisted into one of the most photorealistic gaming experiences imaginable’, providing ‘the closest thing they’ll ever get to real warfare’. Given Modern Warfare’s mass appeal, the veracity of the claims put forward by its developers in relation to realism demand to be taken seriously, and should be the subject of critical evaluation. This case study examination will allow for an assessment of realism within Modern Warfare in comparison to the combat model, and it will be argued that the game is unsuccessful in reproducing any of the three main components of combat.

Hank Keirsey, a combat veteran with over twenty years in the US army and a teacher at West Point, was employed as the game’s SME. Numerous interviews can be found featuring Keirsey attesting to what he describes as the developers’ ‘ruthless passion for authenticity’; he states that ‘These games you end up going from one extreme fire-fight to the next most extreme situation to the next most extreme situation. The realism is absolutely real if you're the one in [sic.] thousand guys that ends up in that particularly bad sector, and got ambushed. Absolutely real’. Throughout the various marketing materials and interviews with Keirsey, Modern

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420 Seed (2009).
421 Jansz/Tanis (2007).
422 Activision (2010b); Aspyr (2015); Aspyr (2010).
423 Eddy (2007).
424 Ring (2007); MegaWhatTV (November 2007).
Warfare’s capacity to recreate the physical nature of combat is extolled due to its large variety of weapons systems and visual verisimilitude:

‘beautifully rendered snow, rain, fog, and smoke, combined with dynamic lighting and shadows...’ and ‘Authentic Advanced Weaponry – featuring an available arsenal of more than 70 new and authentic weapons...’

‘...weapons in the game are exactly as they are in real life as far as what you can get. Now what you don’t get, you know, in real life you get the kick, you get the smoke, you get a piece of hot brass... but as far as what they look, how you draw the sighting systems, it’s spot on...’  

The developers used motion capture suits to record the movements of serving soldiers so that they could be replicated in-game down to the smallest detail, as well as interviewing them to discuss the tactics of platoon level operations; Keirsey gives one example stating that the developers spoke to the soldiers at length about squad based room clearance tactics, ‘we carefully worked with these guys on current tactics so they got that right’.  

These claims demonstrate that the priorities of the developers lie primarily in simulating a narrow band of physical characteristics of the battlefield, mainly relating to visual fidelity, and the extent to which these goals will overlap with the physical factors identified within the combat model will need to be assessed. Their secondary concern would appear to be the conceptual element of warfare, as the aforementioned evidence does suggest that Modern Warfare attempts to integrate current infantry tactics into its simulated environment. There is however only a passing acknowledgement relating to any moral aspects of combat, Keirsey believes experienced veterans would ‘play it with a visceral intensity, because they have been doing this stuff for real and these things look real enough’, and this ties any potential psychological impact directly to the visual accuracy of the physical environment;

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425 Games2c (November 2007); Aspyr (2015); Aspyr (2010).
426 Games2c (November 2007).
visual verisimilitude is thus asserted to be the root cause of any psychological engagement.427

**The FPS Single-player Game Environment**

There are fundamental differences between the observed engagements in *Modern Warfare* and those in the real world that this chapter will need to explain. Playing the game for only five minutes resulted in the author’s avatar personally dispatching 36 enemy troops as well as destroying three tanks with a javelin missile launcher, at a cost of six friendly troops to enemy small arms fire (and such outcomes are fairly typical in this environment).428 Whilst the overall ratio of men killed may resemble that observed in real-world conflicts, the number of confirmed kills to an individual soldier in such a short timeframe bears no resemblance to reality, and the reasons for this will need to be explained. Whilst the bulk of this chapter will be dedicated to assessing *Modern Warfare* in relation to the combat model, this initial subsection will cover a variety of concerns that fall outside this remit, as certain issues required to understand the virtual environment do not have a real-world referent.

Pre-scripted environments follow premeditated linear pathways designed in advance by the game’s developers. This provides the player with an illusion of individual agency on the battlefield; the game world is comprised of a series of interconnecting locales for the player to explore, the scope and scale of which are entirely predetermined as the physical locations in the game world are pre-rendered. This helps to disguise the fact that player actions are largely contrived by the developers, as the avatar progress through specific pathways where player choices are in actuality extremely limited. Such a degree of control is only possible in a virtual environment where any attempts by the player to divert from the predetermined path are met with impassable obstacles or dead ends. Most of the game levels are designed with only one or two viable routes to the end objective so that the player has no option but to follow. Linear paths and pre-scripted events centre the in-game narrative solely on the player’s avatar, and this is how a specific in-game experience is provided.

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427 MegaWhatTV (November 2007).
428 Author’s observations.
The computer AI controls every other dynamic element of the battlefield, most importantly including all the other NPCs which represent both friendly and enemy forces. This gives the developers a level of control unattainable in either the real world or multiplayer environments. If the player was to restart the game from the beginning their second play-through experience would be almost identical to the first; all major actions taken by NPCs and the overall narrative would be repeated, with almost exactly the same actions taken in specific circumstances and identical dialogue being spoken by NPC troops. US Army Staff Sergeant Brian Gonterman said that 'In a game, you know what to expect; whereas in real life, the situation changes every day and you learn by going out of the wire all the time'.\textsuperscript{429} The AI in games is not sophisticated enough to behave like a real person and actually react to external events, so detailed scripting provides an illusion of agency to fool the player into accepting the authenticity of NPC actions.

The visual verisimilitude of the in-game environment to the real world is relatively accurate; the developers of Modern Warfare have clearly gone to great lengths to present a visually authentic recreation of the battlefield. On the game’s release, Infinity Ward’s Studio Head, Grant Collier, stated that ‘I think that we have the most highly detailed characters out there. The shadowing of the characters, the self shadowing of the characters, the particle system, the lighting system…’.\textsuperscript{430} Putting aside arguments surrounding the minutiae of in-game environments, the question that must be addressed is how important visual verisimilitude really is in creating an accurate simulation of combat, as it does not necessarily mean the behaviours of these objects within the game world are accurately represented. Keirsey describes how ‘I look at the Javelin [missile launcher] movement, and I can see that the real Javelin doesn’t go that high. But they say "Yeah, we know, but we like it like this, it looks cool"… they know it’s too high, but it’s a compromise. Same with the smoke grenade - a real one takes fifteen seconds for the screen to develop, but that’s too long for a gamer, their attention span is too short, they had to speed that up’.\textsuperscript{431} When asked directly, one high ranking British official stated that ‘more realistic

\textsuperscript{429} Thang (2012).
\textsuperscript{430} Shea (2007).
\textsuperscript{431} Shea (2007).
graphics do not necessarily make for better training...’.\textsuperscript{432} From a training perspective visually recreating the real world is of secondary importance in comparison to whether the virtual environment accurately simulates the physical component of the real world, alongside the factors identified in the combat model. The benchmarks developers use to measure realism within virtual environments when designing a game for the commercial market are thus completely different from the benchmarks employed by members of the military who are required to use them as training tools. Therefore, whilst \textit{Modern Warfare} has some success in terms of visual verisimilitude, and this clearly increased its appeal amongst gamers, it is not a central prerequisite in accurately simulating the outcomes of engagements.

Similar conclusions to visual verisimilitude can also be drawn in relation to aural fidelity. For \textit{Modern Warfare} the developers have spent a great deal of time and effort accurately recording the sounds of the battlefield, ‘to make sure they got the Marine chatter right, they brought out the Marines... They also went out to the range with them, and shot the weapons, recorded the sound effects’.\textsuperscript{433} However, compromises to create an enjoyable gameplay experience remain evident, the most obvious of which is the intermittent inclusion of music to elicit emotional responses. Important conversations between NPCs can be heard irrespective of the avatar’s location within the physical environment, making sure that the player cannot miss contextually relevant conversation. The enemy AI does not react to sound cues appropriately; shooting an enemy NPC with a silenced weapon will not elicit any kind of response from other enemies, even if they are mere metres away. Although the game’s marketing material stresses the realism of the ‘battle chatter’ system, which replicates the conversations between soldiers on the field, the player has no way of actually interacting with this dialogue – conversations are simply pre-recorded and triggered to play when specific events take place. Whilst this may give an illusion of a dynamic environment, in actuality chatter remains entirely pre-scripted.

Such tight control does not inherently preclude FPS single-player games from creating realistic environments, but the degree to which these games simulate real

\textsuperscript{432} Mouat (2015c).
\textsuperscript{433} Shea (2007).
combat is largely dependent on the goals of the developers designing the experience. Since Infinity Ward’s primary aim was to create an entertaining game for the public marketplace, the gameplay of Modern Warfare is fundamentally compromised in relation to creating an accurate simulation of real-world combat; this will be further demonstrated in the following in-depth comparison to the combat model.

The Physical Component
This section will compare the virtual environment with the factors identified as part of the physical component in order to argue that these factors are inadequately simulated, despite the claims of the developers to the contrary.

Technology is a factor which is comparatively simple to assess. The lethality of enemy infantry weapons within the virtual environment is determined largely by the difficulty level selected at the outset. Although the avatar visually appears to be wearing armour this is completely irrelevant in terms of gameplay. When playing at the lowest difficulty the avatar can be hit by multiple enemy rounds causing little damage; in contrast, when playing at the highest difficulty level taking one or two hits will immediately kill the avatar, and result in the game resetting to the last autosave point. Either way, the lethality of weapons bears no resemblance to reality, as fire is either largely inconsequential or immediately lethal. The point of impact of incoming rounds makes little difference outside of hits to the head, which cause immediate death when the game is on a high difficulty setting – two shots hitting the foot generally do an equal amount of harm as two shots hitting the chest. Furthermore, the weapon wielded and the calibre of its ammunition are largely unconnected to the physical harm caused. When the player is hit and ‘wounded’ they seek cover for several seconds until their health simply regenerates. Wounding in Modern Warfare is an impermanent status effect lasting only seconds, and so there is no requirement for medics or any kind of injury treatment.

Throughout Modern Warfare it can be observed that large numbers of troops occupy small areas of the battlefield, even a large battle takes place in an area measuring

434 Author’s observations and testing
approximately 75m x 75m.\textsuperscript{435} As shown Fig.17, even in these relatively small areas NPCs representing significant numbers of troops both friendly and hostile can be easily spotted roaming the battlefield.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig17.png}
\caption{Troop density in the video game Modern Warfare.}
\end{figure}

This is not entirely unrealistic given that the majority of Modern Warfare takes place in urban environments which do force soldiers in the real world to operate in dense formations. However, it is impossible for any real dispersion to be implemented in the game environment given its diminutive scale and the large numbers of NPCs constantly present at all times. Games such as ArmA demonstrate that the generation of larger environments is not beyond the technological capacity of video games; therefore, the physical constraints imposed upon the size of the battlefield in Modern Warfare are the result of considered decisions made by the developers. In an interview Grant Collier stated that ‘it really sucks to get shot from someone you can’t see’ and a logical extension of this policy is to generate a small-scale battlefield, so that the player can easily keep track of the location of enemy NPCs.\textsuperscript{436}

Following on from this point, as well as seemingly being undesirable, concealment

\textsuperscript{435} Measured in game by the author; can be calculated as the game provides distance information when the player is travelling.

\textsuperscript{436} Shea (2007).
for the majority of NPCs in such an enclosed environment is in practice entirely unattainable. Considering the density of troops alongside the fact that the game follows a linear pathway it is almost impossible to avoid engaging enemy forces at close range on a continuous basis, which perhaps gives some credence to Keirsey’s argument that the game simulates the events soldiers go through ‘on their most intense day of combat’. One veteran soldier commented that ‘No enemy is going to stand out in the open for you to easily shoot, but most of the time enemies in these games like to stand in front of my weapon’. Unrealistic simulation of psychology in AI troops frequently leads to them standing in open ground and shooting from completely exposed positions; they do not even attempt to seek cover.

The use of cover within the game is also an area of some controversy. In an interview with a gaming website Collier was asked, ‘can the AI shoot you through walls? That could be frustrating’; his response was, ‘Yeah, it did at first, but it got really lame really fast, so we stopped that… the AI will not shoot you through the walls’. The player not knowing where their avatar is being shot from is considered to create an unenjoyable and frustrating gameplay experience, despite the fact that enemies attacking from unidentifiable concealed positions are a constant peril in the real world. Therefore, for the player’s avatar alone, cover provides an unrealistically high level of protection. Once the player leaves the direct line of sight of an enemy NPC and hides behind an obstacle of any description they will become completely immune to damage from enemy fire. Since terrain in the game is non-destructible (environmental structures take only minor cosmetic damage outside of scripted events) such cover can be employed indefinitely by the player until they wish to take further actions.

The AI controlled NPCs sometimes attempt to make use of cover and concealment by hiding behind obstacles, but their inability to do so successfully is all-pervasive – a portion of their physical form always remains readily visible to the player, often meaning that heads or arms are exposed, thus rendering their supposed attempts to cover and conceal comical in their execution. In addition, NPCs representing both

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437 BuzzReportz (Oct 2007).
438 Thang (2012).
439 Shea (2007); Ring (2007).
friendly and enemy forces never adopt the prone position, and by remaining standing they present a much larger target profile. Given the ease with which these behaviours could be programmed into the AI their omission must be intentional to avoid frustrating gameplay experiences, as effective usage of cover and concealment could lead to the player being unable to easily locate enemies.

In contrast to their total inability to employ concealment NPCs immediately see through player attempts to remain hidden. As soon as the player fires a single shot all nearby NPCs instantly fire at their exact location, with unerring accuracy on high difficulty levels. Since the computer knows the location of every object within the simulation, NPC AI should, in theory, be programmed with constraints on their reaction times and ability to locate enemies; in *Modern Warfare* this is clearly not the case. This continues to promote a style of gameplay which is fast and highly lethal. The optimal course of action from the player’s perspective is to be continually shooting at enemy soldiers to eliminate them with direct fire as quickly as possible.

Logistical concerns within the virtual environment do not replicate those on the battlefield. Engagements in *Modern Warfare* involve incredibly high volumes of uninterrupted small arms fire, and ammunition limitations are entirely irrelevant as all NPCs possess literally unlimited supplies. This author personally observed an NPC soldier firing continuously from one location for ten minutes (and showing no signs over ever stopping) on fully automatic with an AK-47 assault rifle. This consumed over 1,600 rounds of ammunition without any need to resupply, and any real weapon would likely overheat and destroy itself before firing so many rounds. Although the player ostensibly has ammunition limitations, they can pick up a new weapon from most enemy corpses – since every corpse leaves a serviceable weapon lying next to them – which automatically includes a significant volume of additional ammunition. Additionally, any time the avatar walks near to a corpse, ammunition the fallen soldier possessed will automatically and instantaneously be added to the player’s current total. One veteran stated that in the real world ‘A lot of us learned about the theme of ‘one shot, one kill’ in order to save ammunition. I just waste ammo like crazy in videogames’.440

440 Thang (2012).
These logistical anomalies, in conjunction with the enclosed spaces and lack of dispersion, explain why battles in *Modern Warfare* always involve continuous exchanges of gunfire with no pauses; running out of ammunition is not a concern for either side. Furthermore, problems stemming from fatigue and soldier load are disregarded in their entirety. The avatar and NPCs can run forever without tiring, and can carry numerous weapons and large amounts of ammunition with seemingly no detrimental effects on their combat effectiveness. This also helps to explain the brevity of engagements, as in conjunction with limitless ammunition soldiers are never required to rest or recover from physical exertion.

The player is also not required to keep track of their current level of ammunition, as the bottom right of the HUD includes a real-time counter which displays the exact level of ammunition the player possesses for the weapon they are currently wielding:

![Figure 18 - The HUD in Modern Warfare.](image)

In addition, the HUD also includes a compass and objective indicator, which give the player real-time information as to the location of their next in-game objective. It is therefore impossible for the player to get lost on the battlefield, or even be unsure of their course of action. The HUD thus provides the player with easily available
logistical information at a glance, and in reality such knowledge would take time and effort to gather. In this case, the videogame environment actually offers advantages and increased capabilities in comparison to the real world, as the ready availability of such information could potentially help increase combat effectiveness.

*Modern Warfare* contains a huge variety of weaponry available for use by the player. However, this in itself is perhaps a source of unrealism; one member of the Armed Forces commented that ‘most soldiers don't even get to see those guns let alone use them, because the military only allows a few service rifles to be used’.441 Whilst it is accurate that many weapon systems are present on the battlefield, the variety of weapons the player employs is nonsensical. The player’s avatar is required to fire an assault rifle, eliminate enemies at long range with a sniper rifle, and use a Javelin Missile launcher to destroy enemy tanks. It is well documented how each of these tasks would be undertaken by separate members of the platoon capable of most effectively wielding the prerequisite specialised equipment. *Modern Warfare* conflates numerous specialised roles in order to provide the player with a gameplay experience that centres purely on their individual contribution to the engagement.

This conflation is a cause for particular concern in relation to combined arms usage on the battlefield. Complementary effects as generated via the employment of variety of weapons systems are not evidenced within *Modern Warfare*, as although the player has access to a wide variety of weapons, accompanying NPCs exclusively wield assault rifles. The combat model identified how combined arms is employed to generate dilemmas, and in practice this dynamic is evidenced within the game environment only in one specific instance; the AI use of grenades. On high difficulty settings the AI controlled enemy NPCs prevent the player constantly sheltering behind cover by continuously utilising large numbers of grenades to force the player to leave their current position and expose themselves to incoming fire. The virtual environment thus only manages to recreate one of the many potential usages of combined arms witnessed in real-world engagements.

The lack of dispersion, cover and concealment, highly dense population of the in-game environments, and essentially infinite ammunition supplies contribute

441 Thang (2012).
significantly to large numbers of casualties occurring in short timeframes. Whilst *Modern Warfare* may have some success mimicking the visual and aural nature of a real-world combat environment, these elements are not necessarily even required to accurately recreate the dynamics as observed in the combat model.

**The Conceptual Component**

This section will argue that although the developers have attempted to place a veneer of authenticity in relation to the doctrine and tactics employed by NPCs in the virtual environment, they have almost entirely failed to replicate those employed in genuine engagements. Additionally, there is no attempt whatsoever to train the player in real-world tactics; any tactics players do learn through playing the game would be detrimental if used in the real world, as would the trial and error approach often employed to acquire them.

The first level of the game is a brief training mission designed to teach the player how to use the interface. This five minute segment represents the sum total of training provided to the player before missions are commenced. It provides basic familiarisation with the controls, performing basic actions such as aiming, firing, switching weapons, and using secondary weapons such as grenades. There is no attempt to impart any real-world doctrinal or tactical understanding. Indeed, although the player is then required to undertake a tactical exercise – clearing several rooms in an attempt to recreate a basic training exercise – the player’s avatar undertakes this exercise alone and success is judged purely on hitting enemy targets. This is highly indicative of the tactics the player utilises throughout the game, which would be actively deleterious if employed in real combat. This training bears no relation to the training regimes undertaken by Western forces as described within the combat model.

The combat model revealed that even within a highly trained armed force the majority of bullets miss their targets. A significant reason for the high casualty rates witnessed within the virtual environment is the incredible accuracy of weapons fire from both sides, especially at high difficulty levels. On high difficulty levels the NPCs are expert marksmen, possessing the ability to instantaneously locate their enemies on the battlefield and accurately fire at them, despite the fact that even
Keirsey readily acknowledges the obvious deficiencies in real world insurgent marksmanship.\textsuperscript{442} The accuracy of these fires greatly inflates casualty rates on both sides.

Additionally, enemy forces are also highly adept at employing the infinite supply of grenades they possess; this bears little resemblance to reality, as it is well documented that insurgent forces in real life are poor marksmen and possess comparatively limited numbers of grenades. It should also be noted that these behaviours reveal an obvious artificiality, as this grenade usage appears to be specifically targeted at the player.

Since no attempt is made to train the player in real-world tactics it is unsurprising that most gamers eventually adopt tactics learnt through an iterative approach. These are functional in the virtual environment but would ‘never work in real life’ according to combat veterans, ‘Often in these games, I would break cover and just shoot, most of the time I just dash forward and start shooting’.\textsuperscript{443} Tactics in Modern Warfare are largely predicated around individual actions taken by the player, something which is essentially unheard of in modern militaries:

\begin{quote}
\textit{One depiction that these militaristic games often showcase is the use of small squadrons of soldiers. Often these games will feature four-man teams and even lone-wolf missions...}
\end{quote}

\begin{quote}
\textit{According to [Marine Lance Corporal Nicko] Requesto, these four-man teams are common... The concept of lone-wolfing it, however, is not standard procedure. "In the military, we have a thing called the buddy system....there is always team accountability and awareness. No one would ever go out to conduct any part of an operation by themselves."}
\end{quote}

\begin{quote}
\textit{Gonterman adds. "I was in a recon unit and in a sniper section. We never did one-man missions, but we would go out in two,}
\end{quote}

\textsuperscript{442} Shea (2007).
\textsuperscript{443} Thang (2012).
four, or eight-man teams... I never did a one-man team for an entire mission..."  

The combat model has illustrated how effective employment of soldiers on the battlefield requires actions to be undertaken by soldiers working together, and in the absence of this it is not possible to employ fundamental tactics such as fire and manoeuvre. Whilst the player may be surrounded by friendly NPCs the lack of functionality in regards to dynamically interacting with them precludes any utilisation of group based tactics. There is no requirement for the player to actually engage with NPCs or follow their lead. The ‘lone wolf’ nature of engagements completely compromises the game’s potential to replicate even the most basic of real-world infantry tactics.

Additionally, although friendly troops appear at times to undertake valid battle drills, such as ‘stacking’ when entering a room, these pre-scripted events are triggered by the player’s individual actions. The player is always required to take the lead, and if they do not then the patent artificiality of such scripted events is revealed. If the player joins the back of a stack friendly NPCs will simply wait, unmoving, for an interminable amount of time.

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Figure 19 - The stack, as demonstrated within Modern Warfare.

At this point the soldiers had been standing in this exact position for over an hour.

Furthermore, the scripted nature of the game leads to the player adopting a trial and error approach. The autosave feature allows players to repeat scenarios multiple times in quick succession with negligible difference in the disposition of enemy forces, and this means the player can simply learn where enemies will be located on the map and play the game by rote. The skills required to successfully defeat enemies encountered in the virtual environment thus bear little relation to those required to defeat enemies in the real world.

Enemy forces in the virtual environment do not appear to utilise any tactics more advanced than occasionally failing to hide behind cover. Other than the occasional clearly scripted event involving an ambush or IED, the NPC insurgent forces run around the battlefield in large numbers to provide the player with ample targets. This tactical ineptitude is in no way exclusive to the insurgents, and NPCs representing Western troops also routinely act in a manner that can only be described as suicidal, as shown in Fig.20.
Figure 20 – Numerous Western troops having been slain charging through a doorway in Modern Warfare.

Scenes such as this would never be witnessed if the NPCs possessed even a basic tactical understanding. In this case, a total inability to learn from the very obvious mistakes of their predecessors has led to the same mistake being repeated ad infinitum. Whilst this lack of tactical nous does bear some resemblance to the well-documented ineptitude displayed by insurgent forces, the casualty rates amongst forces in the virtual environment are astronomically high. This reflects a total misapplication of even the most basic tactical principles on both sides, as well as a fundamental misrepresentation of basic human psychology.

The Moral Component
This section will argue that the moral component represents the greatest area of failure in relation to Modern Warfare replicating real-world engagements. There is not even an attempt on the part of the developers to engage with the moral aspects of combat, particularly in relation to psychology, where they are seeking to elicit player responses diametrically opposed to the experiences of soldiers in the real world.

Psychology and physiology is not an aspect of combat that the developers have focused on recreating; according to Keirsey the gameplay environment should elicit
‘visceral intensity’ from the player, and this is the only instance where the psychology of the gameplay is directly addressed.446 *Modern Warfare* is primarily designed to be fun, and the initial reactions of reviewers support such an assessment; ‘I wholly enjoyed my time with this great game, and I’m sure the average FPS (first person shooter) fan will, too’.447 In light of this it is unsurprising that *Modern Warfare* completely fails to simulate the psychology and physiology of real-world combat, as this was never intended. In one interview a facetious suggestion by Keirsey that real-world physical pain could potentially be part of the gameplay experience was met with incredulous laughter from the studio head of Infinity Ward.448

There are a variety of reasons that explain why players can take enjoyment from their experiences of a game ostensibly designed to simulate armed conflict, and these are largely related to the differences between the psychology of the virtual battlefield and the real battlefield. Without fear, the psychological constraints inherent to all soldiers participating in real-world combat engagements are removed, explaining the often seemingly suicidal actions NPCs undertake within the virtual environment. AI controlled soldier behaviour that involves standing in open ground firing at the enemy whilst completely exposed only makes logical sense in the absence of fear.

The lack of fear and stress also impacts other fundamentally psychological factors, such as suppression, and surprise and shock. From the player’s perspective engagement with enemy forces is essentially continuous, precluding the possibility of being taken by surprise as they acclimatise in a matter of minutes to the nominal stresses the sights and sounds of the virtual environment place upon them. Throughout the game, no NPCs representing either friendly or enemy forces exhibit any of the symptoms of surprise or shock irrespective of the tactical situation – they react in a uniform manner to threats which present themselves.

The combat model identified suppression as a powerful moral effect frequently employed by both sides in recent engagements, but there is no indication that NPCs

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446 Italian Stallion’s Channel (August 2007).
448 BuzzReportz (Oct 2007).
on the virtual battlefield are subject to any of the psychological restrictions that suppressive fire should impose. In an environment lacking fear the fundamental mechanism that underpins the suppressive effect in the real world is nullified. Neither the player’s avatar nor NPCs attempt to keep their heads down in the face of enemy fire, which contributes both to the large volume of fire witnessed on the virtual battlefield and the excessively high casualty rates. Soldiers are always poised to fire at enemy troops, even if this in turn exposes them to high volumes of incoming fire.

The virtual battlefield is also highly sanitised and does not depict the violence inherent to real-world combat. Although soldiers are shot and killed the wounds are never visible, NPCs hit by bullets issue a single cry of pain then slump to the ground unmoving, and bodies never suffer from mutilation irrespective of how they were killed. This is a calculated decision on the part of the developers to avoid engaging with moral or social issues that could arise from accurately depicting death and its aftermath, leading one commentator to describe death as ‘a colloquial representation of failure’. 449

There is an ostensible attempt to illustrate group cohesion in the virtual environment, as the NPCs representing friendly forces frequently undertake coordinated manoeuvres and issue commands amongst themselves. However, populating the battlefield with NPCs that follow scripted events may mimic the end results of cohesion, but this is simply a veneer to disguise the fact that cohesion as displayed in real-world infantrymen is simply not applicable in an environment which lacks any form of dynamic interaction between the avatar, the other NPCs, and the events taking place.

In relation to the ROE, Modern Warfare is conspicuous in its total absence of civilians; every NPC is a combatant. The allegiance of these combatants is also immediately obvious, as friendly forces wear Battle Dress Uniforms (BDUs), and enemy forces almost universally wear headscarves. The developers also categorically prevent the player from attacking friendly forces; aiming towards a friendly NPC

449 Thomsen (2010).
will result in an inability to fire the currently equipped weapon whilst pointing at them, even if the appropriate control is pressed. In the event that the player accidentally kills a friendly NPC (perhaps by using a grenade) the game resets to the last autosave point and displays a message stating ‘Friendly fire will not be tolerated!’ There are thus no ‘grey areas’ in the world of *Modern Warfare*, the moral quandaries relating to ROE encountered on the contemporary battlefield simply cannot arise.

The combat experience of the player within *Modern Warfare* is thus totally different to that of a soldier in the real world. All negative or potentially traumatic psychological and physiological elements of combat have been purposefully expunged from the in-game environment, leaving few valid areas of comparison to genuine infantry engagements. The unusual behaviour of NPCs within the game environment can be attributed to the developers being unable or unwilling to program the AI with even a rudimentary appreciation of the stresses encountered by soldiers during combat, further degrading authenticity. Unaccompanied, sights and sounds are not capable of engendering the psychological and physiological responses a combatant experiences in a genuine engagement, and there is thus a total failure on the game’s part to reproduce the moral component of warfare.

Whilst examples of individual heroism turning the tide of an engagement can be found in the real world, these occurrences are exceptional rather than routine. The player’s ability to inflict huge casualties on enemy forces as well as spearhead every assault is more reminiscent of another well-known entertainment medium – cinema. Such comparisons were drawn by the developers of *Modern Warfare* in their marketing materials; ‘players will be drawn into the cinematic intensity of *Call of Duty 4*’. The intensity of *Modern Warfare* may, as Keirsey argues, be similar to the events soldiers experience on their worst day of combat, but players of the game experience this ‘worst day’ over and over again, as direct engagement with enemy troops is an unrelenting feature of the *Modern Warfare* experience. ‘Cinematic’ would be a correct descriptor of this level of intensity, as both these forms of entertainment try to condense the realities of combat into something that can be

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experienced in a few hours, highlighting only the most intense aspects and removing as many mundanities as possible. The phrase ‘cinematic intensity’ betrays the developers’ true inspiration; the basis for the tactics and the intensity of the gameplay is cinema, not reality, as they know that player perceptions of modern combat are primarily shaped by cinematic recreations.

It is thus evident that the primary inspiration for Modern Warfare was scenes from action films, such as Rambo (2008) and Die Hard (1988), which revel in their depiction of a single man taking on an entire enemy force by himself. Indeed, to ‘go Rambo’ on someone is a colloquial phrase in the gaming community meaning ‘to carry out a lone, all-out assault against superior numbers, and live’. 451 Both Modern Warfare and these films pander to the same fantasy of individual heroism, glorifying the actions of one extraordinary individual standing up to the ‘bad guys’ and routinely defeating them in the face of overwhelming odds. The majority of casual gamers want to indulge these fantasies when playing games such as Modern Warfare. They want a simulation not connected with the fears and horrors of real war, but one that apes the heroism of the silver screen.

Conclusions
The inability of the developers to accurately reproduce the factors identified within the combat model explains the radical differences between the observed outcomes of combat within the real and virtual environments. Modern Warfare presents a highly simplified, highly sanitised version of war designed to be fun and palatable to young men without providing any serious challenges, stresses, or moral quandaries.

In terms of casualty levels, the combat model identified the conceptual component as being of central importance to contemporary forces, and Modern Warfare fails to simulate these factors. There is no attempt to actually instruct the player in genuine military tactics, and tactics that players do employ bear almost no resemblance to those seen in the real world. There are a variety of reasons that explain these differences. Players do not fear for their own safety; they know their avatar can heal almost immediately from any hits which are not immediately fatal, and that even if they do sustain a fatal hit the game will reset itself to a situation mere seconds

beforehand. The total lack of stress and fear eradicates detrimental effects on locating targets and laying down accurate fire upon them, greatly enhancing accuracy. They are also entirely unaffected by the suppression effect, and in conjunction with a total lack of logistical constraints this means they manoeuvre around the battlefield with rapidity unmatched in actual engagements. Freedom from the psychological stresses and any physical constraints of the battlefield thus allows the player to produce a large volume of continuous and accurate fire, increasing the player’s potential lethality well above that of any individual observed in real-world engagements.

This increased lethality has a huge impact in an environment where dispersion is essentially impossible, and large numbers of NPC enemies are located in a confined space. NPCs lacking fear as well as tactical competency make no effort to seek cover or concealment, producing a battlefield rich in targets. Group cohesion is non-existent, as the player always takes the lead in any encounters with the enemy and cannot interact with other friendly forces; friendly NPCs simply follow and provide a smattering of covering fire, occasionally eliminating an enemy themselves, but the vast majority of enemy casualties are directly due to the player, which is completely at odds with the teamwork approach observed in contemporary Western forces.

In combination, increased weapon lethality and a target rich environment inevitably lead to a massive upsurge in observed casualties, and these casualties occur in a short timeframe because none of the factors which increased the duration of real-world infantry engagements have any significant impact in Modern Warfare. Fear causes men to be cautious, and without this restriction soldiers run across the field of battle, heedless of their own safety and take great risks in order to attack an enemy position. Since there are no adverse consequences, offensive behaviour patterns are adopted which involve fast paced forward moving offensive manoeuvres, frequently unsupported by friendly soldiers. This behaviour is complemented by a lack of logistical concerns and the nullification of ROE, factors which would reduce offensive potential. In the real world, executing offensive tactics requires co-ordination and cohesion between squad members, which takes time to organise.
Given that there is no way of actually interacting with NPCs the avatar simply does whatever they want whenever they want to do it.

Just as significantly, those aspects which increase duration by providing advantages to the defenders are also poorly simulated. Cover and concealment was a key reason for lengthening engagement duration, but whilst cover can in some cases still be effective, concealment is essentially non-existent. Given the dominance of the offensive in conjunction with the pace of the environment, NPCs incapable of minimising their exposure are eliminated in short order.

Ultimately, *Modern Warfare’s* simplified and sanitised depiction of combat consistently fails to recreate the dynamics or outcomes observed in real combat engagements. The commercial success of the game was predicated on the developers providing a compelling fictional narrative combined with visual fidelity, a functional user interface, and gameplay perceived by the players to be realistic. The game was sold under the pretence of realism, but the developers were willing to make substantial compromises in order to provide an enjoyable experience, and it is quite clear that realism was in actuality the lowest priority amongst their goals. Given that so many of the factors identified in the combat model are not represented within the virtual environment, and the execution of those represented is frequently flawed, the observed casualty rates within the game do not even remotely conform to any current understanding of combat proposed in academic models. These models have no reason to integrate the impact of a Rambo-like individual on an engagement, and so attempting to compare *Modern Warfare* outcomes to those of any currently existing academic models serves no substantive purpose.
Chapter 8: Multiplayer FPS, Battlefield 3

Introduction and Background to Battlefield 3
This chapter will examine Battlefield 3, a multiplayer FPS game, in a similar manner to the comparisons undertaken in the previous chapter. As with Modern Warfare, Battlefield 3 depicts the events of contemporary engagements and is also part of a long running commercially successful franchise. Released in October 2011, the game sold five million copies in its first week and had sold fifteen million copies by mid-2012, when the developers stated that the eleven central games of the franchise had served more than 50 million players between them across all platforms.\footnote{Hackman (2011); Oshrey (2012); Gilbert (2012).}

The developers placed less emphasis on realism when promoting the title. The SME, notable ex-SAS operative Andy McNab, stated that ‘…it’s a vehicle of entertainment… All the effort is really about making this feel right. But it’s entertainment. It’s not a documentary’.\footnote{Purchase (2011).} However, this does not necessarily mean that Battlefield 3 is less realistic than other games, and this chapter will argue that in relation to certain factors of the combat model the gameplay experience is actually considerably more realistic than that of Modern Warfare; this is primarily explained by the differences between single-player and multiplayer gameplay environments. It will be argued that the interactive multiplayer environment of Battlefield 3 is more successful in capturing elements of battlefield dynamics in the moral and conceptual components of warfare, and this stems from the fact that the environment is populated entirely with avatars controlled directly by players. However, in comparison to the combat model there are still significant areas which could be improved.

The FPS Multiplayer Game Environment
Multiplayer environments like Battlefield 3 have significant differences to the single-player environments which need to be explained before a detailed assessment in relation to realism can be undertaken.

The first issue which will be examined are the maps within which engagements take
place. When starting the game players can opt to fight on one of thirty available maps, these vary widely in size and scale and each has its own unique characteristics.\textsuperscript{454} The maps in \textit{Battlefield 3} allow up to a maximum of 64 player avatars to be present at any one time, and many of the larger maps – which will not be used as part of this assessment – contain vehicles that players can operate.\textsuperscript{455}

The focus of this analysis will be on two of the most popular game modes known as ‘Team Deathmatch’ and ‘Squad Deathmatch’.\textsuperscript{456}

\textit{Team Deathmatch is played in an enclosed arena usually surrounded by an 'out of bounds' area. The goal of the game mode is to acquire the amount of kills to match the score limit and thus win the game, the score limit is set by the server... Squad Deathmatch features four squads (labelled Alpha, Bravo, Charlie, and Delta) engaging against one another to reach 50 enemy kills to win the match. Players have the options to spawn on random spawn points or on teammates.}\textsuperscript{457}

Of the game modes available for selection these provide the most realistic environment, as others – such as ‘Scavenger’ or ‘Conquest’ – involve restrictions on available weaponry or capturing predetermined strategic points and holding them for a length of time. These victory conditions would introduce further unrealisms into the virtual environment, and are ultimately less representative of real-world combat, as the goal of contemporary engagements is seldom to hold an area for a brief period of time.\textsuperscript{458} The overall duration of battles is entirely based on the artificial in-game ‘score limit’ and respawning mechanics, neither of which have a real-world analogue. This essentially invalidates drawing substantial conclusions which relate to the duration of battles as a whole, as players are not removed from the game when their avatar is killed, and the overall length of the battle is predetermined by the server. However, given that each battle is comprised of a multitude of discrete engagements/skirmishes, assessing the duration of these individual events will allow

\textsuperscript{454} Battlefield Wiki (n.d. f); Battlefield Wiki (n.d. l); Battlefield Wiki (n.d. a).
\textsuperscript{455} Taormina (2010); Battlefield Wiki (n.d. k);
\textsuperscript{456} Scimeca (2012).
\textsuperscript{457} Battlefield Wiki (n.d. j).
\textsuperscript{458} Battlefield Wiki (n.d. j); Battlefield Wiki (n.d. h); Battlefield Wiki (n.d. b).
some conclusions pertaining to duration to be drawn, as the length of time required
to meet the victory conditions is itself indicative of the rate at which casualties occur.

When starting a game, players can also select from a number of gameplay options,
with the most relevant to this assessment being ‘Hardcore’. This option was designed
‘to provide a more realistic gameplay experience to players’ by:

- Limiting the HUD, which removes the crosshairs, as well as health and
  ammunition displays.
- Reducing the avatar’s base health to 60% of its normal value, thereby
  increasing the lethality of weapons fire.
- Preventing health from regenerating unless healed by a Medkit or being
  invigorated by a defibrillator after incapacitation.
- Disabling the mini-map (a miniature map that is often placed at a screen
  corner in computer games and video games to aid players in orienting
  themselves within the game world).
- Enabling friendly fire.\textsuperscript{459}

The hardcore option will be enabled in all games examined in this assessment.
However, it is important to recognise that the extent to which this mode actually
makes the game more realistic – as defined by the factors identified within the
combat model – is debatable. Whilst developers may assert that the aforementioned
changes increase the level of realism, it is arguable that removing these absurdities
and artificialities does not have any significant impact in terms of replicating the
actual observed outcomes of engagements.

\textsuperscript{459} Quote and examples taken from Battlefield Wiki (n.d. d).
There are also some significant additions to the HUD, as shown below:

![Figure 21 - Objective and different types of friendly soldier HUD indicators.](image)

The large floating letter A indicates the exact location of a nearby objective, and underneath is displayed its distance from the avatar, which updates in real time. The small blue triangles, or an asterisk in the case of designated squad leaders, represent the exact location of friendly soldiers in the direction the avatar is currently looking, even if they are not within direct line of sight. When a member of the player’s four man squad is directly in line of sight, their in-game username is displayed in green text. These indicators have no basis in reality, providing the player with significantly more information than soldiers would have access to in the real world, at a level of precision which would greatly enhance the combat effectiveness of infantrymen if it were ever actually to become a reality.

From the developer’s perspective switching off these HUD elements would be simple, but they exist to satisfy player demands. The majority of *Battlefield 3* players do not want to spend time and effort on mundanities such as having to locate objectives or deal with the potential confusion resulting from mistaking friend and foe, the HUD thus eliminates these complexities.\(^{460}\)

\(^{460}\) Symthic.com (2013).
After joining the game players must select their kit, ‘these kits are: Assault, Engineer, Support, and Recon. Each kit has a certain set of weapons and gadgets that are set… to reflect each kit’s use’. The kits allow each player to assign themselves a role within the team as they provide access to different equipment.

- **The Assault Kit** uses Assault Rifles, and assault players also double as medics. Their gadgets [additions customisable by the player to make their kit unique] include the medkit and defibrillator to heal and revive teammates.

- **The Engineer Kit** uses Carbines for close to medium ranges. The main role of the Engineer is to interact with vehicles. Anti-vehicle weapons can be equipped (Stingers, Javelins, etc.).

- **The Support Kit** uses Light Machine Guns to suppress the enemy. Their gadget, the ammo resupply pack, provides the player or teammates with extra ammo.

- **The Recon Kit** uses Sniper Rifles to spot enemies for the team. Their gadgets provide extra recon intelligence to keep the team informed of the enemy’s position. Mobile spawn points can be set in strategic locations for faster reinforcement of the front lines.

The impact of these kits will be discussed later in this chapter, as they have particular relevance to physical factors such as combined arms and technology.

Along with selecting their kit, players are required to join a squad on one of the two teams. Squads in *Battlefield 3* are made up of between two and four players, making them analogous to real-world fireteams. Each has a leader capable of issuing orders to the other squad members; issuing a command allows the leader to select a target objective or location and convey a variety of simple orders such as attack, defend, move, repair, and destroy. Additionally, upon death players have the added option of respawning their avatars next to the squad leader, even if this would potentially

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461 IGN Battlefield Wiki (2012b).
462 All these descriptions have been subbed down from the text at IGN Battlefield Wiki (2012b).
463 Battlefield Wiki (n.d. e).
put them in the enemy’s line of sight.\textsuperscript{464}

**The Physical Component**

This section will argue that in comparison to *Modern Warfare* there are areas of improvement in terms of realism relating to the physical component of combat; however, there are still substantial issues in comparison to the combat model.

The technological factor can be assessed quantitatively in *Battlefield 3*, as the developers have published the exact details of how each weapon functions, as well as various modifiers to damage which are applied when shots impact certain locations on the avatar’s body. In conjunction with player performance statistics these can be used to precisely assess weapon lethality. Symthic (www.symthic.com), contains a comprehensive examination of weapons functionality, and the weapons chart for an M16A3 assault rifle has been reproduced in part below: \textsuperscript{465}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{M16A3_chart}
\caption{An annotated weapons chart for the M16A3 in Battlefield 3.}
\end{figure}

Some of these values are self-explanatory, but certain statistics relate purely to the virtual environment. Most relevant are ‘Suppression/bullet’, which defines the suppressive effect caused by a single bullet – this is a new gameplay mechanic that will be discussed in more detail later – and ‘Damage graph’, which provides a graphical representation of the damage a bullet does to a target based on the distance

\textsuperscript{464} IGN Battlefield Wiki (2011).

\textsuperscript{465} All information below taken from ‘DraX’ (2012).
Symthic provides charts for every weapon in the game, and using the damage graph it is possible to calculate the exact lethality of each bullet impact. With the hardcore setting enabled avatars can survive up to 60 points of damage before being incapacitated (incapacitated avatars ‘bleed out’ and are eliminated after a short time if they are not given medical attention). With the exception of head shots, three or four bullet impacts are required to achieve this, as the majority of assault rifles apply 25 points of damage from close range and 18.4 at longer ranges. Multiplicative modifiers are applied depending on the location of the hit, the most pertinent being that shots to the head double incoming damage, making them highly lethal. These values do not appear to be modified by armour that avatars may, from visual examination, be equipped with, and this is particularly significant in relation to helmets. There is little variation between different assault rifles in terms of their damage, although there are minor variations in less impactful statistics. In contrast, sniper rifles appear to uniformly inflict greater damage per hit, with values of up to 80 registered for any hit within 20 meters, meaning that any hit will instantly kill an avatar in hardcore mode.

There is no evidence to suggest that these numbers are based on real-world quantitative research, and multiplicative damage modifiers are an abstract and simplistic method of recreating complex real-world outcomes. In reality the location of impact can make a huge difference – multiple hits to armour may be shrugged off in seconds, whilst even a long range shot to a vital location could cause immediate incapacitation. Whilst these weapons charts fail to accurately model the intricacies of real-world combat engagements, they do at least show a modicum of recognition that technological complexities require some consideration.

Detailed statistics relating to player performance, available from websites, show high-level players are capable of consistently maintaining hit rates of around 15% –

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466 Symthic.com (n.d. b).
467 IGN Battlefield Wiki (2012a).
468 Symthic.com (n.d. a).
far higher than any observed in real battles.\textsuperscript{469} This hit rate, in conjunction with the damage statistics, can be used to calculate that in the case of skilled players the average amount of ammunition required to incapacitate an enemy avatar is fewer than 27 rounds. Weapon lethality in \textit{Battlefield 3} thus remains considerably higher than that observed in the real world.

There is also no asymmetry in the weaponry available to each force. Whereas in real-world engagements insurgents are often limited in the weaponry they can potentially employ, the environment of \textit{Battlefield 3} envisions engagements where kits can be entirely customised by each individual participant. Every combatant on both sides this has access to a vast array of weaponry. From a game design perspective such an approach makes sense, as it creates an even playing field; however, real-world examples have shown that recent engagements have almost exclusively pitted sides with differing capabilities against each other.

In terms of reducing lethality, there is a system in place via which avatars can heal damage. Certain kits allow player to equip themselves with medkits, devices which are dropped on the floor and heal players who stand near them.\textsuperscript{470} Players with the assault kit can also equip a defibrillator, allowing them to revive teammates if they have been incapacitated within the last fifteen seconds.\textsuperscript{471} Medkits and defibrillators are gameplay devices that in no way attempt to replicate conditions encountered in the real world. There is no evidence to suggest DICE had any intention of engaging with this aspect of combat, and so a very high level of abstraction is applied.

Players can communicate in real time via microphone headsets using freely available third party Voice Over Internet Protocol (VoIP) software such as Skype or Teamspeak 3.\textsuperscript{472} Outside of the clan setting these are often used in an ill-disciplined manner and channels are filled with irrelevant chatter by players with no real interest in working together or even winning the game.\textsuperscript{473} However, despite not being trained in military radio-communication procedures clan members disseminate tactically

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{469} BF3 Stats.com (2015b).
\item \textsuperscript{470} Battlefield Wiki (n.d. g).
\item \textsuperscript{471} Battlefield Wiki (n.d. c).
\item \textsuperscript{472} Skype (2016), Teamspeak (2016).
\item \textsuperscript{473} BedBananas (December 2011).
\end{itemize}
\end{footnotesize}
relevant information about the current disposition of friendly and enemy forces, as well as co-ordinating their movements. These radio-communications suffer from none of the drawbacks of those in real life – they never break down, are continuously broadcasting, and due to their volume and clarity players can always clearly hear what is being said irrespective of events taking place on the battlefield. When used properly microphones help to increase co-ordination and cohesion at they overcome some of the restrictions simulated environments using PCs inherently place on interpersonal communications.

Up to 64 players are distributed equally between the two teams to ensure that engagements in the virtual environment almost always feature forces of equal size. Additionally, the respawn mechanic means that if a player’s avatar is killed they return to the battlefield in seconds. The number of combatants is thus always equal to the number of players in the server, which is easily accessible to players by pressing the Tab key, as shown below.

![Figure 23 - In Battlefield 3 the Tab key displays the nicknames of all the players currently connected to the server, as well as the number of kills and deaths attributed to each individual.](image)

Whilst public servers often have 64 concurrent players, serious clan matches generally involve considerably fewer participants. A database of *Battlefield 3* clans and information about tournaments they compete in can be found on the website of

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474 LevelCapGaming (December 2011).
475 Taormina (2010).
The organisers at ESL and the developers of the game decided that these tournaments would be five-versus-five encounters, meaning that a total of ten players participate. Clan matches therefore only reflect real-world engagements between fireteam sized elements. The utility of comparing such battles to real-world engagements is not invalidated, but it is limited in scope, as rarely do engagements involve combat between evenly matched forces of such small size.

Maps in *Battlefield 3* are slightly more realistic than those in *Modern Warfare* as they encompass larger areas of engagement— a medium sized map, Operation Metro, is 800 meters long and varies between 80m and 160m wide. These maps are still smaller than engagement zones in contemporary conflicts, but they are large enough that small-scale engagements could be fought in a realistic manner. Dispersion in such an environment is primarily decided by the number of players involved. The full complement of 64 players generally leads to scenarios where large volumes of players cluster around choke points, as shown in Fig. 24. This is compounded by objective points also serving as spawn locations, meaning that respawned players are often channelled into fighting at certain locations:

![Figure 24 - An example of a choke point.](image)

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Players are struggling to advance up the stairs as the exit is covered by enemy firepower. New soldiers on both sides are frequently respawning, meaning that progress is continually impeded.

Clustering of troops in such locations is not inherently unrealistic, as urban warfare does promote such scenarios, but respawning in relatively close proximity – often within metres of the enemy – serves to increase the frequency of such encounters. This issue is less acute in the clan setting, as engagements involving fewer avatars allow room for manoeuvre given the size of maps.

As well as increasing the physical area of engagement, *Battlefield 3* maps often include buildings with many floors, all of which can be explored by avatars and provide vantage points to survey the battleground. The maps are also littered with a large array of objects which avatars can hide behind or underneath to conceal their presence (although avatars still cannot directly manipulate the environment, so all pieces of cover are completely static). The increased distance between the combatants as well as the availability of objects to use as cover creates an environment better suited to the employment of cover and concealment than that of *Modern Warfare*. Whilst playing *Battlefield 3* the author was repeatedly killed by other players hiding in unknown locations, and crossing open terrain inevitably led to drawing enemy fire from previously unidentified positions. Effective use of concealment allows players to get the drop on each other, but almost every shot creates a bright muzzle flash and every weapon fires a large proportion of what appear to be tracer rounds (as the trails of bullets are easily visible).479

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479 Tracer rounds are bullets with a pyrotechnic charge in their base. The charge burns brightly, making the projectile trajectory visible to the naked eye. jackfrags (July 2015).
In reality, tracer rounds allow soldiers to correct their aiming without the use of sights. In *Battlefield 3* their purpose is seemingly to reveal the location of the shooter, which is obviously highly detrimental to the utilisation of concealment. These highly visible streams of gunfire are deliberate inclusions to counteract the inherent power of well-used concealment, and prevent the inevitable frustration of players being constantly eliminated by hidden opponents.

The combat model demonstrated that attacking from concealed locations is a favoured infantry tactic in real-world engagements, and so the reduction of this in *Battlefield 3* inevitably reduces realism. Given that players are for all intents and purposes aware of their opponents’ location, combat outcomes are likely to be more Lanchestrian, as one of the key principles underpinning the square law – which was largely debunked in the combat model – was that soldiers knew the location of their enemies. It is thus plausible that in virtual environments akin to *Battlefield 3*, Lanchestrian style models could be successfully employed to predict casualty levels, as combat effectiveness becomes less important when highly lethal fire superiority can be achieved through rapid manoeuvring to create a local advantage in numerical preponderance. By extension, numerical preponderance is likely to be significantly more important in the *Battlefield 3* environment than was observed in the real world, as bringing large volumes of highly lethal accurate fires to bear becomes a legitimate

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480 jackfrags (July 2015).
tactic when the impact of such fires cannot be negated.

The psychology of combatants will be examined in more detail as part of the moral component of this assessment, but it is relevant at this point to be aware that concealment is also employed to a greater extent because all combatants are controlled directly by players. In real-world engagements it has been observed that battlefield psychology leads to combatants adopting a cautious approach, taking cover and concealment both to protect themselves against threats, and potentially ambush roving enemies from their hidden locations; whilst they are not as pronounced, these behaviours are evidenced in *Battlefield 3*. Although players do not fear physical death in the game world, the killing of their avatar is a mild inconvenience as they are required to respawn in a different location which could potentially cede valuable territory to the enemy. Ambushing the enemy is beneficial as it allows one side to take the first shots, which provide a significant advantage in an environment where weapon accuracy is so much higher than the real world. Therefore, avatars in *Battlefield 3* do display a degree of tactical nous when employing cover and concealment, but in comparison to soldiers in the real world they still regularly take appreciable risks.

Similarly to *Modern Warfare*, logistical concerns in *Battlefield 3* do not mirror those found on the battlefield, as logistical constraints do not apply. Avatars demonstrate no symptoms of fatigue, never tire, and do not require sustenance or rest. Whilst they do spawn with a limited amount of ammunition, each time they respawn this number is reset. Given how frequent an occurrence death is on the virtual battlefield this effectively means that players are unconstrained by ammunition considerations.

Ostensibly, combined arms integration should be evidenced within *Battlefield 3* as experienced players have access to a wide range of equipment and accessories, including dozens of rifles, which far exceeds the equipment available to their real-world counterparts who are issued with standardised kit depending on their role.\textsuperscript{481} Furthermore, each time an avatar is killed the player has the option to customise their kit from all of the currently available options before respawning, meaning that they

\textsuperscript{481} Mitchell (2013).
can quickly and easily adjust their current loadout to suit the situation at hand. The combat model identified the significance of combined arms primarily in relation to generating dilemmas in tactical scenarios – does access to such a variety of equipment allow dilemmas to be effectively generated in the virtual environment? Fundamental to real-world dilemmas is the requirement to subject enemy forces to the psychological effects of suppressive fire. Whilst this will be discussed in more detail in the moral component section of this chapter, pinning enemies down so that friendly forces can manoeuvre is difficult in an environment where players do not demonstrate fear or caution. Therefore, rather than attempt to create dilemmas, players simply seek to locate the enemy and apply direct fire until they have been destroyed. They do use a different weapons system to accomplish this, but they are generally employed on their own merits (for example, large numbers of players arm themselves with sniper rifles on large maps due to their superior performance over long distances). The synergistic complementary effects between different weapons systems are thus nowhere near as significant in *Battlefield 3* as they are in real-world engagements.

**The Moral Component**

Although there are a variety of aspects where the game still falls short in comparison to the combat model, this section will argue that the moral component of *Battlefield 3* significantly improves on the failures evidenced in *Modern Warfare*.

*Battlefield 3*’s most significant area of improvement in comparison to single player games is group cohesion. In this regard, the multiplayer environment exhibits many of the behaviours described in the combat model, which arise due to the participation of multiple players working towards the same goal. Videos of clan training sessions show evidence of players working together to employ a variety of tactics that do reflect those employed in real combat engagements. Evidence for training leading to cohesive gameplay will be dealt with at this point, whilst a more detailed assessment of the actual tactics and training itself will be undertaken in the conceptual component section.

Squad training reels published by the ‘Tactical Gamer’ clan demonstrate how serious
clans employ drills during their training to instil group cohesion into members, thereby increasing combat effectiveness.\textsuperscript{482} These drills revolve around promoting both communication between squad members – microphone headsets ensure the location of both friendly and enemy forces are disseminated – and the ‘Development and consistent use of practical, game-compatible squad operating procedures and tactics’.\textsuperscript{483} The goals of clan training thus correspond to those of real-world infantry training. Videos of well-trained clans in action demonstrate a high level of cohesion between players, who communicate constantly and work together as a group rather than a collection of individuals.\textsuperscript{484} Such cohesion is instilled by consistently training together on a regular basis, and so clans often demand that their members devote time to regular training sessions for a few hours once or twice a week.\textsuperscript{485}

Although the training may not be anywhere near as intense as that experienced by real soldiers in basic training – and the tactics learnt may not be applicable to real-world combat scenarios – clan members successfully form genuinely cohesive squads. One practice video aptly demonstrates that, when playing on public servers against other players not affiliated with a clan, the members of Last Clan Standing (LCS) maintain impressive scores:

![Figure 26 - Battlefield 3 Clan Scores.\textsuperscript{486}](image)

\textit{Alpha and Delta squads are comprised of at least three clan members, and both have excellent kill/death ratios. Bravo squad, with only two clan members, has fared worse.}

LCS’s cohesive group play reveals a stark contrast in comparison to individuals

\textsuperscript{482} 1stMIP (October 2011a); 1stMIP (October 2011c); 1stMIP (October 2011d).
\textsuperscript{483} 1stMIP (October 2011d).
\textsuperscript{484} JurgenCutters (March 2012).
\textsuperscript{485} United Legion (n.d. b).
\textsuperscript{486} 1stMIP (October 2011b) – example at 10 mins 54 seconds.
playing with randomly assigned teammates. The difference in approach and combat effectiveness is immediately obvious; they co-ordinate their actions via effective use of communication tools and discuss the tactics they will use to overcome obstacles encountered in play, frequently employing tactics which require the fireteam to work together to provide mutually supporting fires.\textsuperscript{487} There is thus ample evidence to support the supposition that their effective performance in terms of eliminating enemy forces stems from cohesion leading to successful collective performance, in a similar manner to that observed in real-world professional armed forces.

The assessment of suppression in the combat model revealed that its effects stemmed largely from the fear which nearby weapons fire engenders. However, \textit{Battlefield 3} struggles to replicate this; ‘In reality, suppressing the enemy by sending shitloads of bullets is so effective because he’s sure that sticking out his head will end his life-forever…you won’t have that feeling when sitting in front of the PC’.\textsuperscript{488} \textit{Battlefield 3} does not subject players to the same degree of fear experienced by real soldiers in genuine combat engagements, which is unsurprising given that the risks are so much lower.

Recognising this limitation, the developers of \textit{Battlefield 3} implemented a gameplay mechanic to increase the effectiveness of suppression and provide actual consequences when being subjected to incoming fires. When bullets land near an avatar without directly impacting they will apply certain effects to the player’s gameplay experience, compromising their ability to control the avatar. These effects are designed to be reminiscent of the effects caused by suppression, so whilst the virtual environment does not have the ability to recreate the causal effects of suppressive fire the developers have still tried to mimic some of the physically observed outcomes. ‘While suppressed, a soldier’s vision will blur and lose focus, he will call out for help, experience a noticeably large increase of scope sway and hip fire spread, and… a substantial increase in recoil and bullet spread’.\textsuperscript{489} Most of these effects are automatically applied as penalties to actions the avatar attempts; the

\textsuperscript{487} An example of a player playing alone can be seen here at Chadtopia (October 2013); 1stMIP (October 2011b) – example at 10 mins 54 seconds.
\textsuperscript{488} ‘Laxemann’ (2015).
\textsuperscript{489} Battlefield Wiki (n.d. i).
player may be aiming exactly at a target, but the shots will not impact precisely where expected. However, the vision blur is applied as a consequence directly to the player rather than the avatar, as shown below.490

![Figure 27 - Suppression effects in Battlefield 3.](image)

The blur makes it hard to see, and the intensity of the effect varies between weapons based on the suppression value they have been assigned; weapons with high calibre ammunition have a greater suppressive effect (a realistic outcome noted in the combat model).491 This mechanic does give suppression legitimate impact on the virtual environment, but this impact does not elicit the most important observed outcome of suppression in the real world – keeping the enemies’ heads down and reducing their ability to return fire. Through both personal experience and watching clan battles the author has observed a persistent tendency amongst avatars to react to incoming fire by returning fire and attempting rapid manoeuvres across nearby terrain in an effort to escape, as opposed to being pinned down or suppressed. When subjected to suppressive fire, players almost immediately manoeuvre in an attempt to remove its debilitating mechanical effects and thereby regain full combat effectiveness so they can return fire effectively and attempt to eliminate the enemy.

490 A demonstration of suppressive effects can be seen here: Squirrel (April 2012).
491 Symthic.com (n.d. b).
It is important to recognise that such a response is not necessarily unrealistic, as the combat model examined a variety of scenarios where the most effective course of action was to manoeuvre despite the increased risk; professional soldiers cannot just go to ground and accept being suppressed. However, in reality the psychology of combat means that suppressive fire frequently does result in soldiers – even Western ones – sometimes being pinned down. Such behaviour is almost never seen in Battlefield 3. This is partly because neither side represents untrained soldiers, but also because suppressive fire is not psychologically intimidating.

Despite its imperfections there is sensible logic behind the system, and it demonstrates that the developers recognise the importance of suppression on the battlefield. Reducing avatar accuracy does result in a minor temporary reduction to combat effectiveness, and the suppression mechanic represents an attempt to utilise artificial gameplay mechanics in order to mimic some of the observed outcomes of suppressive fires. While it is incontestable that this reduction in effectiveness is relatively minor in comparison to that observed in real engagements, within the inherent limitations of psychology in virtual environments it is an imperfect but entirely reasonable method to provide at least some advantage to employing suppressive fires. Most importantly, it has resulted in players responding in a tactically plausible manner which mirrors that observed in some real-world scenarios.

However, this mechanic was frustrating for the majority of gamers, who criticised it for not being a fun addition to the game, ‘I think it’s really annoying. I don’t think it has to go, it just has to be tuned down a bit…It’s pretty lame losing a fight when you fire first, hit the first couple shots and the other guy misses you, suppressing you leaving you completely unable to finish the dude off…’.\footnote{‘SuperiorTLS’ (2012); ‘Thebkt’ (2012).} Such complaints were widespread, and eventually led to suppressive effects being greatly reduced in later instalments of the series, such as Battlefield 4.\footnote{XFactor gaming (June 2014).}

Civilians are not present on the battlefield and thus the conclusions in relation to ROE, as previously drawn in the analysis of Modern Warfare, remain pertinent.
However, in hardcore mode *Battlefield 3* servers do allow friendly fire, meaning that avatars can shoot friendly soldiers. One player voiced his dislike of game modes without friendly fire because they led to ‘…spam spam and more spam [a colloquial term referring to the needless expenditure of large volumes of ammunition vaguely towards the target without aiming] resulting in lack of awareness since it doesn’t matter who you hit with what’. 494

Friendly fire thus potentially introduces a slight degree of caution which was not seen in single player games. In terms of the duration, it could be expected that some caution would be displayed by players who do not wish to accidentally eliminate their teammates and thereby result in increased engagement duration – although it important to recognise that such caution stems purely from a desire to not reduce the combat effectiveness of friendly forces, rather than any sort of concern for preserving human life. However, given that it is so easy to identify friendlies in the virtual environment due to real-time information provided by the HUD, such caution rarely manifests itself.

The conclusions drawn previously in relation to *Modern Warfare* regarding the psychological and physiological aspects of combat can be largely replicated in the context of *Battlefield 3*; lack of fear in relation to death, the absence of resistance to killing, lack of physiological engagement as well as a reduction in combat duration due to an overall lack of caution (despite minor additional concerns such as friendly fire) are all conclusions that remain pertinent. Death however does have one other in-game effect, it negatively impacts player kill/death ratios, a quantitative measure often used in video games to distinguish between players and demonstrate individual skill (Fig.23 shows the player names in order of score, which is closely correlated to the kill/death ratio). 495 This may actually lead to some element of caution being displayed by players who care about this ratio ‘…gamers fear getting killed as that is bad for their stats so they stay behind cover or far from the frontlines even in critical moments…’. 496 This sheds some light on player motivation. In the real world soldiers are primarily motivated by the desires of staying alive, protecting those

494 ‘Smooth613’ (2012); Wikipedia.org (2015d).
495 Battlefield 4 Stats (2015).
496 FPSnatics.n.nu (2011).
around them, and completing the mission. In *Battlefield 3*, players with no fear of death are motivated by the desire to defeat the other team and in some cases to also maintain creditable kill/death ratios. Both these goals are accomplished in Deathmatch mode by scoring points through eliminating enemy soldiers. The game ends when one force achieves a certain number of points, but then the scores of each individual player are displayed. This has a significant impact on the duration of engagements, as these fundamental differences in motivation explain why clan gamers do not hold back and are focused almost entirely on taking offensive actions. Scoring as many points as quickly as possible to reach the required amount is the optimal path to overall victory, and players who seek out the enemy and destroy them are likely to accrue more points that those who exhibit defensive proclivities. The FPS Tactics website (www.fpstactics.n.nu) states that ‘Effective movement is likely to require sprinting across a road or other areas with a high risk of getting killed…but you have no choice as losing is not an option… A good gamer is more than willing to take a bullet for the team if the probability of winning is increased’. Speed is thus considered a prerequisite to successful team play, and amongst team-oriented gamers living is less important than winning. Whilst clan gamers are more concerned with making sure the team emerges victorious, if non-affiliated individuals are participating in the same game they may care more about their personal kill/death ratio and be less willing to participate in offensive actions. This may end up mirroring the behaviours of some soldiers being incapacitated by fear on the battlefield, even though the underlying reasons are completely unrelated. Part of the cohesion shown in clans is derived from the fact that in these communities team achievement is always given higher priority than individual displays of skill; as with professional soldiers, the group is prioritised over the individual.

Whilst the virtual environment does not stress the player as described in the combat model, it does provide challenges which players train for in order to apply the same acclimatisation principles. In an environment where hesitation or panic for even a fraction of a second frequently results in avatar death, the speed at which players are required to react produces its own stress; players are thus required to hone what are

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497 FPSTactics.n.nu (2011).
known as their ‘twitch reflexes’ in order to perform proficiently.498 The mouse and keyboard allow avatars to rotate and aim considerably faster than a soldier ever could in the real world. The action of moving the mouse only a few millimetres results in the avatar rotating 180° in a fraction of a second, and this allows players to react unrealistically quickly (another example of virtual environments providing capabilities which exceed those of soldiers in the real world). During training a disproportionate emphasis is placed upon honing these instantaneous reflex reactions to targeting and firing at enemies, since they are often crucial to survival.

As an aside, it is important to recognise that the video game interface can cut both ways and does not always provide players with advantageous additional capabilities. Whilst in relation to aiming the player’s abilities are enhanced beyond those of a person in the real world, FPS games are notorious for their inability to reasonably mimic other basic human actions such as climbing and jumping.499

The effects of surprise and shock in Battlefield 3 are also related to these reflex reactions. Similarly to Modern Warfare, players have the constant expectation of engagement with the enemy, but the sheer speed at which people are required to react in Battlefield 3 still allows surprise and shock to have some legitimate impact. Such increased speed means that if a player panics or hesitates for even a fraction of a second when encountering an unexpected situation they can be shot and killed by another player with faster reflexes before having a chance to react. This does bear some similarity to ambushes in real-world engagements, where the combat model previously established that soldiers targeted in these scenarios were required to demonstrate judicious and instantaneous decision making skills in order to survive. Whilst ambushes do provide a valid real-world referent, these reactions are required from players on a continuous basis rather than just in exceptional circumstances. Whilst surprise and shock can have a debilitating effect on inexperienced players who are unaccustomed to the rapidity of in-game events, experienced players become acclimatised to this pace and rarely demonstrate any detrimental effects. Surprise and shock have as minimal an impact on combat effectiveness amongst experienced players in the virtual environment as they do for trained troops in the

498 Author’s observations; ‘agent86’/’Doomsknight’ (2012).
499 TV Tropes (n.d.).
real world.

**The Conceptual Component**

This section will argue that in *Battlefield 3* clan battles players employ a variety of different doctrine and tactics. Some do correspond to those utilised by professional soldiers, but others are unique to the context of the virtual environment. Clans develop this understanding through regular training of their members, which whilst not as intense as that undertaken by professional soldiers does seek to achieve many of the same outcomes in terms of memorising drills and developing skills through repetition. Both of the conceptual factors are more accurately represented in *Battlefield 3* than they were in *Modern Warfare*, although there is still significant room for further improvement.

Various videos published on sites such as YouTube and individual clan websites demonstrate that serious clans place significant emphasis on the need for regular training sessions.500 This allows them to maintain and improve player skills in order to do battle with other clans in a competitive environment, and in a tournament setting cash prizes provide incentive to perform at the highest level.501 Training teaches teamwork skills to develop group cohesion amongst the clan members, provides a detailed understanding of the maps they will be playing on, develops and maintains individual player skill in terms of marksmanship and using the in-game interface, and instructs players in applicable doctrine and tactics. Even for the most serious clans training is an organisational challenge, and generally occurs over time periods of a few hours once or twice a week, as organisers recognise that players have other concerns in their lives.502 However, individual player profiles show that dedicated players devote huge amounts of their spare time to playing and improving their skills; for example, two of the overall highest ranked individual players according to the Battlefield 3 Statistics website have each spent over 3,300 hours playing *Battlefield 3* (equating to over 137.5 days of uninterrupted play).503 Gamers are willing to spend significant amounts of time honing their skills, and clan training

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500 ‘United Legion’ (n.d. a); The Elite 5 (n.d.); ‘sser Fifty Caliber’, (2014); 1stMIP (October 2011b).
501 Regular tournaments give prizes of up to €30,000 to the winning teams – Electronic Sports League (2014).
502 ‘United Legion’ (n.d. a).
503 BF3 Stats.com (2015a); BF3 Stats.com (2015b).
videos demonstrate that this investment leads to significant increases in combat effectiveness.

Given that *Battlefield 3* has only 30 possible maps over which conflict can occur, players can practise on and learn specific details about each individual map before engaging in a competitive match.\(^{504}\) This gives them the entirely unrealistic advantage of having already fought in an environment which is identical to where the engagement with enemy forces will take place. Players learn the nuances of each map, which provides an in-depth understanding of the layout and knowledge of tactically advantageous positions, potential choke points, etc. They also often take part in friendly matches between different teams and clans to practise against different opponents.\(^{505}\) This provides them with obvious tactical advantages which real-world infantry training regimes would undoubtedly incorporate if they were in any way feasible. Whilst contemporary infantry training constantly strives to train soldiers in an environment close to that which they will encounter in the field, there has never been the capability to exactly replicate battlegrounds in advance.

Training also serves to standardise individual player skill at a level determined by the players who run the clan. Similar to genuine military training, combatants are required to demonstrate a certain standard of competency to their peers before being allowed to participate in engagements against the enemy.\(^{506}\) Such competency pertains to the ability of each player to effectively control their avatar – in terms of individual marksmanship, and mastery of the user interface to control its movement and other actions – as well as their capacity to work with other squad members and employ the doctrine and tactics they have been taught.

Training is also essential in terms of imparting the correct doctrine and tactics onto players. Clan members employ various elements of real-world tactical doctrine in the virtual environment. Players:

- communicate enemy positions and casualties inflicted;

\(^{504}\) Battlefield Wiki (n.d. f).
\(^{505}\) ‘Scrim’, definition at Wikipedia.org (2015c).
\(^{506}\) United Legion (n.d. b).
• demonstrate an awareness of the surroundings and nearby tactical objectives, as well as an understanding of battlefield concepts such as line-of-sight, overwatch, and stacking;
• co-ordinate their movements closely whilst covering each other and attempting to suppress the enemy;
• roughly adhere to military procedure in terms of formations and following orders from clan members further up the established hierarchy.507

Whilst some of these tactics, particularly suppression, are not as effective as in the real world, players exhibit an understanding of their usage and attempt to put them into practice within the constraints of the virtual environment.

Given that psychology plays a reduced role, the duration of engagements is still considerably less than in the real world. However, the demands of effective co-ordination and need to work together lead to squads of clan players being more cautious than individuals outside of the clan environment.508 Clans demonstrate a much slower and more methodical approach to movement in the combat zone, which is reminiscent of real-world engagements. It is also worth noting that periods of actually firing at the enemy are often brief. As previously established the lethality of combat within this environment is incredibly high, and this is increased further when players are well-trained and working together, so once the enemy is located engagements are often resolved in a matter of seconds as one squad is eliminated or forced to disengage quickly under fire. Whilst periods of time without fire are seen in the real world, flurries of decisive activity such as this are not representative of genuine engagements outside of the most lopsided ambushes.

There is no evidence to suggest that Battlefield 3 clan players have undertaken detailed study of real-world doctrinal publications. Players learn advanced tactics from either experienced clan members or websites such as FPS Tactics (http://www.fpstactics.n.nu/), which is a strategy guide for online multiplayer gaming. Whilst Battlefield 3 players apply elements of military doctrine in areas

507 1stMIP (October 2011b); 1stMIP (October 2011c); Joel (2012); 1stMIP (October 2011a).
508 1stMIP (October 2011b) can be compared to Ali-A (October 2011).
where its effectiveness can be demonstrated in game – including effective communication, risk management, and flanking – the FPS Tactics website also introduces tactics developed by players themselves which are applicable only within the context of the virtual environment.\textsuperscript{509} Examples include making sure a single player survives, so that the entire squad can respawn at their location (known as tactical spawning), using the edge of the playable map area to minimise angles of enemy attack, and rushing to take objective points at the start of the game (safe in the knowledge that enemy forces cannot possibly be in the area due to their distant spawn locations).\textsuperscript{510} Players use these tactics to exploit weaknesses in in-game mechanics, leveraging their understanding to manipulate faults in the environment to create advantages that have no real-world analogues.

Online sources provide a filtered mix of tactics applicable to the virtual environment, some being essentially watered-down versions of genuine military doctrine, whilst others have no real world referent. The fact that clan battles are often limited in size (the largest engagements are generally 12vs12 encounters, involving 24 concurrent players), demonstrates the difficulties faced by small scale organisations in both effectively imparting complex doctrine and finding players willing to commit the prerequisite time and effort to training and implementing it effectively. It is however clear that those players who are willing to commit have spent considerable time refining the elements of genuine doctrine applicable to the virtual environment, and that elements analogous to those in the real world remain viable in \textit{Battlefield 3} supports the argument that the environment provides some degree of authenticity.

Given that bodies such as the ESL are instrumental in organising high-level tournaments and provide a compelling financial incentive for players to perform well, it is unsurprising that \textit{Battlefield 3} attracts gamers who have no qualms with abusing in-game mechanics to eke out any and every advantage. These players are competitive, and treat \textit{Battlefield 3} like a sport rather than a simulation. Their motivations are not to play the game in the most realistic manner, but to perform at the highest level. It is thus unsurprising that such gamers employ genuine military strategy only in so far as it is combat effective within the virtual environment. They

\textsuperscript{509} FPStactics.n.nu (2011).

\textsuperscript{510} Saether (2011); Veselka (2012); Joel (2012); FPStactics.n.nu (2011).
have no interest in handicapping themselves for the sake of realism – by removing the HUD for example – and such actions would only be taken if all players were subject to the same handicap. This marks a fundamental difference in motivation between competitive players and simulation enthusiasts (who gravitate more towards virtual environments such as ArmA precisely because of the differing perspectives and motivations within their respective player communities).

However, compared to Modern Warfare this multiplayer environment is far more conducive to implementing both training and real-world doctrine and tactics. The conceptual component of Battlefield 3 demonstrates some evidence of this implementation, but there are still significant deviations from the combat model. Some of these differences are fundamental – as certain tactics in the virtual environment are effective even though they are unrealistic – whilst some are linked to the approach taken by gamers to their hobby; in order to truly test the limits of Battlefield 3 gamers would need to follow precise military doctrine. Thus far, there are no examples of any players willing to take such a radical step.

**Conclusions: Combat Models Compared**

The overall duration of engagements is largely defined by the predetermined number of kills required for one side to win the match. Since the two forces engaged always have an artificially commensurate number of endlessly respawning troops battles would last indefinitely if such a constraint were not in place. The duration of discrete engagements within the battle demonstrate many of the same issues as those in Modern Warfare, as even in clan battles involving cautious players these engagements are incredibly brief. Despite increasing usage of cover and concealment, once shots are fired players are incredibly quick to locate the enemy and engage them with highly lethal direct fires. Since clan matches generally involve at most 24 players this means that one side can be rendered combat ineffective in mere seconds. Such an outcome would only be observed in real-world combat in the event of a spectacularly successful ambush.

The deathmatch games modes are specifically tailored to generate scenarios where
two forces battle on an even playing field. They have identical goals, access to the
same equipment, and the maps they fight on are designed to provide no inherent
tactical advantages to either side. In the real world, such an engagement would likely
lead to a cautious stalemate between the two sides, given that Western militaries do
not generally engage in symmetrical engagements on even terms. In such an
engagement Western troops would likely take a highly defensive posture given the
inherent risks involved when facing a competent enemy. Whilst deathmatch does
create a fun and competitive gameplay environment, which is also more realistic
than the other games modes offered, it still does not accurately represent the nature
of engagements seen in recent conflicts.

The lack of psychological and physiological symptoms of combat, such as fear,
fatigue, and suppression, mean that even when all avatars on the battlefield are
player controlled they do not display the level of caution demonstrated by real-world
infantrymen. Even the addition of friendly fire to promote a cautious approach is not
enough to remedy these fundamental problems, and ultimately the outcome is that
the length of engagements is greatly reduced in comparison to the combat model.

As in the real world, group cohesion does contribute towards increasing engagement
length, although its impact is comparatively minor. Players demonstrate more
cautions in their approach to moving through the combat zone, and working together
requires them to use voice communications. They advance together in co-ordinated
groups, avoiding the tendencies demonstrated by individual players (and NPCs) to
simply to run around the battlefield heedless of potential dangers. The level of co-
ordination is however rather superficial in comparison to that required in real-world
operations, and in conjunction with the reduced impact of psychology and the
necessity of fast paced operations players are mindful not to let cohesion
substantially slow down their gameplay, as this would actually reduce their combat
effectiveness.

Training undertaken by players, as well as the doctrine and tactics they employ,
contributes to both increasing and decreasing the duration of combat in *Battlefield 3*,
depending on the context. Knowing the maps, players keep formation, approach
corners with caution, and when entering rooms potentially containing enemy forces often correctly employ drills such as stacking. Thus, whilst periods of direct engagement with the enemy are brief, the cautious approach they take to areas outside of direct engagement is slower, more methodical, and reminiscent of real-world professional military forces. Overall, combat has a longer duration than was observed in Modern Warfare, but is still significantly faster than that observed in the real world. This is primarily because the pure lethality of weapons fire overwhelms any other factors; eliminating all enemy troops is an entirely feasible tactic.

Clan battles demonstrate numerous links between combat effectiveness in Battlefield 3 and the factors identified in the combat model, especially in relation to the factors of group cohesion, doctrine and tactics, and training. Nevertheless, as with the observed outcome of duration, weapons lethality is crucial. This skill is honed through training and experience, and since players are capable of such lethal fires it is unsurprising that a greater focus is placed on weapons handling skill during training.

Clan players battling in multiplayer demonstrate a different mindset to individuals using single player. Although they are still playing to have fun, this no longer means simply replicating the gratuitous violence of Rambo style encounters. In this context, increased enjoyment is derived from collective success generated by working together and operating as a cohesive unit. There is no evidence to suggest that these gamers have studied actual military doctrine, and so their unit based tactics are almost certainly based on other depictions of combat which are perceived to be realistic; indeed, one article stated that the in-game experience of Battlefield 3 was loosely based on comparatively more realistic films and TV shows such as Generation Kill (2008) and Black Hawk Down (2001). This inspiration and mindset leads to players employing tactics that sometimes approximate reality and are more realistic than those seen in Modern Warfare, but which in many cases are still wildly different from those seen in genuine engagements.

Respawning mechanics are the ultimate manifestation of death being irrelevant, and

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511 Crecente, B. (2011b).
they mean that the battle will continue with both sides at full strength until the victory conditions are met. This artificial mechanic does actually mitigate the impact of increased lethality, as neither side sees any reduction in its overall combat effectiveness via attritional losses or reduced cohesion. This even allows squads in certain circumstances to reinforce in the middle of a firefight, and this completely changes the dynamics of engagements. Direct engagement is almost continuous, as death is a momentary inconvenience which requires the player to change their avatar’s location on the map. Players are thus free to take significant risks and engage in many more skirmishes than would be possible for a soldier in the real world given the timeframe.

Whilst there are significant flaws and unrealisms in relation to the physical component, the moral component demonstrates many improvements over games such as Modern Warfare. Whilst clans, consisting of perhaps a dozen members, are in no way comparable to military institutions, the highest level of clan play does demonstrate the sort of cohesion that is reminiscent of real military squads, and this is an impressive achievement given their comparatively limited time and resources. Observing these players reveals that they often correctly ape military terminology, communicating effectively to co-ordinate their actions as a group in taking objectives. When taken seriously, the psychology of group play appears to be capable of creating an environment similar to military training, leading to many of the same observed results; when players devote time to playing and training they display high levels of cohesion which undoubtedly leads to increased combat effectiveness in comparison to their peers.

Such training itself also provides similar advantages to those seen in professional armed forces. In an environment lacking many of the stresses which compromise soldiers’ performances, the effectiveness of persistent marksmanship training is fully realised. Training also imparts doctrine and tactics which are clearly based around real-world understanding of the battlefield that has been adapted to suit the virtual environment. As with doctrine and tactics in the real world, participants have learnt from their experiences in the game and adapted their training to suit the environment they are operating in. This increases their combat effectiveness, but can also lead to...
the use of unrealistic tactics which have been specifically developed for use in the virtual environment.

There is ultimately a huge onus on the players themselves to behave realistically. Whilst public servers are crowded affairs bearing almost no resemblance to real-world combat, clan battles involve small groups of more dedicated players willing to put the time and effort into mastering the game, and in employing real-world doctrine and methodologies they demonstrate significantly higher levels of combat effectiveness than their aforementioned counterparts. There is an argument that realism would be increased further if soldiers themselves were to play the game, as they would implement their understanding of real doctrine on the virtual battlefield – this hypothesis will be tested in the case study of VBS2.
Part 4: Military Video Game Usage

Chapter 9: The Armed Assault Series

Introduction and Background to the Armed Assault series
This chapter will examine the Armed Assault series – developed by Bohemia Interactive Studio and based on the Operation Flashpoint game engine – with a particular focus on the latest instalment, ArmA 3. Despite being a commercial product ArmA 3 was designed specifically with the aim of catering to a comparatively niche element of the FPS market, and many of its functionalities are similar or identical to those in VBS. This means that the combat model comparison undertaken in this chapter will also be largely applicable to the VBS case study in chapter 11.

ArmA 3 is a complex large-scale simulation of combat which requires extensive time dedicated to understanding its mechanics and effectively utilising its array of features:

‘The scale of Arma 3 dwarfs everything in the genre...The enormity of the map is the foundation for the experiences that distinguish Bohemia Interactive’s flagship franchise. It’s what makes radios, topographical maps, binoculars, and compasses practical equipment in an FPS... It’s what makes using your eyes to spot hints of enemies--muzzle flashes, tracers, gunsmoke--as valuable as being a crack shot...It takes a long time to comprehend, but once you’re comfortable enough with its mechanics to take advantage of them under pressure, you’re able to engage in a kind of large-scale tactical combat that’s simply not offered elsewhere....’

One reviewer encapsulated the developer’s approach when he stated that ‘The most important, and perhaps the only, important thing about ArmA III is that it is what you make of it....ArmA is all toolkit’. The game strives to provide players with a

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512 Lahti (2013); Maiberg (2013).
513 Stanton (2013).
sandbox – otherwise known as an open-world – environment, promoting the free utilisation of the engine as a toolbox to facilitate the creation of a vast array of user-driven content. Such an approach differs greatly to the small selection of maps and scenarios included by other developers in the previous commercial case studies, such as Battlefield 3; as of March 2015 the official online distribution centre lists over 12,000 user generated scenarios which are freely available for download to all ArmA 3 players. Although the game does have a single-player component this assessment will focus on multiplayer engagements, as these are the environments in which serious organised clan-centric play takes place. Unlike the other case study games, ArmA 3 was also a PC only title that was not released on any console system. It therefore has low sales figures in comparison to other triple-A titles; two years after its release two million copies had been sold, a significant number, but a far cry from the five million copies of Battlefield 3 sold in a single week.

Before any assessment can take place, one aspect of this sandbox environment needs to be considered in more detail – its modifiability. As well as generating scenarios, users have the capability to actively develop their own in-game content and manipulate basic gameplay functions. Players can add additional weapons, vehicles, and locales, as well as altering the UI, the actions of AI controlled characters, and the underlying physics of the environment itself. Popular downloadable mods such as the Tactical Battlefield and Authentic Gameplay Modification constitute complete overhauls of the entire gameplay system, aimed at providing a more authentic military experience as well as addressing perceived gameplay concerns ranging from increasing the usability of the UI to providing wind effects and enhanced ballistics.

It is important to recognise that even niche games like ArmA still need to sell millions of copies to be commercially viable. The vast majority of gamers are happy to play the single-player narrative campaign which comes packaged with the game or use the multiplayer outside of clan environments without any modifications, and this demonstrates that realistic games do have a sufficiently large market draw for games

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514 Ibid.; Harris (2007).
515 Steam Community (2015).
516 ‘Dr_Eyeball’ (2013); ALiVE Developer Team (2015).
like ArmA to be produced in the first place. Only a small proportion of players wish to experience the game at a further enhanced level of realism; even amongst the market for ArmA, realism appeals to only a small segment of the players. The website ‘arma clans’ provides a list of nearly 200 currently active clans (although there is no guarantee this list is comprehensive), and given the average number of active members per clan it can be calculated that there are around 20,000 hardcore players who comprise around 1% of the total player base. ArmA could not have been made specifically to appeal to hardcore realism clans, as the segment of the market they represent is simply too small. The modifiability of the product allows it to satisfy the needs of its more general player base alongside those seeking an ultra-realistic gameplay experience.

Mods are not required to make the game more realistic; for example, *Day Z* (2012; Dean Hall) is one of the most popular mods for ArmA 2, which ‘places the player in the fictional post-Soviet state of Chernarus, where a mysterious plague has infected most of the population, turning people into violent zombies’. *Day Z* boosted the sales of ArmA 2, and was so popular that Bohemia Interactive Studio developed their own version of the game which went on to sell more copies than ArmA 2 or ArmA 3. This does however expose a problem; there are a huge variety of different modifications used by various communities, and gameplay experiences can therefore diverge greatly depending on the configuration of the server in question.

Shack Tactical (ShackTac), is a serious gaming clan run by Andrew Gluck, otherwise known by his username ‘Dslyecxi’. Gluck was a member of the US Marine Corps, serving as an IT specialist during the 2003 invasion of Iraq. After leaving the military he went on to work as the lead designer of VBS 2 tactical weapon systems at Laser Shot Inc., a company specialising in firearm training.

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517 Number calculated by averaging the number of active members over 25 clans from ArmA Clans (2015).
518 Wikipedia.org (2015a).
519 Nutt (2015).
521 Hall (2014).
522 Ibid.
In 2006 he founded ShackTac as ‘a group that cares about tactics, authentic simulated combat, and serious fun’. ShackTac’s approach is based upon Gluck’s vision of what constitutes a realistic combat environment, and it is important to recognise that his vision is one of many. Each clan has its own unique approach to playing the game, and since attempting to assess the realism of so many different configurations would be unfeasible, this research will primarily focus on a few specific clans, with ShackTac being the primary case study. ShackTac is a suitable selection because they provide an excellent case study of a clan dedicated to creating the most realistic combat scenarios feasible within the virtual environments of the ArmA games, starting with ArmA 2 and then moving to ArmA 3 upon its release. ShackTac has lists of approved mods that members must have installed and activated in order to participate in engagements on the servers they run. The impact of these specific modifications in conjunction with how Gluck justifies their employment will highlight where clans perceive the ArmA game engine to be deficient, as well as showing how they mitigate these perceived problems.

Since ShackTac is Gluck’s personal project his perspectives will be crucial, as in this context he is just as important in shaping the in-game experience as the developers. Gluck is clear that even ShackTac players primarily use ArmA 3 as a means of entertainment; their ultimate goal is to have fun. However, the difference between ArmA 3 players and those observed in previous games is how they derive enjoyment from a gameplay experience which would likely frustrate the majority of FPS gamers. Many members of the clan have previously served in the armed forces, and some are even current active duty service members. The dedication of these clan members to the authentic simulation of infantry combat borders on the fanatical. Gluck single-handedly produced the *ArmA 3 Tactical Guide*, a 150,000 word doctrinal publication that provides an outline of infantry tactics, techniques, and procedures based on real military doctrine to be employed by players. The guide is so comprehensive that it was officially endorsed by Bohemia Interactive Studio, and is now sold on their website. He has also produced a series of YouTube videos

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523 LinkedIn (2015); LaserShot (2015).
526 Hall (2014).
527 Bohemia Interactive (2015a).
detailing various TTPs to be employed within ArmA 3, such as bounding overwatch and peeling, as well as examining ROE on the virtual battlefield, and he scrutinises and justifies the modifications ShackTac make to the game engine to achieve the most realistic gameplay experience possible.528 The clan thus represents the pinnacle of realism in regards to ArmA 3 simulations of combat undertaken by enthusiasts, and as such provides a prime case study to evaluate the capabilities of ArmA 3. Gluck and other members of the clan also use YouTube to publish hundreds of hours of recorded gameplay content, showing different engagements from the perspective of various participants, and this provides an invaluable resource for evaluating the realism of their scenarios.

The 15th Marine Expeditionary Unit (MEU) are another noteworthy clan; defining themselves as an ArmA 3 realism unit they strive to accurately recreate real-world engagements, ‘We’re simulating a Marine environment in a virtual world …even a few of our members are Marines or are planning to serve in the Corps. They bring their experience to the table to further enhance our Unit’.529 Like ShackTac they produce a large number of YouTube videos documenting their engagements, and these also provide some useful examples of serious gamers in action.

**The ArmA 3 Tactical Guide**

The guide is extensive and covers the following pertinent topics:

1. **Basic Infantry Skills**
   
   An introduction to basic gameplay functionalities and military tactics. These skills cover a mix of real-world issues – such as the employment of cover and concealment and the basic use of suppressive fires – as well as concerns purely related to the virtual environment – such as adjusting the avatar’s stance and using the inventory system to equip the avatar.

2. **The Company**

   An assessment of the organisational structure of a company sized element, expanding upon the concept of the fireteam and squad, and also touching on issues of logistic resupply. It outlines key differences between the structure of

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528 Dslyecxi (July 2014b); Dslyecxi (November 2012).
529 15th Marine Expeditionary Unit (SOC) Realism Unit Command Staff (2015).
ShackTac low-level elements and those used in the real world.

3. Communication
The methods of voice communication and the software that gamers employ, it also provides an outline of the terminology used during radio communication, which is heavily modelled on military paradigms.

4. Leadership
How to effectively plan and execute missions, issuing orders effectively to subordinates, and basic decision making in dynamic combat environments.

5. Battle Drills
Rooted in military doctrine this section examines battle drills as standardised ways to react to common battlefield events. It covers reaction to contact drills, provides instructions on how to conduct an ambush, and action to take against direct and indirect fire.\textsuperscript{530}

6. Tactics
Also borrowing heavily from military doctrine, this section examines basic infantry formations, team movement techniques and tactics – utilising both suppression and fire and manoeuvre – and principles of attacking and defending.

The guide will be central to the forthcoming analysis of ArmA 3 gameplay, as it provides an in-depth analysis of the tactics and procedures serious gamers should use; however, whether the contents of this guide are followed in practice and whether it actually relates to real-world doctrine with any accuracy are matters which will need to be addressed. Additionally, since gamers play for entertainment there is no way to force them to read this document, so their levels of understanding will be assessed by watching clan members in action.

**The Physical Component**
Whilst still fundamentally playing to be entertained, the niche market for this game demands a much higher level of realism than other products. This section will argue

\textsuperscript{530} Gluck, A. (2013).
that ArmA 3’s virtual environment exhibits further improvements in terms of realism relating to the physical component of warfare when compared to more commercially successful game titles.

Several of these factors are covered by the guide, with corroborating evidence available from both gameplay videos and the author’s experience of playing the game itself.

ArmA 3 represents the physics of the real world to a much higher level of fidelity than previously examined games; bullets have ballistic arcs determined by gravity and air resistance, and weapons sights require calibration to take account of bullet drop.\(^{531}\) It is however worth noting that although the engine can handle many more variables than other commercial products, it still provides only an estimation of real-world physics which may not be entirely accurate – calculating exact values would require an immensely detailed physical simulation, which would not make enough difference to be worth the time and expense of its construction.\(^{532}\)

Although the game is similar to other commercial titles in its use of HP as a basic method of measuring an avatar’s health, it has a far more complex system to calculate both damage and damage mitigation via armour, which leads to higher fidelity. Various players have undertaken detailed analysis of weapon and armour effectiveness. The video ‘ARMA 3 - Damage, Armor, and Health Explained (Mostly)’ provides an excellent assessment of these traits.\(^{533}\) Firstly, the game engine tracks both the overall HP of each avatar as well as specific levels of HP for different bodily locations; avatars can be killed from taking either excessive damage to a particular location or a greater amount of damage across the body as a whole. Generally any unmitigated bullet impacts are highly dangerous, far more so than has been observed in the case study previous games. Secondly, armour and the wearing of a helmet prove to be excellent defence from impacts to the central torso and head, providing a great degree of mitigation which allows the avatar to take numerous hits and still remain combat effective – this can greatly reduce casualty rates to a force. This game engine provides a far more detailed implementation of these features than

\(^{532}\) Edwards (2014).
\(^{533}\) ExecConfig (December 2014).
any of the previously assessed commercial products.

ArmA 3’s engine also tracks the location of impacts/wounds and applies debilitating effects to the avatar. ‘Arma 3’s wounding system localizes trauma to the injured areas. When you are hit in the arms, you can expect to see decreased aiming stability, whereas leg hits may make it impossible to move at anything other than a slow limping pace’.534 The game includes a basic set of actions for dealing with these injuries – medical equipment and procedures are employed in order to mitigate the impact of the wound, allowing the wounded soldier to continue fighting with only minor penalties. This functionality continues to remain entirely abstract; the player simply needs to press a couple of buttons on the keyboard and wait whilst their avatar undertakes a visual representation of a medical procedure by the nearby friendly soldier – no actual medical knowledge is required from players. Players do actively attempt to help wounded comrades, as most scenarios ShackTac play prohibit respawning. Death thus results in permanent elimination from any particular engagement.535 The lack of respawns and the impact of wounding create an environment where there is an obligation to deal with wounded soldiers, and there are more serious consequences to player actions. However, this does not necessarily result in a realistic degradation of combat strength. Most wounds in ArmA 3 can be dealt with in seconds, and soldiers are then free to rejoin their comrades and continue fighting. In the real world, wounded soldiers would be evacuated from the combat zone so that they can fight another day, which could potentially lead to suspending a mission in order to ferry wounded comrades back to base. Whilst ArmA 3 does attempt to provide a slightly more authentic simulation of medical complications, its abstractions prevent these from having the same impact observed in real-world scenarios.

Another technological aspect of ArmA 3 is the use of player operated microphones to simulate both spoken word communication between individual soldiers and radio communications. ShackTac employ the Advanced Combat Radio Environment (ACRE) mod to enhance the base functionality of the game.536 Players have access to

535 Gluck (2015c).
536 ‘NouberNou’ (2014).
a number of different channels, and their detailed usage is outlined in the tactical

guide. 537 Clan members are trained to use a basic range of genuine military

radiotelephone procedures in order to communicate concisely and effectively, and

microphones thus allow effective command and control to take place, meaning that

the actions of multiple units can be coordinated across the battlefield. 538 However, in

reality radio nets are only set up to allow intra-squad communication, with the

exception of the designated radiotelephone operator who can also communicate with

command. ShackTac members have the option to simply press different buttons in

order to converse with players in their immediate vicinity, players in their squad, or

even every friendly player on the battlefield. Although the expectation is that they

use only channels which would be available to a soldier in the real world, these extra

capabilities are still available should the need arise. As with Battlefield 3, these

radio-communications also suffer from none of the drawbacks of those in real life.

Additionally, to realistically simulate contemporary engagements the opposing force

should theoretically not be allowed access to radio communications at all, yet

ShackTac engagements generally involve two sides of which both have these

capabilities. As in the real world, organising coordinated actions takes time, and so

the addition of this added layer of complications into the simulation does serve to

increase the overall duration of engagements.

Central to the physical component is ArmA 3’s capability to simulate large-scale

environments. Unlike the previous case study games, where engagements took place

in environments of perhaps 1 km², the map included with ArmA 3 is a 270 km²

island. 539 This area is fully traversable and covered in realistic natural and man-made

terrain details. Restrictions relating to the number of players that can populate the

environment are largely due to the technical limitations of individual participant’s

computers, and there are many examples of players running scenarios which pit

company sized elements of players against even greater numbers of AI forces; a

developer stated that the average game of ArmA 3 includes around 64 player avatars,
as increasing this number would require expensive server hardware to run the

537 All examples taken from Gluck (2013), pp.112-113.


539 Bohemia Interactive (2015c).
The scale of these environments has a significant impact on the duration of engagements. In ArmA 3 players sometimes spend substantial lengths of time simply traversing the map in order to find the enemy before an engagement can begin. Once it has begun, the distances involved serve to reduce the accuracy – and consequently the lethality – of weapons fire. Scale is thus a core reason ArmA 3 engagements often take hours as opposed to minutes.

Urban engagement zones contain fully explorable buildings – which could potentially be populated by civilians – and rural areas exhibit substantial amounts of flora and fauna, which provide an environment where cover, concealment, and dispersion can be used by players to great effect. This is central in explaining two important observed outcomes; the rate of casualties in ArmA 3 player versus player engagements are significantly lower than those in previously assessed commercial titles, and the duration of said engagements are greatly increased. It is important to recognise that this observation holds only when assessing engagements which do not feature AI forces. AI soldiers tend to be eliminated in very short order as they generally fail to seek cover and thus do not effectively reduce their exposure to incoming fires – skirmishes pitting AI versus AI therefore tend to last only a few minutes.

As the screenshots below demonstrate, terrain in ArmA 3 is expansive and highly detailed:

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540 XylonGaming (February 2014); Edwards (2015b).
541 BurnerTactical (September 2015).
These two screenshots encapsulate the potential density of foliage and urban dwellings in ArmA 3 maps, which can provide ample cover and concealment. The tactical guide impresses the importance of utilising cover and concealment upon

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542 Screenshots taken from Silola’ (2014).
players; ‘You should strive to always be in cover or concealment when combat is occurring. If the enemy cannot visually locate you, they will not be able to accurately shoot at you. Even if they do know where you are, hard cover can prevent them from effectively engaging you’. It is therefore logical to suggest that the increase in cover and concealment as well as the size of the environment successfully reduces weapons lethality, and is at least in part responsible for the observed outcomes more closely resembling those seen in real-world engagements. These assertions are borne out watching the ShackTac members play. Unlike previous games, ArmA 3 utilises muzzle flashes and tracer rounds in a realistic manner; in conjunction with the effectiveness of cover players are required to spend a great deal of time manoeuvring as they attempt to locate the enemy positions, and locating the source of incoming fires remains a significant challenge even once direct engagement with enemy forces has commenced. It is arguable that given the inherent problem of visual acuity in video games (discussed in chapter 6), skilled use of concealment may potentially be more effective in the virtual environment than in the real world, as players have a reduced capacity to locate well-concealed enemies.

One feature does provide players with a clear capability advantage over their real-world counterparts – the mini-map.

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544 Dslyecxi (June 2014); Dslyecxi (July 2014a).
The mini-map allows players to overlay their screen with a map of the battlefield at the press of a button. The locations of nearby friendly and enemy troops are visible and updated in real-time; standard NATO symbols are used to show enemy infantry in red and friendly infantry in blue, and any enemy soldiers currently in the line of sight of any friendly soldiers are depicted. Whilst this provides an obvious advantage the mini-map does cover the player’s screen, preventing them from controlling their avatar, and so using it increases the risk of player elimination whilst not paying full attention to nearby events. ShackTac players restrain their use of the mini-map to brief bursts to provide a concise summary of nearby infantry positions, rather than attempting to actively exploit it as a tool for creating unrealistic combat advantages (this shows how their mindset differs from Battlefield 3 clan gamers, who would utilise every potential advantage to its maximum capacity).

The guide also outlines various gameplay techniques players can employ to enhance their usage of cover and concealment, and the ‘Stance Adjustment System’ is singled out in particular as something which helps in this context. ArmA 3 allows the player’s avatar to adopt one of nine different vertical stances (shown in Fig.31 below) which allow experienced players to take greater advantage of their surroundings:

Figure 30 - ArmA 3 Mini-map.

Figure 31 - Vertical Stances in ArmA 3

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545 Dslyecxi (February 2016).
546 Dslyecxi (February 2016).
‘Utilising the stance options allows for you to match your stance to the cover and concealment available, minimising your exposure to enemy observation and fire. Try to only peek up as much as necessary to see or shoot’.\textsuperscript{548} Additionally, the level of accuracy obtainable when firing a weapon depends on the stance being used – as in real life, firing from a standing position results in reduced accuracy.\textsuperscript{549} In conjunction with the scale of the maps and player caution due to the lack of respawns, cover and concealment contributes to the increased duration of engagements as they can be employed reasonably effectively.

Whilst stances are a useful additional capability they in no way solve the fundamental problems of computer interfaces highlighted in Chapter 6, which pertained to the inherent difficulties of undertaking complex physical interactions in an environment where the player does not have a corporeal presence. Stances provide players with a degree of finesse and fine control which is not evidenced in the other case study games, but the inherent clunkiness of interacting with the environment via any hardware interface, even a mouse and keyboard, is still present. It is extremely difficult to employ stances to their maximum efficacy given that the player can never be entirely aware of their avatar’s physical positioning within the game world – whilst ideally only a small portion of their avatar would be exposed when they peek out from behind an object, it is extremely difficult for a player to know if an arm or leg has been accidentally left exposed. Therefore, whilst this system is a welcome addition, its practical application has limitations.

The ‘ShackTac Fireteam Heads-Up Display’ (shown in Fig.32 and Fig.33) was designed as an attempt to further mitigate inherent environmental limitations and create a higher level of situational awareness amongst players whilst smoothing out gameplay and bridging the gap between reality and simulation.\textsuperscript{550} It is an ‘abstracted representation of the kind of peripheral vision and extra sensory input that you have in reality…’ which gives ‘an indication of where teammates are located, as well as providing an easy to reference list of player names’.\textsuperscript{551}

\textsuperscript{548} Ibid.  
\textsuperscript{549} Ibid., p.27.  
\textsuperscript{550} Dslyecxi (March 2013b).  
\textsuperscript{551} Ibid.; Gluck (2013), p.70.
In the real world, environmental cues allow soldiers to employ intricate physiological traits such as sound localisation – ‘the ability to identify both the position and changes in position of sound sources based on solely acoustic information’ – to estimate the location of their nearby comrades. The Fireteam HUD is an artificial solution to the problem of limited awareness; it provides players with a visual tool that pinpoints the location of soldiers in the same squad as the player – if they are located within a 50m radius, as shown in Fig.32 – whilst

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552 Psychology Dictionary (n.d.).
additionally serving as a basic compass. It also reminds players who is in their current squad (as configurations can change frequently depending on whether particular players are available to participate in an engagement), and the icons change colour when players are within 3m of each other, as a subtle reminder to disperse.553

The Fireteam HUD is a viable, although imperfect, solution to the dilemma of awareness within virtual environments. The information it provides is in many ways more precise and detailed than that which would be available to a soldier in the real world, but the alternative is to leave situational awareness at a level below that experienced in reality, as was evidenced in other FPS games. This is an undesirable outcome given the highly co-ordinated nature of engagements ShackTac participate in. The Fireteam HUD results in squads which operate with significantly improved cohesion. This is a key reason players can achieve a level of coordination similar to that demonstrated by Western infantry squads, in spite of the many limitations inherent to videogame interfaces. The Fireteam HUD is a compromise which demonstrates where the priorities of the clan lie; they are willing to compromise immersion and add unrealisms into the game if the result is to achieve outcomes which more closely resemble those of real-world engagements.

The increased map size and availability of cover and concealment also links into the factor of dispersion. Dispersion in ArmA 3 engagements bears far more resemblance to real-world combat than previously examined commercial titles. The guide states that ‘…when operating in urban areas or where the threat of observation is high, avoid travelling in large groups – it’s much easier for the enemy to identify a group of people as a threat. Aside from that, large groups tend to make good targets for powerful weapon systems. The more dispersed you are, the fewer casualties you’ll take in the event you’re surprised by heavy enemy assets’.554 As in the real world, dispersion is a prerequisite in order to take full advantage of the cover and concealment, as well as avoiding the full effects enemy weapons systems. When watching clans play, soldiers are clearly seen to spread themselves and keep distance between each other, and there is obvious awareness amongst players of the benefits

553 Dslyecxi (March 2013b).
of dispersion.555

ArmA 3 also attempts to simulate some of the logistical concerns faced by soldiers in the field. Fatigue, stamina and load management are considerations that players are required to take into account. ‘As you fatigue in Arma 3, you’ll find yourself gradually slowing down, with movement and actions such as reload and stance changes both being influenced by high levels of fatigue. The heavier your gear and pack are, the quicker you’ll fatigue. Severe fatigue is indicated by heavy breathing combined with the screen edges pulsing and the whole view blurring periodically. Recovery is brought about by moving more slowly, or stopping entirely’.556 Dealing with fatigue requires players to monitor encumbrance, spread heavy equipment amongst different players, and pace movement over long distances to conserve energy.557 This directly contributes to increasing the duration of engagements, as ‘sprinting everywhere is not the answer’ – this sets ArmA 3 apart from other games which do not attempt to simulate fatigue.558 Ammunition is also a valid logistical concern. ArmA 3’s inventory system keeps track of any item a soldier may currently be equipped with, and each soldier can only carry so much kit. This limits players to volumes of ammunition which could reasonably be carried by a real-world soldier.559

Each player’s avatar can be equipped with a large scale map of the entire battlefield which can be consulted so that they may orient themselves in relation to objectives. Unlike the minimap, this map does not display individual soldiers and shows the entire battlefield rather than just nearby features. This addresses real-world logistical concerns which simply do not exist in games operating within the confines of smaller environments, i.e. the coordination of actions between multiple squads, potentially over significant distances and extended timeframes. Players can place markers on the map, and these instantly become visible to all other friendly troops whenever they consult their maps:

555 XylonGaming (February 2014).
557 Ibid.
558 Ibid.
559 Ibid., pp.38-39, 45-46.
Obviously these markers provide players with far more up-to-date information than would be available to soldiers in the real world, and this abstraction significantly reduces the burdens of organisation on leaders, allowing the game’s primary focus to remain on infantry combat as opposed to becoming more of an operational level challenge.

Combined arms tactics can be used with a high level of effectiveness within ArmA 3. An excellent example of this is provided in one of Dslyecxi’s YouTube videos entitled ‘Riverside Ambush - Hindsight Episode 1‘. In this video Dslyecxi undertakes an AAR of a single engagement which took place within a clan battle, where two soldiers ambushed an enemy squad whilst they were attempting to flank a friendly compound. The video demonstrates how two defending soldiers – utilising combined arms in conjunction with cover and concealment, and taking advantage of the enemy’s lack of dispersion – caused multiple casualties to an advancing enemy squad, which was eventually forced to retreat. Dslyecxi states that:

‘...two people had contributed towards the death of around seven enemy including two fireteam leaders and the squad leader... there were several things that contributed to the outcome, and we will briefly go over each of them. The first of

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560 Dslyecxi (January 2015).
course was concealment; the enemy didn’t expect to run into my fireteam because they haven’t seen anything in that area up until that point… The effectiveness of our concealment was made clear after the ambush began, as there was relatively little return fire from the element being ambushed… the tightness of their formation relative to blue team’s position made for a very dense target. When the ambush began, the enemy in the kill zone were immediately taken under effective fire by the two deadliest weapons in the fireteam; the automatic rifle, and the grenade launcher, which provided a lethal combination of direct and indirect fire... The proximity of the enemy’s major source of cover, the slope that the rest of the river was masked by behind them, meant that even after retreating behind it grenades were able to inflict casualties through indirect fire... 561

This example shows multiple factors from the physical component in action. Most significantly it demonstrates that different types of weapons systems can be employed at the squad level to provide direct and indirect fires, the effects of which are complementary and effectively place enemies in a dilemma. The guide outlines the many different types of weapons which are available to players, including shotguns, rifles, machineguns, grenades and grenade launchers, anti-tank launchers, and crew served weapons such as the MK30 .50 CAL machinegun; this demonstrates that not only is combined arms fire actually effective within ArmA 3, but also that the game provides a variety of different weapons systems through which it can be applied.562

Although numerical preponderance is not decisive in explaining the outcome of contemporary infantry battles it can have a more significant effect in the virtual environment, depending on the circumstances of the engagement. ShackTac engage in a mix of different scenarios, with a ‘70% adversarial, 30% co-op mix’; this means that some scenarios pit ShackTac members against each other, whilst others involve

561 Ibid.
the members playing against AI opponents. Scenarios the clan undertakes are generally less likely to be asymmetric – both sides are often comprised of experienced members, are of equivalent size, and are equipped with comparable weapons systems. If other things are equal local numerical superiority plays a more decisive role than has been evidenced in recent real-world infantry engagements. The circumstances seen in these types of engagements have no real-world referents, as there are no recent examples of two well-equipped and well trained Western forces engaging each other in infantry combat. Co-op games, where ShackTac members attempted to defeat AI opponents in predesigned scenarios, can display a range of outcomes based on the difficulty settings of the AI in question. AI soldiers vary greatly in their levels of competency, and this will be discussed in detail later in this chapter.

Overall, ArmA 3 is more successful in simulating the physical component of combat than previous case study games. The dynamics of clan engagements appear to bear a strong resemblance to those observed in the real world, and the duration of engagements extends to hours rather than minutes, which is significantly more realistic than observations from previous games. However, this is still shorter than real-world conflicts, and even the most hardcore of gaming communities has failed to overcome the inherent limitations of the hardware they employ, although in some areas they have successfully reached compromises designed to promote more realistic combat outcomes.

**The Moral Component**

Although both the developers and the modding community demonstrate a willingness to engage with the moral component of warfare, this section will argue that it remains a highly problematic aspect of combat simulation. As with other games, replicating the basic psychology of combat appears to present a serious obstacle, and providing players with a high fidelity environment does not in itself guarantee that it will be used effectively. It will be argued that the emergence of real world combat dynamics is more a result of the conscious psychology and tactical understanding of the players than the environment itself.

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563 Gluck (2009).
Conclusions in relation to fear and its accompanying psychological and physiological effects remain largely the same as games assessed in previous chapters, and so will not need to be repeated here. Whilst a lack of respawns means that there are some consequences to actions within the virtual environment, there are no YouTube videos of ShackTac in action that provide any indication that playing ArmA 3 elicits the sort of fear displayed by soldiers in real-world combat. All communications between soldiers are comparatively calm and collected, seemingly irrespective of the scenarios they find themselves in. However, there are some important conclusions in relation to the behavioural psychology of ArmA 3 players that must be addressed – specifically, how they purposefully engage with the virtual environment in comparison to players of more commercially popular titles.

ArmA 3 players have goals which extend beyond entertainment. One player stated that ‘they want the game to be as they expect military operations to be; people want that relation to reality, which is why they play Armed Assault over other games… the community doesn’t want hundreds of people being slaughtered, they don’t want a giant insurgent army. They can play other games for that. The reason they play Armed Assault is because they want a realistic tactical experience. This can lead to a game that is very slow and paced, but this is what people want – they want a game that is slow, realistic, and where they have a chance to actually think about actions’.\textsuperscript{564} Given that many players and modders have no experience of genuine infantry combat, it is a valid question to ask how they know what constitutes a realistic environment. The answer to this is research.\textsuperscript{565} Many of the players have a love of history – evidenced by the fact that many mods are set in the Second World War – and a genuine fascination with military operations; ‘Pure enthusiasm is a big advantage … everybody within the Armed Assault community has a real interest in the military and military history, and they want something that recreates it’.\textsuperscript{566} The community is also assisted by the veterans who operate within it, as ‘serving military members can be some of the most proactive people…’.\textsuperscript{567} This research and understanding explains why the community are capable of producing game mods

\textsuperscript{564} Ibid.
\textsuperscript{565} Ibid.
\textsuperscript{566} Ibid.
\textsuperscript{567} Ibid.
and documents like the tactical guide, which serve to enhance the physical fidelity of
the simulation itself and promote the understanding of genuine military procedures
to players operating within the environment.

This points towards a very different player mindset within the ArmA community.
Players are willing to participate in engagements that last longer in order to focus on
aspects of engagements beyond combat. How these players actually engage with the
game itself is thus completely at odds with the players of more commercial titles; ‘in
a fun game you simply slaughter all of the enemies in front of you. In Armed Assault
you have to think about whether you want to actually engage the enemy at all. This
is an important difference between the two types of games… people will sit down,
play, put their character to bed, and they will leave their computer on next to them
whilst they sleep, ready to sound up in case there is an ambush…’.568 There is thus a
complete difference in mentality between gamers who want to simulate Rambo, and
those who want to simulate real-world soldiering. Although their end goals – to have
fun – are the same, the niche gamers who play ArmA 3 clearly define this in
different terms. The frenetic desire to be immediately involved in a firefight has been
replaced by a willingness to undergo the military experience in greater depth. Players
of ArmA 3 willingly subject themselves to the mundane aspects of the soldiers’
experience in order to enhance the realism of the simulation, as they derive their
enjoyment from participating in what they perceive to be an accurate representation
of combat.

Although ArmA 3 does not inherently capture the psychology and physiology of fear
on the battlefield, the difference in mindset means that despite not receiving these
stimuli players are inclined to react to events in a manner they perceive as realistic,
based on their prior understanding of combat. This willingness to act in a manner
which conforms to their understanding of real-world combat is a key factor in
explaining why the outcomes of clan battles in ArmA 3 provide a more accurate
representation.

The continued absence of the fear factor has obvious implications in relation to

568 Ibid.
surprise and shock as well as suppression. This issue has been recognised and in some cases directly addressed by some members of the ArmA 3 community, as various mods implement a solution almost identical to that which was seen in *Battlefield 3*. Mods such as ‘Tactical Battlefield’ and ‘L.Axemann's Suppress’ includes a ‘Suppression effect’ where ‘By suppressing your enemy with accurate fire, he will temporarily experience gradual shake and vision blur, enabling realistic infantry tactics for suppression fire and assault elements’. However, many players see this as an imperfect solution. One stated that ‘If players think something is unrealistic or gamey then they will stop playing… although these effects can create a more realistic outcome they are not worth the cost in terms of disengagement… [the] compromise will not be accepted…’. This may explain why ShackTac decline to employ these mods, and seemingly prefer to accept the limitations of the simulation in relation to this factor.

Suppressive fire’s effectiveness (or lack thereof) also impacts player expenditure of ammunition, as in battles that last hours rather than minutes, running out of ammunition could be a genuine problem. The combat model demonstrated that a significant amount of ammunition fired in real-world firefights is used to suppress the enemy, and the other commercial games examined thus far have not demonstrated this tendency. Despite the slightly increased effectiveness of suppression, ArmA 3 is still closer to other games than it is to real-world engagements. Its ineffectiveness in comparison to the real world means that players are generally less inclined to spend large volumes of ammunition in attempts to suppress the enemy, and so they save their resources to employ them in a direct fire role. Additionally, given the increased effectiveness of cover and concealment, providing large volumes of suppressive fire runs the risk of players giving their position away to the enemy, so in many cases it is more sensible to remain concealed until effective direct fires can be applied.

The combat model argued that surprise and shock do not hamper Western forces on the contemporary battlefield, and as with other games this is mirrored in ArmA 3, although not for the same reasons. Unlike previous games players do not expect

\[569\] ‘Dr_Eyeball’ (2013).
\[570\] Edwards (2014).
constant engagement in ArmA 3, and so other reasons must explain the absence of this factor, as it is certainly possible to catch an enemy by surprise in an ArmA 3 engagement. Dslyecxi provides an excellent example of this in one of his older videos entitled ‘Unexpec ted training ambush, November 11th 2009 - ShackTac Arma 1’.\textsuperscript{571} The video takes place whilst training some new clan players, and it shows an ambush of potential recruits as they were in the process of being transported to a new location. However, although taken by surprise, shock – the central debilitating outcome of surprise and the primary physiological response to a sudden life-threatening event – does not manifest itself. Even new players, upon being ambushed, reacted calmly and neutralised the enemy threat in short order. In reality, only extensive training leads to this outcome, as it fundamental to preventing soldiers from being paralysed by shock. However, in ArmA 3 these new players were taken by surprise, but the lack of fear meant that shock was not induced. Although the factors which explain the absence of shock differ between the real and virtual environments, the overall outcome is actually realistic; the responses of gamers mirror those of well-trained Western soldiers being ambushed in the real world. In the absence of the psychological and physiological stresses inherent to real-world engagements, surprise and shock continue to remain tertiary factors.

The tactical guide and Dslyecxi’s videos do examine RoE on the battlefield, as scenarios in ArmA 3 can include civilians. The video entitled ‘Dslyecxi’s TTPs - Universal Rules of Engagement’ examines when the use of deadly force is appropriate within the virtual environment.\textsuperscript{572} Whilst this clearly demonstrates an awareness of RoE, almost none of the battles the clan participate in involve maps where civilians are present. This is largely because players would not want to spend their time controlling civilians. The AI could be used in this capacity, but it has significant flaws in terms of its behaviour which would result in completely unrealistic outcomes, and these issues will be examined in more detail later in this chapter. Thus, whilst RoE could potentially be integrated into an engagement, as with previous commercial games the scenarios players favour eliminate this factor in its entirety. It should be noted that if players did use maps containing civilians on a more frequent basis then RoE could take on significance similar to that in the real

\textsuperscript{571} Dslyecxi (November 2009).
\textsuperscript{572} Dslyecxi (November 2012).
world. This view is of course predicated on the assumption that clans would approach such engagements with the serious mindset they have been seen to already employ in relation to other factors. However, until such scenarios become more popular RoE will remain inconsequential.

Clan players of ArmA 3 demonstrate higher levels of cohesion than have been observed in previous games, and this factor represents one of the single most significant areas of improvement. Based on King’s definition of cohesion, all evidence points towards ShackTac being extremely successful in terms of inculcating an ethos into players which is highly reminiscent of a professional armed force, and this allows them to achieve high levels of collective performance. The ‘battle drills’ section of the guide lists a number of drills ShackTac players should follow when engaging the enemy, including ‘reaction to contact or enemy fire’, ‘conducting an ambush’ and ‘reaction to ambush’.\textsuperscript{573} These exact drills were identified in the combat model and the guide lifts them almost in their entirety from doctrinal publications. Although ShackTac players do not undertake the same concentrated training regimes as contemporary infantry forces they are required to participate in two eight hour training scenarios a week, some of which are directly focussed on running drills under the supervision of more experienced members, who then engage in AARs with trainees to review performance and offer criticism in a manner reminiscent of most real-world AARs.\textsuperscript{574}

ShackTac place emphasis on ‘Teamwork, Maturity, and Integrity… Esprit-de-corps brought on by a rich history of camaraderie, evolution, and achievement… Well-defined tactics, techniques, and procedures, with a group-level comprehension and proficiency of them… Motivated leaders leading dedicated troops…’ and a “No Bullshit” mentality…The group trumps the individual, and toxic attitudes are simply not tolerated’.\textsuperscript{575} ShackTac training seeks to generate the ‘moral obligation upon soldiers who were expected to perform’ that was evidenced by King in contemporary professional forces; serious gamers do not want to let each other down, and as

\textsuperscript{573} Gluck (2013), pp.151-158.
\textsuperscript{574} AAR from 27.15 – 33.35 seen in Dslyecxi (October 2011).
\textsuperscript{575} Gluck (2015c).
Dslyecxi states, ‘we hold our members to high standards of conduct...’ 576 The ethos instilled into players is not ‘professional’ in the strictest sense, but it can be argued that the end results are essentially the same. In the real world, high levels of group cohesion result in the capability to implement complex battlefield tactics, and numerous videos demonstrate the abilities of ShackTac members in this regard – they frequently and effectively implement fire and manoeuvre, communicate effectually, and work together at the fireteam, squad and platoon level to accomplish their mission. The clan thus displays all of the hallmarks associated with high levels of group cohesion.

The capacity of ArmA 3 to simulate the moral component of combat is largely independent of the actual technical capabilities intrinsic to the virtual environment itself. The successes observed in relation to this component largely stem from the mindset and approach taken by players towards the engagements they are participating in. Although the technical capability of the environment is not completely irrelevant, as serious gamers are inclined towards serious games – these players use ArmA 3 as their game of choice precisely because it provides the best vehicle to realise their goals of accurately recreating combat.577 Despite the fact that the psychological and physiological effects of combat are still not felt, many of the other moral factors have seen great improvement from previous games, and the employment of a serious approach to gaming has allowed ShackTac to partially overcome the problems inherent to virtual environments which have almost entirely precluded the simulation of moral factors up until this point.

The Conceptual Component
This section will argue that the doctrine and tactics used by clan players in ArmA 3 show significant development in comparison to other games, and in many cases accurately represent those used in the real world. The serious mindset of ArmA 3 clans means that accurately representing real-world engagements is fundamental to their enjoyment of the game, and their willingness to undertake detailed research into tactics and engage in serious training sessions enhances their ability to employ them.

This chapter has already made extensive references to the *Arma 3 Tactical Guide* and the various real-world tactics players employ. Arguably the single greatest achievement of the guide is filtering a comprehensive collection of tedious, complex and extremely detailed doctrinal publications – its bibliography includes over a dozen US Marine Corps and US Army field manuals, such as FM 7-8, Infantry Rifle Platoon and Squad, and FM 6-5, Marine Rifle Squad – into precise and straightforward prose, effectively elucidating doctrinal concepts in a manner palatable to gamers who may potentially have no previous military experience. Therefore, although the guide provides information in far less detail than the thousands of pages contained within the multitude of doctrinal field manuals, it does provide an excellent overview of military doctrine fundamentals tempered through the lens of a knowledgeable gamer and ex-soldier. In writing the guide Gluck deliberately avoided certain complications:

*One thing that I noticed back before doing my first guide was that military-game guides commonly fell victim to two pitfalls – the first being the recitation of actual military publications, without any attempt to separate the wheat (info relevant to gaming) from the chaff (military or real-world procedures that are irrelevant or not simulated in games)... The second pitfall is that of being “gamey”. “Gamey” guides are those that are oriented around giving a very precise info about things in a fashion that takes advantage of knowledge that would not exist in reality... These “gamey” guides also tend to give tactics that are meant to exploit the game itself. I do not believe in those types of guides*.578

It is crucial to note that although the guide is not ‘gamey’ in the sense of taking advantage of weaknesses or predictability inherent to the game engine, it does focus on the application of military tactics specifically within game environments. As such, some of the tactical advice offered does differ from real-world infantry doctrine. This is often justified due to the artificial constraints inherent to operating within a virtual environment. For example, at low levels the clan utilises six man

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578 Bohemia Interactive (2015a).
fireteams, as opposed to the four seen in most contemporary forces. This is partly due to the limitations of videogame hardware; a computer monitor only provides an 84° FoV, and so for a single fireteam to achieve effective 360° coverage on the battlefield additional members were required (six men provide 500° of cumulative coverage).\(^\text{579}\) Although this problem is surmountable, as the FoV can be modified in the game settings, the clan recognised that having larger fireteams also provided a number of other advantages; firstly, the overall reduction in the number of fireteams in the group reduced the burden on leadership, ‘Since we tend to play lengthy sessions of eight or more missions on average, there is a great deal of leadership required throughout. With our new structure, we end up requiring about 30% fewer fireteam leaders per session, which results in less leader fatigue and burnout. When you’ve been playing as a community for over seven years, this sort of consideration is significant’.\(^\text{580}\) Secondly, the levels of firepower within each team were increased, and thirdly there was an increased resilience to casualties.\(^\text{581}\) This demonstrates that even the most hardcore of clans remains pragmatic as to the burdens placed on members in order that they continue to enjoy their experience.

Player willingness to learn and employ real-world doctrine and tactics is fundamental to accurately recreating the contemporary infantry battle in any virtual environment, and the existence of the guide shows the lengths that serious gamers are willing to go to in order to achieve this in ArmA 3. Given ShackTac’s strict enlistment process – which involves members sending applications directly to Gluck, who processes them in batches and recruits only 30-45 per year – only those who demonstrate the appropriate mindset and willingness to study the aforementioned doctrine are likely to become fully fledged members.\(^\text{582}\) Throughout this chapter it has been clearly demonstrated that ShackTac players have a solid understanding of contemporary tactics, and training has given them the ability to put these into practice during engagements.

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\(^\text{580}\) Ibid.

\(^\text{581}\) Ibid.

\(^\text{582}\) Gluck (2015a).
Many of the conclusions in relation to clan training have already been drawn in the *Battlefield 3* chapter. To briefly summarise:

- Training sessions take place a few times a week, as even serious gamers can only commit so much time to their hobby.
- This makes their training less intense than that undertaken by real soldiers, but also to some extent more consistent over time, as players train twice a week every week – essentially, training never stops.
- The environment they are training in exactly matches that in which they will be engaging the enemy; gamers train in an environment which can have 100% fidelity in relation to the actual engagement zone – skills learnt in training are thus highly transferable to the actual environment, as no fidelity related compromises are required.
- Training also includes a variety of game related skills, mainly centred on effective operation of computer hardware so that players can competently control their avatars within the virtual environment.

The substantive differences between training in *Battlefield 3* and ArmA are the focus on real-world doctrine, in-depth AARs, and an avoidance of ‘gamey’ methods of training, such as committing the layout of a map to memory in order to take advantage of design flaws.

ArmA 3 clan training explores fundamental concepts which effectively correlate to fire and manoeuvre, combined arms integration, suppression, and dispersion; these then form the cornerstone of their infantry tactics, and are drilled into members throughout training sessions.\(^{583}\) The 15\(^{th}\) MEU dedicate ten minutes of a one hundred minute training scenario – around 10% of their total training time – to AARs.\(^{584}\) The best example of well executed AARs probably can be found in ShackTac’s fireteam leadership training video, as multiple ‘instructors’, or senior members, watch over the session in order to provide detailed feedback to the fireteam leaders.\(^{585}\) As was discussed in relation to group cohesion, AARs allow experienced members to assess overall performance and advise players on tactics and mistakes that may have been

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\(^{583}\) Dslyecxi (October 2011); XylonGaming (February 2014).

\(^{584}\) XylonGaming (February 2014).

\(^{585}\) Dslyecxi (October 2011).
made. Clan gamers are highly motivated to learn from their AARs and through doctrinal publications such as the tactical guide, and the fact that the guide is sold for profit via the Bohemia Interactive website shows people are even willing to pay additional costs for this information.

Given that players approach both their training and their understanding of doctrine and tactics with a serious mindset these factors are far more accurately recreated in ArmA than any of the other virtual environments examined so far, and since the conceptual component is more accurate simulated it is thus no surprise that the outcomes of engagements within ArmA 3 more closely resemble those in the combat model.

The Deficiencies of Artificial Intelligence
Roughly 30% of ShackTac’s games involve AI troops, and so some points need to be drawn in relation to their shortcomings and unrealistic behaviours.

The unmodified AI as included with the game has been the subject of great consternation; ‘It's one thing to have an enemy to [sic.] light you up from distances from point contact-to 100 meters, but 600 meter head shots with an AK as you are prone with minimal exposure is insane …they have super human accuracy, and have always been able to spot you regardless of heavy cover... one guy on a hill sees you behind a bush, instantly the entire platoon on the other side of the bush knows where you are…’

The AI in ArmA is capable of superhuman accuracy, but simultaneously it often lacks basic battlefield competency; ‘…it won’t use cover properly (By telling it to take cover it just goes prone… ignoring every tree or rock around and can’t tell where it is being shot from so it stands to the wrong side of the cover… The path finding is all over the place sometimes too (the ai may make a 60 yard circle in order to move 20 yards forward)’

These behaviours produce an asymmetry which is the exact opposite of that observed in real-world insurgents. Insurgents were reasonably tactically aware, but demonstrated deficient marksmanship; the AI on the other hand are excellent and

highly lethal marksmen, but are completely incompetent at protecting themselves. The greatest danger to players is therefore at long distance, where accurate AI fire will kill them before they can react or have even located the enemy position, whereas if the players can close to shorter ranges then the AI’s inability to cover and conceal will lead to their rapid destruction. It is arguable that the increased accuracy of AI soldiers may be a purposeful inclusion by the developers, as it balances the gameplay in light of the AI’s ineptitude at employing utilising cover and concealment.\textsuperscript{588} If AI soldiers were simultaneously incapable of maintaining accurate fire or protecting themselves, then they would not provide any sort of challenge to skilled gamers. Similar to both the previous case studies, casualty levels of battles involving AI troops are likely to be Lanchestrian in nature, as the impact of combat effectiveness is reduced whilst the importance of applying accurate fire onto easily identifiable opponents is increased.

Players have tried to fix these behaviours. AI mods are prevalent amongst the community – lists of dozens can be found on the Bohemia Interactive forums, with some being designed to fix specific issues, whilst others completely overhaul every aspect of their behaviour.\textsuperscript{589} Ultimately, the community has not reached a consensus on this issue. Various commentators have gone to great lengths to compare the advantages and disadvantages of different mods, but in the estimation of this author none have successfully managed to accurately reproduce the dynamics seen in contemporary engagements.\textsuperscript{590} One player created a series of videos where he set up skirmish battles pitting two AI forces against each other, so that he could evaluate their performance. Despite improvements when compared to the basic AI included in the game, it was not capable of recreating the caution and the stalemates observed in real-world engagements. Rather than cautious sporadic fire, these trials showed that soldiers still regularly remain out of cover, casualty rates were high on all sides, and battles lasted ten minutes at most.\textsuperscript{591}

Overall, these deficiencies explain why the majority of scenarios remove AI soldiers...

\textsuperscript{588} Edwards (2016).
\textsuperscript{589} ‘Gunter Severloh’ (2014); ‘fabrizio_T’ (2014).
\textsuperscript{590} BurnerTactical (September 2015).
\textsuperscript{591} \textit{Ibid.}
from the equation, as even with mods their behaviour is erratic and does not accurately mimic that of real soldiers on the battlefield. In order for a scenario to display even vaguely realistic outcomes, both sides need to be played by humans. Due to their severe limitations, AI soldiers are generally only employed in scenarios where they have to simply defend a static location from a player led assault. This does not require them to do anything other than patrol a small area, and the focus on the player side shifts towards effective planning and execution of the assault.592

Conclusions
The observed outcomes of ArmA 3 demonstrate significant progress in comparison to previously assessed games, and improvements in relation to all three of the components of combat mean that outcomes of engagements bear a stronger resemblance to those observed in the combat model.

The combat model argued that in terms of the observed casualty levels and combat effectiveness the conceptual component provided the key explanatory factors. What this chapter has demonstrated is that effectively simulating the conceptual component of combat in a virtual environment is reliant on the mindset of players and the manner in which they engage with the simulation itself – an inherently moral factor. The mindset of clan players in ArmA 3 is focused on authenticity; they do not play for monetary prizes or to win competitions, they play because they want to be part of a simulation. As a factor, mindset is purely relevant to simulated environments, but is fundamental to creating realistic outcomes.

Despite the fact that the moral factors previously identified within the combat model remain problematic aspects within the simulation, player mindset leads to a far more accurate recreation of contemporary infantry combat than the other case study games. It is primarily due to mindset that players react to fire in a realistic manner, by seeking cover and concealment rather than simply charging towards the enemy. The mindset factor is also crucial in terms of explaining why cohesion is so much higher within the ArmA 3 environment in comparison to any other. Working together is a key part of ShackTac philosophy, and it is repeatedly stressed how important this factor is in relation to player enjoyment of the game itself – in order to

592 JiveDilettante (November 2012).
have fun, members need to work together. This generates a level of motivation equivalent to that seen in a professional armed force, even if the reasons underlying it are different. Members train to work together and take this factor incredibly seriously; they do not want to let each other down. However, as in the real armed forces, it is training which enables clans to achieve these high levels of group cohesion and put their doctrine and understanding of combat principles into practice. Simply deciding to work together is not sufficient, players need to spend a considerable amount of time learning how to work together effectively with other members of the clan, and this is one of the core functionalities of regular training sessions.

There are clearly still limitations on the physical accuracy of the simulation due to computer hardware, and players have enacted their own artificial solutions in order to help mitigate these problems. Some of these do lower the fidelity of the environment, but such compromises are considered worthwhile if their overall effect is to produce a more realistic outcome. Such an approach makes a great deal of sense in this context, and ultimately the mods examined in this chapter contribute positively in terms of creating realistic combat outcomes, even if they further reduce the authenticity of the gameplay experience itself.

Most adversarial engagements involving player controlled troops take place between two forces both of which are well-trained clan members possessing a solid understanding of contemporary doctrine and tactics. Consequently, the outcomes of many engagements clans participate in do not mirror those seen in recent real-world conflicts, as there is no asymmetry. From a doctrinal and tactical perspective the two sides are generally evenly matched. The most accurate way to actually reproduce the asymmetry of real-world engagements would be to pit ShackTac against a casual gaming clan of much lower skill. However, there are no examples of such a scenario, because it would not be a challenge to ShackTac, who would likely win the engagement without much trouble, and casual gamers would not consider being annihilated by a well-organised opposition to be enjoyable. In theory the AI can be used in these types of scenarios, but the deficiencies in its behaviour also make it unsuitable.
The overall duration of these engagements is greatly extended from previous games, but this has a lot to do with the scale of the environment. It is almost impossible for engagements to take a significant amount of time in the miniscule environments presented in other commercial games, but in ArmA 3 the size of the map means that players actually have to find each other on the battlefield. Significant amounts of time are spent scouting and attempting to locate hidden enemies, and this takes a lot longer in an environment where cover and concealment can actually be employed effectively. Once the enemy have been successfully located their disposition may well require friendly forces to plan their assault, and organising such coordinated actions also takes time. This serves to greatly increase duration from a number of minutes, as seen in other games, to a number of hours.

However, the length of the individual firefights when they take place is still significantly faster than those observed in the real world. This is once again due to the inability of a virtual environment to capture the psychology and fear of combat, the other main factor identified in the combat model which was responsible for increasing duration. Commensurate with the actions taken by players in other games, ArmA 3 clan members are still willing to manoeuvre whilst under enemy fire in a manner that exposes avatars to a significant level of risk. Videos taken from real-world engagements often show soldiers spending long periods behind cover, suppressing the enemy whilst they attempt to locate them, and this level of caution is still not evidenced in ArmA 3.

The most important limiting factor on the overall duration of a battle is the willingness of players to participate in such scenarios. Even in ShackTac most scenarios tend to last a maximum of around eight hours, and this is incontrovertibly linked to the willingness of players to participate. However, the effective use of cover and concealment, maps, and tactical planning demonstrate that players are willing to take a slow and methodical approach to engagements, resulting in a tempo which more accurately reflects the real world rather than other games.

The duration is also limited by the numbers of players the simulation can support.
Given that most servers will only allow around 64 players to participate at once this equates to only 5 or 6 squads of human players being present in the virtual environment at once. The level of infantry engagements that can be simulated are thus relatively small-scale, unless large numbers of AI soldiers are used to increase the numbers. However, given that engagements involving these sorts of numbers examined within the combat model frequently last less than eight hours, there is ample time available to accurately simulate real-world infantry conflicts.
Chapter 10: Historical Military FPS Usage

This chapter will provide an overview of the FPS games which have previously been employed by different armed forces as training tools. Rather than undertaking a single detailed case study, this analysis will seek to examine how different military establishments have engaged with various COTS video games; it will assess the continuously developing capabilities of these products, and chart their usage up to the adoption of the VBS series by over a dozen major armed forces by 2014.\textsuperscript{593} This will serve to provide context for subsequent evaluation of the VBS case study.

In order to undertake this assessment an innovative framework has been devised, which codifies the somewhat disjointed discourse currently examining this topic. The author has identified three distinct phases which characterise military experimentation with COTS video games. The first phase involved purely commercial products being modified by the military themselves; however, due to the complexity of game engines and a lack of in-house expertise, manpower, and available time, the results of such experimentation were unsatisfactory. In light of these early setbacks the second phase saw military establishments contracting commercial developers, in the hope that leveraging their technical expertise would allow the end product to better fulfil training needs. With such liaisons proving unsatisfactory – largely due to the competing requirements placed upon games developers to serve different markets – the most recent phase began, which saw specialist third parties being contracted to modify existing commercial products on behalf of the military, thus allowing their exacting specifications to be met, and VBS is the most significant result of these types of arrangements.

The First Phase – Marine Doom

The first military attempts to utilise FPS games for training purposes began in 1997 at the USMC Modelling and Simulation Management Office. Although most commercially available titles at the time ‘held scant value for their purposes’ Lieutenants Dan Snyder and Scott Barnett eventually settled on a surprising candidate as the basis for their experiments, \textit{Doom II} (id software; 1994).\textsuperscript{594}

\textsuperscript{593} BISIM (2015b).
\textsuperscript{594} Halter (2006), p.122.
Although at the time *Doom II* was reasonably technologically advanced, it was also wildly unrealistic. Gameplay involved the player fighting against fantastical demons on the moons of Mars with weapons taken directly from science fiction, before attempting to escape from Hell itself.\(^{595}\) As a progenitor of games such as *Modern Warfare* and *Battlefield 3*, it also suffered from many of the same unrealisms which have been discussed in the case study chapters. Given its fantasy setting, primitive visual effects in comparison to modern titles, clunky UI, and capacity to generate only the most simplistic of environments, *Doom II* had significant flaws which would need to be overcome in order for it to be of any real use. The reason it was selected was unsurprisingly nothing to do with the realism of the game itself. It had one significant feature which redeemed these imperfections – its modifiability. Snyder and Barnett spent six months completely reconstructing it to create *Marine Doom*, and although their efforts were constrained by technological limitations, the result was a significant advancement over anything which existed in the commercial sphere at the time.\(^{596}\)

![Figure 35 - Screenshot from Marine Doom](image)

In order to create an environment akin to a real world urban combat scenario, these modifications transformed martian dungeons ‘…into a sparse, dust-covered plain punctuated by small brick bunkers…the player’s artillery choice was reduced to

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\(^{595}\) Doom Wiki (2015).

realistic weaponry… life refreshing power-ups disappeared. With lower life levels and no chance to raise them, the player died quickly. 597 Such restrictions and the inclusion of a far more realistic setting were a complete departure from the largely fantasy gameplay of FPS titles available at the time, and the two Lieutenants pushed this primitive piece of software to its limits.

The game could be used for the training of ‘four-man fire teams in concepts such as mutual fire team support, protection of the automatic rifleman, proper sequencing of an attack, ammunition discipline, and succession of command’, and the website for Marine Doom stated that ‘While weapons behavior is not extremely accurate, sound tactical employment of these models should give the desired effect’. 598 Although it never became an official training tool, Marine Doom was popular with the marines themselves. According to Barnett, they ‘would plead to be allowed into the base’s gaming lab even after it closed at night’. 599 The idea that soldiers would use games to potentially continue their training outside of official hours was an unexpected discovery which later gaming initiatives would attempt to harness, and USMC commandant General Charles Krulak went on record stating that ‘[PC]-based wargames provide great potential for Marines to develop decision making skills, particularly when live training time and opportunities are limited’. 600

However, the widespread use of training games outside of official hours never really caught on. Soldiers both in training and on deployment do spend their free time playing FPS games, but they, like other gamers, play those which they consider to be most entertaining. This is demonstrated in recent interviews with veterans from Iraq and Afghanistan. Nathaniel Dietrick, a Combat Medic in the US Army stated that FPS games ‘…are very popular for a lot of people I have known within the army. Games like Battlefield and Call of Duty can be heard blaring in any barracks across the US. I think these games are usually far enough from reality that it doesn’t bother most soldiers. I don’t think soldiers play military games for different reasons compared to most people. They are fun and entertaining, and provide engaging

600 Department Of The Navy, Headquarters United States Marine Corps (1997).
competitive opportunities’. Off-duty soldiers clearly demonstrate a preference towards games with minimal training value beyond basic coordination, and they are tolerant of the unrealistic depictions of combat in these games. US Army Sergeant Dave Mull concurs with these sentiments, ‘… by my second tour, guys were getting Xbox 360s shipped over, so in downtime, we were playing Halo 2 and Tom Clancy’s Rainbow Six: Vegas. It’s like a cartoon version of reality — it lets you work out aggression and build hand-eye coordination at the same time’.

Recognising the limitations of assigning overburdened active service personnel the task of modifying increasingly complex COTS software packages, military establishments began to assess the viability of working directly with commercial developers to create more advanced simulations tailored to their needs. These experiments were the initial steps ‘of an initiative to investigate the use of re-engineered commercial software as a training tool’.

The Second Phase – Working With Commercial Games Developers
Initial attempts to employ commercial developers led to the DoD licensing the game engine from Tom Clancy’s Rainbow Six Rogue Spear (Ubisoft, 1999), as part of a scheme to develop training games for military personnel conducting urban-warfare operations. The developers stated that ‘It will be modified to use maps and scenarios requested by the U.S. Army, and will teach strategy and tactics, as opposed to weapons training’. In the same year Novalogic’s Delta Force 2 (1999) was also employed by the US Army to help familiarise soldiers with, and evaluate the effectiveness of, the ‘Land Warrior’ system. Land Warrior was described as ‘a self-contained computer and radio system; a Global Positioning System receiver; a helmet-mounted LCD [Liquid Crystal Display] …; and a modular weapons system that adds thermal and video sights and laser ranging to the standard M4 carbine or M16A2 rifle…’ it was seen as ‘a weapons system intended to integrate existing equipment with modern electronics to increase soldiers’ lethality and survivability…

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601 Parker (2012).
602 Jsnlomberg (2012).
604 Huntemann/Payne (2009), p.98.
605 Salzman (2001).
[to] improve communication, navigation, and situational awareness'.

Delta Force 2 was chosen as a human-in-the-loop simulation to test the performance of ‘Land Warrior’ equipped soldiers, since it ‘already included many of the features TRAC-Monterey wanted for the soldiers… the ability to render vast outdoor terrain as well as indoor and urban settings; multi-player support …; varied weather conditions; map displays; night vision; a large array of real-world weapons (including the M4 carbine); and a full-featured mission editor’. A modified version of the game which included ‘the ability to move the weapon separately from the body, as well as using a video camera feed from the end of the weapon to survey a scenario from behind cover’, was used to allow the US Army to evaluate the weapons and tactics which would be used in the real-life system, and compare the performance of soldiers equipped with the system to those without.

Although these early examples demonstrate a willingness to engage with commercial products – Novalogic distributes 1,200 copies of their next game, Delta Force 2: Land Warrior (2000), to West Point as part of the cadet military science education program – neither of these products saw widespread usage, as their utility continued to be limited by the technology available at the time and the customisation options of the software.

Rather than continuing to attempt modifications of pre-existing games platforms, the US Army decided to finance and direct the development of a ‘commercial platform training aid’ in order to better meet their requirements; it was hoped that army involvement from an early stage of development, as opposed to adapting a pre-existing game engine, would lead to a more suitable training tool. In 1999, Michael Macedonia, who at the time was a member of the Program Executive Office for Simulation, Training and Instrumentation (PEO STRI), approached a DoD-sponsored University Affiliated Research Centre – known as the Institute of Creative Technologies (ICT) – which was brought in to help begin the development of a PC

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607 Ibid.
and console-based training system. This led to a $4.4m contract by the Army to create the video game *Full Spectrum Warrior* (2004; Pandemic Studios). Macedonia called the game a ‘first-person thinker’; the player commands a squad of two fireteams rather than directly controlling one single avatar. The player then switches between the members of the fireteams, issuing orders which the AI executes. ICT stated that ‘It is the combination of tactical planning and guided execution on modern [sic.], asymmetrical battlefield that is the foundation of FSW’.  

![Figure 36 - Screenshot of Full Spectrum Warrior](image)

*Full Spectrum Warrior* was designed to leverage the familiarity with commercial gaming systems already possessed by soldiers; ‘a new generation of recruits who had grown up mashing buttons on *Tomb Raider* and *Sonic the Hedgehog* would already be versed in the equipment, and any officer could see that video games were among

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612 Ibid., p.229.
613 Ibid.
614 Ibid., p.233.
615 USC, Institute for Creative Technologies (n.d.).
the most popular pastimes with younger members of the forces'. 616

The intent was for the Army to ‘get a great-looking, great-playing game for use as a new-generation-friendly training aid, and the commercial partners would get a product to sell’. 617 However, the extent to which this goal was realised has become the topic of considerable debate. Although documents such as the ‘Train-the-Trainer Package for the Full Spectrum Warrior Game’, produced by the US Army Research Institute for the Behavioural and Social Sciences, demonstrate that the Army made a genuine attempt to employ the game as a training tool, its effectiveness was immediately called into question. 618 According to one former art director at Sony, the reasons for this were that ‘the companies were so focused on creating a best-selling game that they cut corners on the Army version… urban scenes are not as accurate as they should be’. 619 Keith Ashdown, Vice President of the watchdog group Taxpayers for Common Sense says the game was ‘a feeble attempt at training our troops in urban combat. But it became a cash cow for Pandemic and Sony’. 620 Internal documents from Sony went some way towards confirming these suspicions, ‘A February 2001 memo from Sony manager Tom Hershey to another Sony division said the goals were "1) creation of state of the art entertainment, 2) creation of a commercial success, 3) the showcasing of advanced game design R&D." The Army's needs were last: "4) potential use as a demonstration and/or training tool."’. 621 However, the most damning criticism came from those who were meant to be using the game; Army officers stated that ‘the battle tactics in the game were already out of date when they started using it, and its graphics and scenarios were too simplistic for use as a training tool’, in 2005 ‘Jim Riley, chief of tactics at the Army’s infantry school at Fort Benning, Ga., said that his school almost never uses Full Spectrum Warrior because it fails to provide an accurate simulation of urban combat… He said his soldiers were disappointed by the game’s lack of realism and did not learn the

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617 Ibid., p.234.
620 Ashdown quoted in Adair (2005)
intended lessons’.622

Whilst *Full Spectrum Warrior* was a commercial success – winning awards for ‘Best Original Game’ and ‘Best Simulation Game’ at the prestigious Electronic Entertainment Expo, and selling one million copies by February 2005 – the Army’s experience with the product was sobering.623 Whist officials asserted that they had ‘no regrets over what happened, and that Full Spectrum Warrior was a valuable research lesson for the future’, it was evident that the game did not live up to expectations; the armed forces too readily believed the claims of authenticity put forward by the developers, when the developers were basing these claims on specific elements of realism which have been elucidated throughout the preceding case study chapters.624 Riley stated that ‘Army officials were so dazzled by early reviews from game aficionados that they did not get a useful training aid’, and that ‘It became very evident to us we hadn’t done a good job in the development effort… people got caught up in the hype…’.625

*Full Spectrum Warrior* is a clear example of a game where the developers failed to balance the requirements of gamers with those of professional military users. Since large sums of money were provided up-front, and the development process was not sufficiently overseen, the developers essentially took advantage of the funding they were provided to pursue their primary motivation – profit. The Army ended up with a product which failed to serve their training requirements.

At the same time as *Full Spectrum Warrior*’s development the USMC were continuing their attempts to employ video games as an element of their infantry training. They worked closely with developers Destineer – providing doctrinal publications and more than 40 marines as advisors – to help develop the video game *Close Combat: First to Fight* (2005) for the PC and Xbox console platforms; the USMC spent only $900,000, with Destineer being required to cover any additional costs.626 Michael Woodman, project manager for Marine Corps Systems Command,

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624 Ross/Rackmill (2005).
625 Riley quoted in Adair (2005).
626 Adair (2005); Peck (2004); Caie (2004).
stated that ‘We have developed it with the full expectation that it will become a tactical decision-making simulation’; the game requires the player to lead a four man fireteam through various urban combat scenarios.\textsuperscript{627} The player’s fireteam were coded to employ tactics such as Ready-Team-Fire-Assist (RTFA) – a Marine Corps system of formations, movement and tactics used in urban combat – so that each of the player’s three AI teammates would emulate behaviours advocated in official Marine Corps doctrine.\textsuperscript{628} Additionally, one of the major selling points of \textit{First to Fight} was the integration of a psychological model for each NPC. The model represents the morale of each soldier, and ‘affects their speed, agility, accuracy, and will among other things… [morale] will ascend when they’re close to other teammates (i.e. proximity), when helicopters are present, when an enemy unit is defeated, and when there are more than 12 marines are [sic.] around. It’ll descend when civilians are present, when a marine is left alone for too long, when you issue stupid orders, and when they’re injured’.\textsuperscript{629} The game was met with positive responses from Marines, one Sgt. Maj. Stated that ‘Lots of Marines don’t get a chance to practice combat arms or use their tactics without going to the field…I am definitely going to play this game at home…’.\textsuperscript{630}

Furthermore, \textit{First to Fight} was designed with a secondary educational training goal:

> ‘Officials at Marine Corps Community Services... decided that video games could serve both to teach drug awareness and as a useful tactical simulator... Marines will receive the version of \textit{First to Fight} with the drug awareness module, which they can play on their home computers. They’ll see how a stoned Marine can ruin a fire-team leader’s day. At some point in the mission, one of the team members will scream incoherently or run out in the middle of a bullet-crossed street...Marine simulation centers will be able to shut it down, thus enabling them to use it as a multiplayer tactical trainer’.\textsuperscript{631}

\textsuperscript{627} Woodman quoted in Peck (2004).
\textsuperscript{628} Caie (2004).
\textsuperscript{629} Perry (2004).
\textsuperscript{630} Muth (2006).
\textsuperscript{631} Peck (2004).
Col. James N. Flowers, commanding officer, Marine Corps Engineer School believed that employing the game for this purpose was a good idea which might help to deter marines from taking illicit substances on the battlefield by showing them how drugs reduced their combat effectiveness and risked friendly soldiers’ lives.632

An Intermediate Experiment: America’s Army – Repurposing a Recruitment Tool

In 2002 the United States Army embarked upon a unique experiment in the history of military video game usage; for use as a recruiting tool, the Naval Postgraduate School’s Modeling, Virtual Environments and Simulation (MOVES) Institute developed a mass market commercial video game, America’s Army (2002). The game was designed as a tool to boost army recruitment whilst revitalising their image amongst younger demographics.633 In this it succeeded, becoming the ‘crown jewel’ in army recruiting; in 2008 a Massachusetts Institute of Technology study noted that ‘30% of all Americans age 16 to 24 had a more positive impression of the Army because of the game and… the game had more impact on recruits than all other forms of Army advertising combined’.634 By 2013 the game had more than 11 million registered users.635 America’s Army is an unusual example; firstly, it is the only instance of a military force producing an entirely commercial product, and secondly, the game was never designed as a training aid – only after its release was it adapted to serve training purposes. In the commercial sphere,

‘America’s Army was such a hit primarily because it’s what the game industry refers to as a “triple-A” first-person shooter game, meaning that it’s on a par with the best commercial examples of the genre... For players who are interested in the United States military, America’s Army is attractive not only for the exciting game play but also for its claim to realism; one of the game’s taglines is “The most realistic Army game ever!” This supposed accuracy derives in part from the spot on depictions of weapons, uniforms, and missions in the game’.636

634 Ibid., p.75.
635 Ibid.
636 Ibid.
Upon its release the game’s commercial success was due to a combination of exciting gameplay which engaged players, and perceived realism, in the form of replicating the visual physical attributes of contemporary combat environments. Once again this form of realism mirrors that found in the case study games, which is no surprise since America’s Army was designed for mass market appeal and commercial viability. There were no competing demands when developing the product, as realism from the perspective of creating a viable combat simulation was simply not required.

There were however some differences which marked America’s Army out from its many commercial predecessors. Player kit and equipment choices were restricted until certain training missions had been completed; for example, medical training required players to sit and listen to genuine lectures on basic medical procedures and then pass a test to demonstrate their understanding. Only if they succeeded would the option to play as a medic be unlocked, although like most other commercial products healing a wounded soldier simply requires the player to press a button at the appropriate time. In a similar vein, friendly fire is enabled, but if the player shoots a friendly soldier during training they are transported to prison indefinitely, and cannot continue the game unless they exit and restart. Such additions were designed to bring a sense of responsibility into the gameplay, and a willingness to emulate army values. The developers allowed currently serving soldiers to obtain an in-game ‘Army Star’ which would mark them out to other players; this would create ‘a new channel for communication between Soldiers and the public they serve’, and allow soldiers to be influential in shaping the fan culture, as ‘…soldiers and Vets are valued by civilian unit members as experts on military life’. The game was highly successful as a recruiting tool because whilst providing an enjoyable gaming experience it also taught players about army values and furthered engagement with the ethics of warfare.

In the ensuing years the America’s Army game engine was incorporated into a number of different training initiatives. In the fall of 2005, the Convoy Skills

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637 America’s Army Game Manual (n.d.); mrmatius (June 2009).
638 the4armedmonk (October 2009).
Engagement Trainer (CSET), was created as a pilot project for the army’s basic officer leadership course. The system was a deployable, instructor led training system for convoy skills: ‘In the application Soldiers configure convoys and develop tactics as they embark on different scenarios such as VIP [Very Important Person] transport, pick-ups or drop-offs, and trying to reach a checkpoint to hand off their vehicles’. The system could be used from a traditional PC desktop, or moved beyond the basic setup to include a real rifle mounted on a real gun turret in front of three large wraparound screens. The developers stated that the system aimed to complement live training and facilitate mission planning and rehearsals, whilst concurrently validating tactics, doctrine and weapons familiarisation.

The game was also used for procedural training. In late 2005, the Improved Target Acquisition System (ITAS) was implemented as part of the army’s Basic Skills Trainer (BST) in order to simulate the usage of wire guided anti-tank missile systems. The BST used the America’s Army platform technology to train and qualify non-proficient and advanced gunners in all critical operational tasks of the tactical ITAS weapon system… the ITAS BST helps familiarize Soldiers with the controls, grips and system responses, and accurately simulates all system functions including power-up procedures, on-screen menus, laser ranging, and accurate missile flight. The BST also connects directly to the ITAS tactical hardware allowing the Soldiers to experience the "real feel" of the system. This system was deployed at Fort Drum and was used as part of their platoon-level training as late as 2012. Although this virtual environment was created using the America’s Army engine, the system went well beyond the traditional PC setup, employing extensive additional hardware to meet its training goals.

640 America’s Army Official Website (2012a).
641 Boyd (2005).
643 America’s Army Official Website (2012b).
644 Ibid.
645 Foss (2012).
Usage of the game was not limited to purely combat training environments. The adaptive thinking and leadership initiative was used to by Special Forces at Fort Bragg in 2005 for soft skills training, focusing on interpersonal flexibility and strategic communication in cross-cultural settings, the aim being to provide soldiers with a role-play experience which would allow them to expand their skills into areas such as negotiation and combat resolution.

The *America’s Army* example is notable for a number of reasons. Firstly, the game was never intended to be a training tool, and this meant that the dichotomy evident in the creation of dual purpose products did not exist. Secondly, the game demonstrated the increasing willingness of different sectors to engage with virtual environments for training purposes. Unlike previous examples that were used in niche efforts, the different initiatives to use *America’s Army* were widespread and undertaken by multiple different elements. It is arguable that at this point the stage was set to develop initiatives in a similar vein, allowing military establishments to author their own training environments. However, the ascendance of the VBS series which was spearheaded by the release of VBS1 in 2005 rendered any future efforts at in-house development largely redundant. Despite the success of the aforementioned initiatives, *America’s Army* 3 lost repeated competitions against VBS 2 and VBS 3.

646 Ibid.
647 Sandia Corporation (2005).
to be selected as the official soldier training tool of the US Army; the BISIM software provided key additional capabilities such as the ability to mod the simulation, increased interoperability with other simulations, the simulation of battle command systems, and significantly larger maps.648 Michael Bode, executive producer of America’s Army, also stated that ‘while the Unreal 3 engine [used in America’s Army] focuses on graphical detail, which is great for entertainment games, VBS2 focuses on simulating reality by building large virtual worlds’.649 Ultimately, ‘the crux of the issue appears to be VBS2’s enormous flexibility available right out of the box, even for non-expert end users. This is something AA3 can’t deliver…’.650

The Third Phase – Working with Third Party Developers
Concurrent with American attempts to develop and employ the aforementioned products, forces in other countries were also attempting to leverage the potential of commercial FPS games via a different approach. In the UK, QinetiQ – a private partnership formed from elements of the defunct Defence Evaluation and Research Agency, and working under a 25 year agreement to test and evaluate military platforms – modified hit titles from the commercial series Half Life (1998 and 2004; Valve) to develop a research and operational analysis tool used for war fighting experimentation.651 They developed two versions of the Dismounted Infantry Virtual Environment (DIVE 1 & 2) between 2002 and 2005 for MoD and Army usage, and the system was best known for its virtual representation of the Copehill Down urban combat training ‘village’.652

649 Peck (2009).
650 JC (2009).
652 QinetiQ (n.d.); Jilson (2004); Defense Industry Daily Staff (2005); Stone (n.d.).
A typical DIVE scenario was described as focusing ‘on house search and clearance. Each PC is networked so that soldiers go through the game as a section against an ‘Opposing Forces’ threat using real tactics and techniques. Enemy Forces are controlled by team mates and some computer generated Forces are also included’.

These experiments with the Half-Life game engine highlighted significant flaws which would need to be overcome to create an effective training environment:

'[there were] some undesirable results for a military training system. An example of one of these was… the game method of play called team deathmatch in which the game ended when all the opposing forces were eliminated. This led to the users fighting in the game for some time until it appeared that there was no enemy left standing. The game however did not stop and the users realised that those enemy who were shot in the leg were disabled, but were regarded by the game engine as

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653 Stone (n.d.).
still alive, so the game did not end. The practical effect of this was to have created a training system where the only way to win was to go around shooting the enemy wounded. This virtual breach of international law was seen as unacceptable practise in training...\textsuperscript{654}

Various studies of DIVE’s effectiveness concluded that despite its flaws it was beneficial in terms of:

- Introducing, teaching and rehearsing new drills and TTPs
- Showing the viewpoint of both sides, enemy and own forces
- Representing the use and effects of current and future systems that either cannot be or are poorly represented in conventional training…
- Reviewing actions and events from all perspectives both during the event and in post-game analysis
- After Action Review (AAR). This was reported as a ‘big win’ and developed a feeling of inclusion in the training process for all participants
- Developing new teams and fostering teamwork.\textsuperscript{655}

However, it must be noted that DIVE was experimental, and was never officially implemented as part of training.\textsuperscript{656} Those who were involved with trialling the system, such as Cpl Owen, Section Command, 1\textsuperscript{st} Royal Anglian Regiment, stated that his soldiers ‘…found the DIVE system an excellent training tool which quickly improved our skills and enabled us to try out things that would normally be far too time-consuming or dangerous’.\textsuperscript{657} Interestingly, one assessment undertaken by the DSTL concluded that the environment was more effective at augmenting training at the section level than the fireteam level, perhaps vindicating the view that FPS virtual environments are more successful at training decision making and teamwork skills than low level TTPs, which require traditional drill based methods to ingrain into individuals and small groups.\textsuperscript{658} Several years after its inception, a 2006 report

\textsuperscript{654} Curry \textit{et. al.} (2015), p.7.
\textsuperscript{655} List taken from Roman/Brown (2008).
\textsuperscript{656} Fawkes (2015).
\textsuperscript{658} Smith/McIntyre (2005).
did state that ‘The game has been elevated to front line status for pre-deployment training, and it is understood that DIVE is being received fairly warmly by troops outside of working hours’.659

Ultimately, before any widespread adoption could take place the DIVE games were superseded by VBS.660 This example does however aptly demonstrate the advantages of collaborating with an organisation directly affiliated with the military establishment itself, as opposed to utilising commercial developers. This solution allowed the MoD to avoid many of the problems encountered by the DoD in their attempts to make use of games such as Full Spectrum Warrior. The Half Life series may have been produced as a purely commercial product, but QinetiQ did not develop the software and were responsible solely for modifying it to properly suit the MoD’s needs. This meant that their efforts focused entirely on the suitability of the product and fulfilling the needs of their client, the MoD, rather than working under the potentially diverging requirements placed on developers who also need their products to appeal to a mass market. Introducing this extra link into the development chain meant that the MoD’s requirements were QinetiQ’s sole prerogative, and this appears to have led to a much more successful outcome.

Indeed, the US armed forces were also pursuing this approach with similarly successful results. In 2004 the Defense Advanced Research Projects Agency (DARPA) funded the creation of DARWARS Ambush!, which was based on the game Operation Flashpoint: Cold War Crisis (2001; Bohemia Interactive Studio), as part of the DARWARS (DARpa’s universal, persistent, on-demand training WARS) initiative.661 The development of Ambush! was primarily handled by BBN Technologies, run by the American defence contractor Raytheon.662 Ambush! was ‘a multi-player, game-based training system for convoy operations… It allows soldiers and Marines to both experience lessons that others have learned and to construct their own scenarios based on actual experiences… Individual trainees move about in a shared, immersive, first-person-perspective environment where they carry out

661 Tobias/Fletcher (2011), p.76.
662 McDonough (2004); Raytheon (2015).
mounted and dismounted operations… They learn to anticipate and respond to ambush situations, practice existing tactics techniques and procedures (TTPs), and experiment with new ones. BBN technologies modified the game to create more realistic weapon and vehicle behaviour, facilitated the addition of tools to allow after-action reviews, and delivered an initial set of 24 ambush scenarios; other resources were then added due to requests from users.

One of the fundamental reasons for the eventual success of *Ambush!* was the inclusion of intuitive user authoring functions; users could author almost any changes they wanted, as the game provided a set of stock resources for the soldier-editor to work with. Users could also import other resources taken from either online libraries created by *Operation Flashpoint* players or custom created by military users themselves.

> ‘Within a year the Battle Command Training Centre at Fort Louis, Washington had adapted Ambush! software to train up to 400 soldiers per week on a pre-existing bank of 64 networked PCs… A platoon commander would come to the center with his training needs. By the next day a few staff members had authored scenarios to meet them. The training centre command commented that it was the fastest way to get soldiers into an NTC-like after action review where they would force themselves to think about what had happened, what they did (right and wrong) and how to improve’.  

A report given at the Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) in 2006 stated that *Ambush!* has been shown to be adaptable to training across a wide spectrum of other types of missions, including reacting to escalation of force, cordon and search, checkpoint security, questioning, crowds, and VIP protection and transport.

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664 Tobias/Fletcher (2011), p.78.
Usage of the software quickly spread to different locations, with training sites arising in locations such as Afghanistan and Germany, and by 2006 *Ambush!* was being used ‘to train 500 soldiers each month as part of a noncommissioned officers’ leadership course’.669 Lt. Col. Charles Hodges even used the software as part of Duke University’s Reserve Officers Training (ROTC) Department – modifying it to help cadets learn combat planning – by mid-2007 the National Cadet Command had distributed the software to 1,300 army ROTC programmes for potential usage by 6,000 cadets.670 The United States Military Academy also engaged with the software, adopting it to teach dismounted infantry operations to over 1,000 cadets.671 Uses for the game went beyond its originally intended functions; soldiers at Fort Louis authoring training videos by recreating within the software actual battles that had taken place only weeks earlier, and then showing them to a brigade’s officers and enlisted leaders, pausing at various points ‘to provoke discussion of what soldiers in that simulation should be thinking and what they might do next’.672 The software was replaced by VBS 2 in 2009.673

The inherent adaptability of *Ambush!* led to adoption which took place from the ground up, as many of the reported modifications were undertaken by trainers independently; one of the key figures involved in the initial procurement of the software stated that ‘neither I, nor the developing contractors, nor anyone in the formal Army training establishment knew anything about these developments until they had been created and used extensively…’.674 Those involved in the procurement procedure did not foresee the myriad of potential uses and training means the software would eventually serve, and the widespread adoption of *Ambush!* demonstrates the importance of satisfying end users in order to drive adoption.

*Ambush!* provides another comparatively successful example of COTS technology use within the military establishment. The most important reason for its continued

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669 Tobias/Fletcher (2011), p.79.
670 Ibid., p.80.
671 Ibid.
672 Ibid.
674 Tobias/Fletcher (2011), p.81.
usage after so many years was undoubtedly the ease with which it could be modified. This also explains why many other commercial products were never even considered for adoption. *Ambush!* was still being used in 2009, and by this point games like *Modern Warfare* had significant advantages over it in terms of graphics and physics; however, a lack of modifiability meant that these newer – and in many ways more advanced – games were never even considered by military forces despite their claims to enhanced realism (which by this point were treated with a considerable degree of scepticism).

This overview has examined only the most pertinent examples of military employment of FPS games; the examples given here encompass only a specific element of military engagement with commercially available products related to the sphere most relevant to this research. Engagement with COTS products has increased greatly across the board in recent years. Military establishments and contractors are attempting to take advantage of recruits who have been playing video games for many years prior to joining the armed forces by re-purposing commercially available hardware and software. One Unmanned Aerial Vehicle (UAV) system was seen to be using a controller seemingly taken directly from an Xbox 360 games console.

*Figure 39 - British Army Personnel Utilise an Xbox Controller to Pilot UAVs*

When queried about this, a representative of the British Army Recruiting and Training Division replied that ‘The system used to control the planes has been adapted by Lockheed Martin and although the controller used by the soldiers to fly the plane is very similar to a Microsoft Xbox 360 controller, it is not the same… the
skills and abilities that an individual develops in their life prior to joining the Army may have a critical application within the British Army on operations today’. It is significant that military establishments feel that recruits have an affinity for console controllers, and this reflects the fact that by some estimates console sales of FPS games now exceed those on the PC.

Experimentation with FPS games appears to have declined markedly since 2005, even though increasingly successful results were demonstrated across the various initiatives. This can be attributed directly to the increasing market dominance of the VBS series. It has already been determined that several earlier initiatives were superseded by VBS, and in the ensuing years a large number of armed forces across the globe began to adopt it to fulfil a diverse range of training objectives.

Current FPS Usage – The Ascension of VBS
Founded in 1999, Bohemia Interactive Studio (BIS), first entered the commercial market with *Operation Flashpoint*, which became the basis of *DARWARS Ambush*! Recognising that the military were taking an interest in their products, it was decided in 2001 that Bohemia Interactive Simulations (BISIM) would be established as a sister/subsidiary company with the primary goal of marketing and developing video games for military establishments. BISIM was the first commercial company specifically aiming to develop FPS video game technologies for military users.

Initially, both companies utilised the *Operation Flashpoint* game engine as the basis for their products. BIS produced *Armed Assault 1*, and BISIM producing *Virtual Battlefield System 1* (which became *Virtual Battlespace 1* in 2005). VBS 1 was poorly received. Its marketing model required a per-seat licence, and the physics engine had fundamental issues which had not been fixed during the conversion from *Operation Flashpoint*; for example, ‘grenades exploded on impact – which could be a problem when attempting to throw one through a window and the inadequate collision detection that meant it was possible to run through the junction of two walls’.

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675 Picture and quote taken from Maunders (2008).
676 Orland (2013).
677 BISIM (2015a).
By 2007 both companies were working on their next versions of the software. BISIM’s offering, Virtual Battlespace 2, successfully addressed many of the issues of its predecessor, and the UK MoD became one of BISIMs first major customers, as well as being one of the earliest military forces to officially adopt the software as a training tool.\textsuperscript{679} In May 2007 the MoD purchased an enterprise licence, allowing an unlimited amount of copies to be distributed on an as-needed basis.\textsuperscript{680} This provided BISIM with a significant influx of funds which would be crucial for further developing the series.\textsuperscript{681} The British initially purchased the software to meet a specific training need, that of a convoy trainer. It was used as the basis of the Operational Joint Combat Operations Virtual Environment (Op JCOVE), which was created with a small budget of £25,000 at the Princess Royal Barracks, Deepcut, and will be examined in more detail in the next chapter.\textsuperscript{682} Previous initiatives, such as DIVE, were entirely superseded, as although the Half Life game engine showed potential VBS provided improved scenario development capabilities, detailed AARs, and an augmented content library.\textsuperscript{683} The budgets employed by the British army highlight the impossibility of any force other than the US Army to create bespoke video game solutions; in 2009 the cost to develop a high-end commercial game, Call of Duty: Modern Warfare 2, was estimated to be around $50 million.\textsuperscript{684} VBS 2 was subsequently adopted by the US and Canadian armed forces in 2009 and 2010 respectively, with the US forces using the software as part of their ‘Games For Training’ program, and the Canadians also purchasing an enterprise licence.\textsuperscript{685}

Throughout this chapter a timeframe of roughly a decade has been delineated which was characterised by great experimentation amongst military forces, as they attempted to leverage different COTS video game products to suit their needs. Ultimately, VBS 2 brought this era to a close. Since 2007 there have been no serious attempts to use any other FPS games as part of military training, as the increasing list of capabilities intrinsic to the VBS series rendered other experimentation redundant. VBS provided all the advantages of a COTS video game with the added advantage of

\textsuperscript{679} BISIM (2015a); Mouat (2015d), Cruz-Cunha (2012).
\textsuperscript{680} Games Industry International (2007)
\textsuperscript{681} Mouat (2015d), Cruz-Cunha (2012).
\textsuperscript{682} Army-technology.com (2010a); Arup (2015); Cruz-Cunha (2012).
\textsuperscript{683} Fawkes (2015).
\textsuperscript{684} Fritz (2009).
\textsuperscript{685} BISIM (2015a); BISIM (2010).
supplementary features tailored specifically to the military audience. From 2007 onwards signifies the most recent phase of development in terms of military experimentation with COTS video games.

After ten years of working in parallel, BISIM formally split from BIS in 2011. As separate entities both companies began working on proprietary game engines derived from ArmA 2. An agreement was reached whereby each company would not impinge upon the other’s sphere of influence; BIS products would only be sold to the commercial market, and BISIM products would only be sold to militaries and other industry clients specifically for training purposes.686 Interviews with BISIM employees reveal that the reasons for this split were largely due to the different needs of their respective clientele and the requirement for both sides to maintain a consistent pace of development; operating separately, each side had more freedom to modify the base engine, and the need to cross check modifications was bypassed.687 This is highly significant, demonstrating that even two closely aligned development teams – who had been working on the same software for a decade – could not effectively juggle the competing requirements of the commercial and military spheres.

Since their rise to prominence and acceptance within military spheres the VBS suite of games has dominated the market. By 2014 BISIM had achieved widespread penetration into the military market with customers including the armed forces of countries such as Australia, Canada, Finland, France, New Zealand, the Netherlands, Poland, the United Kingdom, the United States and various other NATO members.688

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687 Ibid.
688 BISIM (2015b); BISIM (2016c).
Chapter 11: The Virtual Battlespace (VBS) Series

Introduction
This chapter will examine the VBS series and its usage within armed forces to augment infantry training and education. Firstly, there will be an assessment of the academic debates surrounding the effectiveness of VBS and FPS games as training tools. Secondly, an examination of how the British Army employs VBS will be provided, in order to establish an understanding of current training methodologies. The British Army has been chosen as the primary case study given that there are extensive logistical challenges which would need to be overcome in order to assess VBS usage across different countries around the globe – the scope of such an assessment would likely be overwhelming, as different forces take distinctive approaches to infantry training. Thirdly, the limitations inherent to game-based training will be examined, as some factors unique to the training sphere have not yet arisen in the previous case studies. Fourthly, a technical assessment of the expanded suite of functionalities offered by VBS will be undertaken. This will determine the functional differences between VBS and ArmA, revealing where military requirements contrast with those of the purely commercial market. This should shed light on why VBS has been successful in the military sphere where other commercial products have failed. Fifthly, in light of the aforementioned technical assessments there will be a critique of the strengths and weaknesses of current British training methodologies. Finally, as with the previous case study chapters, VBS will be assessed in relation to the combat model.

The Academic Debate: How Effective is VBS as a Training Tool?
Given the burgeoning acceptance of video games as training tools, academics and various armed forces have undertaken studies into their effectiveness and there is a considerable debate surrounding VBS. Academic analysis thus far is relevant to specific instances of VBS usage in particular contexts, and so no consistent conclusions have been reached. Studies have also struggled to produce methodologically sound quantitative conclusions, as much of the evidence presently supporting virtual environment training is anecdotal; the current state of empirical research has been described as ‘fragmented, filled with ill-defined terms, and
plagued with methodological flaws’. Furthermore, no military force has been willing to finance and undertake extensive experimentation in order to provide a more definitive answer to some of these questions, as ‘the cost of obtaining these kinds of measures routinely is prohibitive’. However, despite these issues there is still a growing body of evidence which supports the use of VBS as an effective infantry training tool when employed appropriately.

Purely anecdotal assessments of VBS are common throughout the literature. In 2010, a US Army combat battalion used VBS 2 in Afghanistan for training, mission rehearsal and visualisation. The Battalion Commander for the unit stated that operationalising VBS 2:

‘... provides the ability to rapidly conduct mission rehearsals and leader certification exercises prior to execution outside of the wire. The ability to get all soldiers involved in a pre-mission VBS 2 exercise allows for modifying enemy scenarios and providing after action review capability with complete situational awareness that otherwise would not be possible with any existing simulations or equipment... they can mentally prepare and readily visualize the actions they will take on a given mission or during a certain scenario with enemy contact... Ultimately, the capabilities offered by VBS 2 have tremendous potential to save soldiers’ lives and make them more effective in the conduct of operations....’

He went on to conclude that ‘Based on my discussions with the soldiers who built the exercises as well as those that participated, the training was on the mark and effective’. Whilst positive in their outlook, such anecdotal assertions lack the supporting quantitative evidence required to truly assess the effectiveness of this training.

Various early studies of game-based training, such as Nolan and Jones’s ‘Games for

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693 Ibid.
Training: Leveraging Commercial Off The Shelf Multiplayer Gaming Software For Infantry Squad Collective Training’ (2005) and Proctor and Woodman’s ‘Training “Shoot House” Tactics Using a Game’ (2007), attempted to provide this qualitative element. Both studies sought to evaluate which skills COTS games could train, alongside their impact on improving team performance. One of the immediately obvious limitations of both studies, and indeed many others, is that they involve only a small number of soldiers – 41 and 16 respectively – who participated in short training evaluations which comprised only a small fraction of their overall training regime; Proctor and Woodman state that in their study only two hours of virtual training were included in a four-week, 160+ hour course of instruction. Therefore, whilst they did provide further anecdotal support from both instructors and trainees relating to training having a positive impact on decision making skills, little in the way of reliable or statistically significant quantitative data was actually produced to back up these claims.

Wiederhold and Weiderhold published two articles in 2006 and 2008 respectively, entitled ‘From SIT to PTSD: Developing a Continuum of Care for the Warfighter’ and ‘Virtual Reality for Posttraumatic Stress Disorder and Stress Inoculation Training’, which seemingly provide some of the strongest quantitative evidence to support training using FPS games. The first article states that a three-year study completed in 2005 and sponsored by DARPA ‘proved the effectiveness of a low fidelity laptop simulator to train military personnel’. 970 participants from a combination of US Navy, Marine Corps, and coastguard were used; one group received training in a virtual combat scenario, whilst the other did not, and their psychological arousal was measured. ‘Afterwards, all participants were tested in a real-world version of this same combat scenario to determine the effectiveness of training in a virtual environment’.

The articles discuss these results in detail, stating that:

696 Wiederhold/Wiederhold (2008); Wiederhold/Wiederhold (2006).
698 Ibid.
699 Ibid.
‘...the VR groups scored higher in every exercise. For example, the VR group completed a weapons search of a house about 2 minutes faster than the group without VR training. The non-VR group, for all trials, located and cleared rooms successfully, but 2 exercises resulted in teams clearing rooms multiple times (93% accuracy). The VR group, for all trials, located and cleared rooms successfully with no rooms cleared multiple times (100% accuracy)...

In the second part of the study, one group trained on the virtual shoot house via laptop computer for 10 minutes before entering the shoot house. A control group was monitored over 4 rounds in the real world shoot house without any virtual training. Then the groups’ performances were compared. The result showed that 10 minutes on the laptop produced the same result as 4 runs and 1 hour in the real-world shoot house. Essentially, the study’s investigators saw that virtual training can reduce real world training by 75% in terms of training sessions... significant transfer of skills from virtual to real-world exercises was demonstrated...’  

Unfortunately, neither of these papers provide specific details relating to how exactly the training was carried out, or the methods which were using during training itself; there is thus little clarity as to the methodology the researchers employed. Also, they specifically focus on the stress inoculation aspect of training, and so even such positive results only validate the effectiveness of game-based training in this context. Whilst these studies do go some way to confirming that repeated exposure to artificial battlefield stimuli does help soldiers to perform under stress in the real world, this does not validate game-based training as a learning environment to facilitate knowledge transfer.

Some assessments have argued directly against the tenet that game-based learning can be employed effectively at the dismounted level. In 2013 the Australian
Government DoD undertook a study entitled ‘Evaluating the Effectiveness of Game-
Based Training: A Controlled Study with Dismounted Infantry Teams’, which
concluded that ‘...traditional training produced significantly better outcomes than
game-based training... game based training had no measurable benefit for training an
infantry team...’.\footnote{Whitney et al (2013), p.40.} The outcomes of this study were ‘in contrast with previous studies... which have concluded that game-based training is effective when delivered
in addition to or in conjunction with traditional training methods’.\footnote{Ibid., Executive Summary.}

However, as with the previous studies, various methodological problems have been
identified which to some extent undermine these conclusions. The participating
soldiers are described as novices just having finished Army Recruit Training.\footnote{Ibid., pp.9, 34.} It is
arguable that at this stage of learning they are still working to perfect basic execution
of drills, techniques and procedures rather than enhancing their cognitive tactical
understanding of the battlefield; VBS provides minimal benefit at this stage of
training, and this is why most forces use it to train officers and command teams in
higher level decision making skills. Indeed, in the specific area of knowledge transfer
the study does indicate that learning took place. Although VBS had some difficulty in
providing the soldiers with directly transferable physical skills when executing an
attack – which is to be expected of any virtual environment – it did impart some
knowledge and understanding of how these attacks should be executed on a cognitive
level.\footnote{Ibid., pp.31-32.} Due primarily to a lack of familiarisation with the software, the section
commander felt the soldiers had ‘difficulty keeping the section in formation and
appropriately spaced, which led to poor situation awareness at various times during
the mission’.\footnote{Ibid., p.24.} Finally, the experiment involved comparing the performance of a
section that had received eight hours of VBS 2 training in section attack procedures
against a section receiving eight hours of field-based training with the same focus.\footnote{Ibid., Executive Summary.}
VBS was not used in conjunction with other methods, but was employed entirely in
isolation. VBS should be used to supplement traditional training methods, rather than
replacing them.

\footnote{Whitney et al (2013), p.40.}
\footnote{Ibid., Executive Summary.}
\footnote{Ibid., pp.9, 34.}
\footnote{Ibid., pp.31-32.}
\footnote{Ibid., p.24.}
\footnote{Ibid., Executive Summary.}
Despite these areas of contention this study should not be dismissed. It is one of the most detailed of its kind undertaken by a military force, and its conclusions are certainly not invalidated by the aforementioned methodological problems. The study verifies the general understanding that VBS does not excel at training low level drills, techniques and procedures, as training for these elements of combat is based upon the repetition of physical actions.

The most reliable quantitative evidence in support of game-based training comes from two sources. The first is the 2008 paper ‘Games – Just How Serious Are They?’ by Roman and Brown, which examines different attempts in both the US and Canadian Armed Forces to use games, including VBS, as convoy and dismounted trainers. These extensive trials provide the first solid qualitative data to support previously anecdotal claims. A five-week convoy training course conducted by the Canadian Combat Training Centre ran three different trials using VBS for different proportions of the course. The pass rates are shown in the table below:

<table>
<thead>
<tr>
<th>Serial 0602 (No VBS®) (1 demo/6 assessed traces)</th>
<th>Serial 0701 (1 day VBS®) (1 VBS®/1 demo/6 assessed traces)</th>
<th>Serial 0702 (2.5 weeks VBS®) (4-6 VBS® no demo/4 assessed traces)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% pass on 1st trace</td>
<td>0</td>
<td>30%</td>
</tr>
<tr>
<td>% pass by ½ of traces</td>
<td>61%</td>
<td>72%</td>
</tr>
<tr>
<td>% pass by end of course</td>
<td>72%</td>
<td>83%</td>
</tr>
</tbody>
</table>

Figure 40 - VBS performance results with increasing amounts of game-based training.707

In this case the game based training appeared to result in a significant improvement in reaching training goals, although there were potential confounds such as different

instructors running each course. Furthermore, for soldiers who moved onto the live phase of the training after completing the virtual section, ‘…substantial savings in ammunition and vehicle mileage were also made by releasing those who had reached the necessary standard from training early’. It was identified that although the virtual environment appeared to have a positive benefit on cognitive training, its impact on affective training – which relates more with the emotional state of the soldier and their ability to perform under stress – had not been properly explored.

The second is the Dutch forces analysis of VBS 2 for Job Oriented Training (JOT) – a constructivist approach to training assuming that students must be actively engaged in their proficiency in order to construct tactical knowledge and skills by themselves. Their initial investigations provided anecdotal reports that ‘both instructors and students claim that their learning experiences improved as a result of JOT’. They tested these claims by measuring the performance of acting commanders in three successive courses, taking into account their analysis of the situation, tactical planning, and situational decision-making. The results are shown below.

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708 Ibid., p.6.
712 Ibid., p.7.
This graph shows the average performance of the acting commanders in three successive courses (A, B, and C)… the figures along the horizontal axis depict the four successive measured runs [in the virtual environment]. Along the vertical axis the average scores of the different squad leaders are shown on a scale from 1 to 4, with four indicating ‘optimal performance’. The graphs indicate an overall trend of continuous improvement, eventually leading to NCOs managing to perform close to optimal, even though the latter scenarios were far more complex. The study then examined how this performance transferred to training scenarios taking place in the field, and these conclusions are highly significant:

‘Coming from a virtual game-based environment, we see students act as if they were doing a live exercise for the first time. Their performance is substandard and they generally do not take things seriously. This issue seems to be a result of classical transition problems. After one or two runs, the students discover that what they learned in the game can be applied in the field. After this realization kicks in, performance

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713 Ibid., p.8.
714 Ibid.
Since this course has been run over a number of years, these results have been verified through repeated testing. In addition, commanders asked about trainee performance in the field stated that ‘these students performed at least as good as, and usually better than the students who were trained traditionally…’. 716

Ultimately, there is only a small amount of solid quantitative data which directly supports the use of FPS games as effective training tools. 717 When asked directly whether the British Armed forces have actually undertaken any studies to evaluate the effectiveness of VBS training, Major Mouat stated that there was no official documentation. 718 Up until now, adoption has primarily been based on a drive to reduce costs and recurrent anecdotal assertions of effectiveness. The extent to which FPS games enhance training, as well as the methods which should be used to get optimal results, are still areas of debate and on-going research and development.

How VBS 2 has been Employed in British Army Training, Education and Experimentation
Officially, VBS was purchased by the British Army for use in two major systems – large-scale convoy training, and artillery fire control training. 719 Its remit was therefore to train soldiers, as opposed to educating them. These terms are often misunderstood and/or misapplied, and it will be instructive to clarify their meaning as it is arguable that in reality a significant amount of VBS usage in the British Army actually qualifies as education. Training consists of repeatedly practising drills and procedures in order to increase efficacy, which leads to them becoming second nature. 720 Education teaches people how to think – soldiers learn tactics and doctrinal principles which require dynamic cognitive engagement to be applied correctly in a variety of different scenarios. 721 Major Mouat argues that these two terms are
frequently conflated, as soldiers often refer to elements of their ‘training’ which are more accurately defined as education.\textsuperscript{722} This distinction is important to recognise, as VBS usage takes different forms depending on whether the goal is to train or to educate.

Op JCOVE, discussed in the previous chapter, involves the large-scale use of VBS for convoy training. Major Mouat states that it was used to train over 12,000 British soldiers prior to their deployment in Afghanistan out of around 80,000 who were deployed.\textsuperscript{723} This training was delivered by third party contractor NCS – otherwise known as Newman and Spurr Consultancy – as a managed service.\textsuperscript{724} Given that the British Army has only invested in a small number of permanent VBS suites, NCS were required to provide a mobile training solution which could move around 60 PCs to different locations, set up to conduct training, then relocate in short order if required.\textsuperscript{725} Between November 2007 and March 2015, NSC delivered 228 training events, totalling 295 weeks or 1,475 days of training; 14,612 individuals used the system from over 197 Regiments and Battalions in 79 different locations.\textsuperscript{726} The most intense training undertaken in this timeframe involved 17 soldiers from one unit employing the software for three consecutive weeks; the least, 30 soldiers participating in a single four hour training session.\textsuperscript{727}

Op JCOVE’s training objectives were to familiarise and train soldiers in convoy drills, for use in major operations such as the wars in Afghanistan and Iraq.

\textsuperscript{722} Ibid.
\textsuperscript{723} Mouat (2015d).
\textsuperscript{724} Mouat (2015e).
\textsuperscript{725} Ibid; MacMillan (2016).
\textsuperscript{726} Mouat (2015c).
\textsuperscript{727} MacMillian (2016).
Each training event is created as a bespoke experience by NSC, and prior liaison with the Officer Commanding (OC) allows scenarios to be constructed which cater to the specific training goals of each unit.\textsuperscript{729} The training is facilitated by NSC personnel, who are generally ex-soldiers subsequently trained in VBS.\textsuperscript{730} These veterans bring their prior understanding of combat to the training environment, and they also undertake Operational Training and Advisory Group (OPTAG) training programmes run by the Army for current soldiers, in order to make sure that they are informed of the most up-to-date enemy tactics.\textsuperscript{731} Soldiers practise executing all elements of a convoy, including driving in formation, maintaining distance, the location of electronic countermeasure vehicles, when to halt, and when to get out of the vehicle as well as which checks are to be carried out in such a scenario.\textsuperscript{732} Major Charles Burbridge of the Queen’s Royal Lancers stated that, ‘…we repeat the training over and over again until the procedures become instinctive. We take it very seriously and, while it will never replace live training, it has helped prepare soldiers...’

\textsuperscript{728} Army-technology.com (2010b).
\textsuperscript{729} MacMillan (2016).
\textsuperscript{730} Ibid.
\textsuperscript{731} Ibid.
\textsuperscript{732} Mouat (2015e).
for conflict situations.\textsuperscript{733}

Only a small proportion of serving British soldiers – around 5\% – have used VBS to simulate purely dismounted actions.\textsuperscript{734} The majority of trainees engage with the game as a convoy trainer, although it should be noted that convoy training can involve some dismounted aspects. The aforementioned 5\% are generally young officers going through training at one of three locations the Royal Military Academy, Sandhurst, the British army’s initial officer training centre; the Royal Electrical and Mechanical Engineers (REME) School of Electronics and Mechanical Engineering, Lyneham, the UK’s largest electronic and mechanical engineering teaching establishment; or the Defence Academy of the UK, Cranfield, which is responsible for post-graduate education and the majority of command, staff, leadership, defence management, acquisition and technology training for members of the UK Armed Forces.\textsuperscript{735} One final intermittent use of VBS in a dismounted capacity was to run BARMA drills – procedures for searching for IEDs, normally using a vallon metal detector.\textsuperscript{736}

\textsuperscript{733} Army-technology.com (2010a).
\textsuperscript{734} Mouat (2015d).
\textsuperscript{735} Mouat (2015e); MoD (2016).
\textsuperscript{736} MacMillan (2016).
Figure 43 - VBS Lab at Cranfield

Figure 44 - VBS setups and dismounted infantry usage, Cranfield training exercises, 2012
Major Mouat argues that officer training is less about practice and more about learning, and that VBS is largely used in these locations to educate soldiers, rather than to train them.\textsuperscript{738} As an example, officers at the REME School use VBS in its

\textsuperscript{737} Photos provided by T. Mouat.

\textsuperscript{738} Mouat (2015e).
capacity as a simulator to practise section attacks.\textsuperscript{739} Rather than simply sitting classes of Captains around a map and asking them to come up with a plan, VBS allows ideas to be put forward and tested in a dynamic environment. Members of the class are assigned different roles within a platoon, varying from command level positions to private soldiers (some will also be sent to another room to control a simulated UAV which provides intelligence, meaning that radio-communication procedures will be practised simultaneously).\textsuperscript{740} These scenarios are designed to educate soldiers on the process of undertaking a section attack in a variety of conditions, rather than requiring them to mechanically replicate rigidly defined drills.\textsuperscript{741} Although it could be argued that some of the participants are receiving less training value given that they are playing subordinates – one Captain might spend the entire task simply following the machine gunner and standing next to him – the majority of the process is visible to all participants. This means that everyone can observe the actions of the commanding officer, so all participants should be capable of contributing to after action discussions analysing the commander’s performance.\textsuperscript{742}

Given that the training objective is to educate soldiers, the opposition for these scenarios is usually played by VBS 2 AI set to a very low level of competence. This approach is taken because highly competent enemies eliminating the trainees would not help them to learn the appropriate lessons, especially early in the training cycle. Only in circumstances where trainees are repeatedly making significant errors is death an appropriate training outcome.\textsuperscript{743} This explains why, according to Major Mouat, computer controlled AI is rarely used if nuanced opposition is required. When an intelligent enemy is called for, instructors, or occasionally other trainees, will generally role-play as the opposing force, ‘…what he will do is deliberately shoot to miss, but in a way that the soldier can see where the bullet went so that he reacts properly. If the soldier keeps being completely stupid then you tell the role-player to shoot him in the head’.\textsuperscript{744} When an enemy presents itself trainees are then

\textsuperscript{739} Ibid.
\textsuperscript{740} Ibid.
\textsuperscript{741} Ibid.
\textsuperscript{742} Ibid.
\textsuperscript{743} Ibid.
\textsuperscript{744} Mouat (2015d).
required to react in a manner which confirms to their current doctrinal understanding, ‘... I send a gun group over there to keep their heads down, and then I sneak up behind them so I’m at 90º...’ etc. Only humans can provide such nuanced opposition so that scenarios can be properly calibrated to allow trainees to win engagements, but always be hard-pressed in doing so. The British Army considers this approach to yield optimum training benefits.

VBS is also used frequently as part of instructional toolkits to augment traditional classroom based learning/knowledge transfer, as its virtual environment is ideal for generating learning materials which can be employed as part of training and education. Screenshots from VBS can be put into PowerPoint slides and other visual aids to demonstrate fundamentals, such as what makes up an Infantry Company, and provide visualisations of section attacks or the layout of a roadblock, ambush, etc. As a visualisation tool VBS allows soldiers to see an accurate 3D representation of the areas they may be deployed in, as shown in Fig.47, which they can then manipulate at will, rather than simply viewing the environment on a map, or in photos.

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745 Ibid.
746 Ibid.
747 Mouat (2015a).
748 Ibid.
Figure 47 - British Army model of ‘a City in Iraq’ (2010)\textsuperscript{749}

Figure 48 - Photograph of a gateway in Iraq

\textsuperscript{749} Cruz-Cunha (2012).
At the REME School, officers also use VBS to demonstrate their understanding of how to site a workshop. They are given a piece of terrain and use the mission editor to place vehicles and items which would be located in such a facility using a ‘drag and drop’ approach to construct the layout. These scenarios use VBS as a sandbox for its mission editor, rather than employing it as a real-time simulation. After each participant has constructed their own facility the instructor selects a good example to scrutinise in front of the class, allowing individual officers to ask questions with the goal of enhancing individual understanding.

Finally, VBS is also used at the Defence Academy as an experimentation tool for the testing and evaluation of proposed new systems. The software provides an experimental environment within which dangerous and expensive weapons systems can be tested without their usually associated costs and risks. The ‘Multiple Launch Rocket System (MLRS) cannot be used during live training due to its tremendous

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750 Cruz-Cunha (2012).
751 Mouat (2015e).
In computer GUIs drag and drop is a pointing device gesture where the user selects a virtual object by ‘grabbing’ it with the mouse cursor and dragging it to a different location or onto another virtual object.
752 Mouat (2015e).
destructive power and therefore can only be represented virtually. One cannot fire salvoes of rockets and blow up several square kilometres of British countryside, even if it is a military training area’. Additionally, running a simulation of a system which allows soldiers to remotely operate the machine guns guarding compounds in Afghanistan involves significantly less risk than trialling the system in the real world. Actually testing such a system would also be ‘colossally expensive’, but it can be relatively easily modelled in VBS. Major Mouat uses an a fortiori argument to argue that the results observed in the simulation can provide a useful indication of whether a concept should be given further consideration; ‘You accept that the simulation is an imperfect model of reality, but because I know how imperfect a model it is it can still be valuable – all simulations are wrong, but some are useful. Just because it doesn't have 100% fidelity, doesn't mean it isn’t valuable’. If, due to reduced fidelity, undertaking a task in a simulation is easier than undertaking it in real life and you still cannot achieve the desired outcome, then there is no reason to undertake the task in the real world. This kind of experimentation allows concepts to be evaluated before progressing to the next stage of development.

Limitations Inherent to Game-Based Training

Prior to critiquing how the British Army employ VBS, some issues need to be discussed which relate to the inherent limitations of virtual environments as training tools. Certain issues arise when using virtual environments as training tools in the context of an armed force which have not been relevant to the commercial gaming sphere. Of particular pertinence to this study are problems of ‘buy-in’, and the small percentage of trainees who are unable to learn from simulated environments. ‘Buy-in’ is defined by academics as ‘…the degree to which a person recognizes that an experience or event is useful for training. The conjecture is that higher levels of buy-in imply that the user will invest more effort to extract generalizable lessons from training, and more effort to transfer those lessons to the real world. Transfer is

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754 Mouat (2015e).
755 Ibid.
756 Ibid.
consequently more frequent and successful as a result’.\textsuperscript{757} It is important to note that the term ‘transfer’ encapsulates the concepts of training effectiveness and efficiency within the context of learning from virtual environments – it denotes the ability ‘to flexibly apply (parts of) what has been learned to new tasks and/or new situations… as well as in terms of preparation for future learning’.\textsuperscript{758} The ability of virtual environments such as VBS to transfer knowledge and deliver effective training can suffer greatly if participants do not fully buy-in.

Buy-in is a cause of significant concern, as it can engender unwillingness to engage with VBS, together with scepticism of its capabilities amongst both instructors and trainees. More than half the units in the British Army with access to the Op JCOVE convoy trainer only sent their driver, and sending a single individual is largely pointless; those who actually benefited from the training sent the entire team.\textsuperscript{759} Proctor and Lucario argue that acceptance of virtual environments can be problematic, as ‘…expectations of social cultural groups represented by the junior officers we examined may infer a potential reticence on the part of that group toward applying game-based human performance technology to serious training’.\textsuperscript{760} Such reticence is more commonly evidenced amongst the older members of the armed forces rather than younger ‘digital natives’, ‘…senior leaders simply did not understand the potential of the new technology… [younger soldiers] were naturally inclined to use games as a training tool because they had grown up playing such games’.\textsuperscript{761} However, since their research was published in 2008, the success of game-based training has begun to erode such reticence. Neville MacMillan, Business Development Manager at NSC, states that as more soldiers have had positive experiences with Op JCOVE participation rates have steadily increased.\textsuperscript{762}

Buy-in also has a second connotation related to fidelity and perceived realism. ‘Digital natives’ who have grown up playing commercial video games require a certain level of graphical fidelity in order for them to take a virtual environment...

\textsuperscript{757} Alexander \textit{et al} (2005), p.8.
\textsuperscript{759} Mouat (2015d).
\textsuperscript{760} Proctor \textit{et al} (2008), p.194.
\textsuperscript{761} Smith (2009a), p.347.
\textsuperscript{762} MacMillan (2016).
seriously. If from the visual perspective a game looks significantly worse than its commercial counterparts – which soldiers are likely to have played prior to joining the armed forces – they will not buy in, and overall engagement could suffer as a result. Thus, poor fidelity “…may decrease motivation, attention to details, and subsequent transfer of learning.”

This issue did not arise in previous discussions of purely commercial products, as buy-in is essentially implied when players purchase a video game. Players simply would not invest time and effort into such a hobby without it. It can essentially be considered a prerequisite to their participation.

The high levels of visual fidelity coveted by gamers are generally beyond the capability of most military facilities. VBS is frequently required to work on outdated or portable PC systems which cannot handle the most up-to-date graphics, and a visual upgrade for the game would prevent them from being used, stopping the force from actually delivering VBS training. However, one Dutch study found that whilst trainees sometimes criticised the fidelity of VBS ‘the limited fidelity of games currently used in the RNLA [Royal Netherlands Army] schools appears to have no significant effect on the learning outcomes… when aiming at tactics, relatively low fidelity still yields good learning results’. The main requirement of VBS is therefore to provide the minimum level of graphical fidelity to achieve buy-in and display necessary visual cues, whilst simultaneously functioning on the widest variety of PC systems; this is known as ‘functional fidelity’.

Major Mouat also identifies an issue which has thus far not been addressed by academics – the small percentage of soldiers who do not benefit from simulated training. The evidence to support his claims is entirely anecdotal and is based on his professional experience in this field. He claims that there are a proportion of people – which in his estimation could be as high as ten percent – who cannot be trained via simulation; they appear to be perfectly capable of using a computer, but simply receive no training benefit from using a virtual environment. MacMillan, who has helped run many JCOVE training scenarios, disagrees with this assessment. He states that in his experience problems using simulated environments come primarily from the small numbers of soldiers – probably less than 5% – who simply lack basic competency using computer systems, and therefore find it difficult to get

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766 Ibid.
768 Ibid.
Given that this evidence is almost entirely anecdotal it will not impact heavily upon the conclusions that will be drawn in this thesis. This is however an area which demands further examination by the simulation community, as such claims should be taken into account in any study which examines the effectiveness of virtual environment training. Even if these percentages are accurate, the presence of such a minority does not preclude the usage of training simulations; rather, it means that they should be carefully integrated into training routines so as not to disadvantage these trainees.

**Technical Assessment: The Functionalities of VBS**
Throughout their development, the VBS games have increasingly diverged from their ArmA counterparts. It will be argued that increased military usage has led to BISIM prioritising different aspects of gameplay, ultimately leading to significant differences in the functionalities between VBS and ArmA. The expanded suite of functionalities in VBS requested by military users has led to the series becoming the *de facto* choice amongst military establishments. These differing priorities demonstrate the difficulties in bridging the gap between the commercial and military markets, with the military product focusing on the inclusion of substantial additional functionalities rather than heightening visual appeal.

One of the fundamental problems when creating any simulation is the disconnect between actual combat dynamics and the developer’s understanding of combat. Whilst commercial game developers have employed SMEs in an attempt to convince consumers of their product’s realism, such a thin veneer of authenticity is unacceptable in the military sphere. Creating a realistic simulation without having any actual combat experience is an exceedingly difficult task, and Nicholas Edwards – a developer at BISIM – sees this as a significant issue and a problem which is yet to be satisfactorily solved. He argues that since very few people in BISIM have combat experience or an academic background [at the time of interview he was the only one with an academic background in War Studies amongst the 300 employees, and there were only two ex-military staff members] they have to rely on their own

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769 MacMillan (2016).
research alongside doctrinal pamphlets provided by the military.\footnote{Ibid.} Edwards argues that knowledge of combat through academic research or first-hand experience provides a greater understanding of the friction inherent to engagements in the real world; real combat is not precise, but ‘programmers like things that are quantifiable, and this is why games focus on these aspects’.\footnote{Ibid.} Even within BISIM ‘The notion of realism is still very much based on the technical. Anything else is purely based on the doctrine. How long should an assault take? It says on the doctrine it should take five minutes to cross this point; therefore, in the game, it takes five minutes’.\footnote{Ibid.} BISIM thus suffers from some of the same problems which were encountered by commercial companies and enthusiasts examined in the previous chapters. However, BISIM’s closer working relationship with military establishments helps to mitigate the impact of these problems, as they can directly respond to the demands of military users.\footnote{Ibid.}

Early British experiences with other games as part of the DIVE initiative highlighted that a fundamental requirement for any future system was the possibility ‘for the trainer himself to modify the scenario each time in order to get the greatest training benefit...’.\footnote{Cruz-Cunha (2012).} Due to these essential requirements the editing suite included in VBS is far more advanced than that in ArmA.\footnote{Edwards (2014).} The editor in ArmA was included as a bonus; gamers who knew what they were doing and were willing to put in time and effort could write their own scripts and manipulate the game’s functions, and therefore BIS made no real effort to make the game editor easy-to-use.\footnote{Ibid.} BISIM however worked under the assumption that military users may not have particularly strong IT skills, and were unlikely to be experienced gamers. Their need to create scenarios quickly and easily led an expanded suite of functionalities for both the Offline and Real-Time editors, which are demonstrated in the manuals for VBS 3 – available online at https://manuals.bisimulations.com/vbs3/latest/manuals/. The manuals provide concise guidance on a wide range of functionalities such as:
1) Placing objects within the game world and determining their behaviours (if they require AI control).778

2) Assigning any necessary waypoints, which ‘are used to both move AI units and also give human participants a visual indication of where they need to move in order to accomplish the mission’.779

3) Changing the overall settings of the scenario to control environmental effects such as the time of day and weather.780

4) Terrain modification – users can directly manipulate the layout of terrain on the battlefield.781

The Real-Time editor also allows instructors running the scenario to perform additional actions during play. These include manipulating the inventory of any entity, transmitting certain overlays of tactical markers to either side, reviving dead units, spectating the game through the perspective of any currently active avatar (AI or player controlled), and enabling the AAR to record data from events taking place.782 Real-time editing capability was only made available to ArmA players in 2014, and even then they were only provided with a cut down version containing functionalities military forces have been employing for years.783

These editing requirements provide a particularly good example of the differences between gamers and military users. Military forces need to constantly change and adapt scenarios so that soldiers do not become complacent due to being forewarned of events. Gamers on the other hand will repeat the same scenario to achieve a better outcome, or simply play a different one. They have no active imperative to repeat a particular scenario as their goal is to have fun rather than to impart a learning objective.

VBS also allows access to the SDK (Software Developer Kit). Eschewing technical details, the main advantage of this is to allow the software to integrate with other

778 BISIM (2015i); BISIM (2015k).
779 BISIM (2015h); BISIM (November 2011a).
780 BISIM (2015l).
781 BISIM (May 2012).
782 BISIM (2015j).
783 Bohemia Interactive (2016); Bohemia Interactive (2015b).
pieces of hardware and by extension different military training systems. For example, using the SDK VBS can be engineered to integrate a laser-based trainer with a rifle, as shown below.

![VBS laser-based rifle trainer](image)

This capability gives the software a versatility which is useful in a dynamic military environment, and allows innovation at low levels – which has been a hallmark of COTS software experimentation – to continue. Such functionality is not required in ArmA, as gamers generally do not possess the additional, and often bespoke, hardware which would be required. Whilst there are examples of inexpensive hardware additions, such as the TrackIR head tracking system, gaining some traction within the community, these do not require direct manipulation of the SDK by players and are integrated into the game by BIS themselves.

Maps within VBS 3 can be over 2,200km² and are generally modelled on high-fidelity satellite imagery taken from the real world which is recreated in specialist software packages such as TerraTools 5 and MaterialMAP, rather than being generated by instructors/end users. Trainers can employ the maps provided as the basis of their scenarios rather than attempting to undertake such an extensive task themselves. As an aside, the implementation of terrain on this scale also allows the game to potentially provide an environment suitable for simulating naval and aerial combat, but this aspect is beyond the scope of this research, and so will not be

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784 Curry et. al. (2015), p.18; Mouat (2015d).
785 Ibid.
786 Photos kindly provided by T. Mouat
787 Dslyecxi (April 2009).
788 BISIM (2014a); TerraSim (2016b); TerraSim (2016a).
considered in further detail.\textsuperscript{789} Maps of this size dwarf those available in ArmA, but their significance does not necessarily stem from their size; rather, the mapping of vast tracts of real-world environments allow instructors to instantly transport trainees to a wide variety of different environments which accurately represent potential conflict zones. This means that scenarios can be tailored to whatever environment soldiers are likely to find themselves operating in.

Instructors also require access to extensive libraries of premade content so that scenarios can feature a wide variety of personnel, weaponry, and vehicles, which can be employed by both friendly and enemy forces. The basic version of VBS 3 provides access to over 10,000 different models, which is significantly more than any ArmA game (users wanting additional content for ArmA are required to design and implement it from the ground up, using any 3D modelling software they have access to).\textsuperscript{790} Accurately modelling the behaviours of these models can however pose problems. Since VBS is distributed amongst many nations, the British Army does not allow the game to include any classified technical data.\textsuperscript{791} BSIM therefore estimates the capabilities of weapons and vehicles they are modelling via publically available data, on the dubious assumption that the military will fix any erroneous calculations.\textsuperscript{792}

Whilst blatantly unrealistic behaviours are likely to be fixed, there is little doubt that minor errors remain which lower the overall fidelity of the physics, as they will either not be noticed, or will not be worth investing the time and effort required to correct them. However, inaccuracies in the environment do not necessarily compromise training as long as functional fidelity is achieved and negative training is avoided.\textsuperscript{793} This is an important explanatory factor as to why the VBS series is more suitable for military usage than other commercial products – despite its imperfections the physics and modelling of the environment are still far more accurate than other commercial software. Additionally, VBS is capable of modelling a comprehensive range of physical elements which are standard within military

\textsuperscript{789} Arup (2015).
\textsuperscript{790} Mouat (2015d); Arup (2015).
\textsuperscript{791} Edwards (2014).
\textsuperscript{792} Ibid; Curry et. al. (2015) p.17.
\textsuperscript{793} Mouat (2015d).
systems, but are often faked in commercial games which ‘…give a workaround that looks like it is working’; these include real terrain correlation, real/varying coordinate systems, atmospherics, proper ballistics, windage, and fire control computers.\textsuperscript{794}

The AAR is also a highly significant function in regards to military usability. In real-world training, instructors can only view events from certain perspectives and most of the action is essentially unrecorded. The AAR however helps to collate ‘a wide range of data, from individual participant movements and actions through to collective measures of effectiveness’.\textsuperscript{795} Effective AAR tools generate both screenshots and movie files, providing the facility to ‘…replay training events in order to conduct analysis of what had actually happened from whatever viewpoint the trainer required. This is essential to learn lessons from training and greatly improves the quality of the training experience’.\textsuperscript{796}

\textit{Figure 53 - AAR Screenshot of a single soldier which shows the avatar’s current field of view.} \textsuperscript{797}

\textsuperscript{794} Arup (2015).
\textsuperscript{795} Discussed in detail in McKeown et al (2012) and BISIM (2012).
\textsuperscript{796} BISIM (2015f).
\textsuperscript{797} Curry \textit{et. al.} (2015), p.18; Cruz-Cunha (2012).
Figure 54 - Lines can also be enabled which show the exact paths of movement taken by avatars during an engagement; blue lines represent friendly forces, red lines, enemies. 798

Figure 55 - Statistics allow the trainer to see casualty rates, the time of an engagement, how many rounds were fired, who was killed on each side etc. 799

798 BISIM (November 2011b).
799 BISIM (2016a).
VBS provides instructors with the capability to review scenarios in far greater detail than they could in the real world, which can ‘be used to augment normal classroom instruction and bring out specific training lessons…’. The many functionalities included within VBS for accomplishing this greatly increases the software’s utility within an infantry training context, and this is a crucial point given that effective AARs are essential to both learning lessons and improving the overall quality of the training experience.

The dynamic relationship between BISIM and their military clients allows for a continuous process of adding and changing minor features of the game engine. For example, safety switches were included on all weapons; this is a feature other commercial developers did not feel the need to include, as there is no demand for it from gamers. More recently, the ability to import real-world biometric data into the game was requested by the US Army. This enables avatar attributes – such as appearance, fitness and weapon skills – to directly reflect those of each individual soldier they are meant to represent. ‘People should be more engaged in the game itself if the avatar has their face imported’ and the inclusion of this data ‘…gets you over the virtual world problem of everybody being a superhuman, everybody running at exactly the same speed, can carry the same amount of gear etc… a larger person who can’t run as fast and gets tired more quickly is like that in the game, but the upside is that he can carry more stuff’.

The British Approach: A Critique
This section will argue that current usage of VBS in the British Army suffers from significant deficiencies, both fundamentally and in comparison to other Western forces. Whilst the game does have inherent strengths and weaknesses as a training and education tool, the people and processes governing its practical employment are causing it to be used suboptimally. The regular rotation of soldiers to different posts poses a significant impediment to establishing a solid understanding and coherent methodologies, and as with any tool efficacy is reduced if instructors do not have an

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800 Cruz-Cunha (2012).
801 Ibid.
803 Read (2015); BISIM (2014b).
adequate understanding of how to use it to its full potential. The methods used to employ VBS in other forces around the world also demonstrate that it has further potential which the British Army has yet to exploit.

It is important to recognise that overall VBS only sees a small amount of use amongst most units in the British Army. In a six month course at the REME School officers may only use it five or six times.⁸⁰⁴ Whilst Op JCOVE delivered 1,475 days of training, when this is broken down into individual units (regiments or battalions) only 12 spent six or more weeks using VBS as part of their training; this indicates a significant variation in the acceptance of simulation amongst different units, but even in the most optimistic of cases contact time with the software is still limited.⁸⁰⁵ As a managed service run by NSC Op JCOVE incurs additional costs, and there is evidence to suggest that British Army financial constraints prevent requested training events from taking place.⁸⁰⁶ MacMillan states that whilst 30 units requested Op JCOVE training events – totalling approximately 60 weeks of training time – the Army was only willing to pay for around 20 weeks of training, roughly 1/3 of that which was requested.⁸⁰⁷ This is highly significant; whilst managed services do provide expertise which increases the efficacy of training events, the increased costs associated with this partially negates one of the fundamental advantages of using VBS in the first place.

Alex Gwilliam, a Senior System Engineer for NSC, argues that training is most productive when the OC runs the event and NSC personnel facilitate by handling the practical side.⁸⁰⁸ Gwilliam served in the British Army, and so has direct combat experience, but he also ran an ultra-realistic Armed Assault clan for many years before being trained by NSC in using VBS.⁸⁰⁹ His expertise means he is one of a very small number of individuals who possess an in-depth understanding of both virtual environments and infantry combat. His presence at NSC demonstrates the advantages that a contractor based system can provide. The company specifically

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⁸⁰⁴ Mouat (2015e).
⁸⁰⁵ Mouat (2015c).
⁸⁰⁷ Ibid.
⁸⁰⁸ Gwilliam (2016).
⁸⁰⁹ Ibid.
targets individuals who have both military and computing experience, so that they can maintain a wide range of relevant in-house expertise.

NSC personnel have an intimate understanding of VBS, and utilise a modified version of the software with changes made in consideration of British Army training needs. The NSC team’s experience means they can create objects and scenarios on the fly. They also control the opposing forces. Enemy actions – such as shooting – are determined by the AI, but contractors use the real time editor to exert close control over their locations and behavioural traits, such as belligerency and how/where they will move. They also use their own scripts to fix minor problems with the AI, such as increasing bullet dispersion so that gunfire is less accurate. The dynamic interplay between the contractor’s technical expertise and the soldiers’ practical military expertise aims to harness the best of both worlds, removing the requirement of technical expertise from military personnel so they can concentrate on maintaining a high standard of training.

The VBS AI does however continue to display serious deficiencies. Edwards explains that the AI is:

‘...extremely simplistic in that it doesn’t care much about the terrain, it doesn’t move tactically (in a manner you would expect from a trained soldier, bounding etc.), it doesn’t take into account the Rules of Engagement (will know magically who is friendly and who is foe), it’s far too accurate... [and it does not] fire at proper military rates of fire... VBS AI just unloads in full automatic and uses all their ammo in minutes.

The reason why it’s so bad to begin with is simply because it’s the same AI that was used in Arma 1 and 2. This AI was made for a game for entertainment purposes and as such realistic AI

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810 Ibid.
811 Gwilliam (2016).
wouldn't likely be "fun". There hasn't actually been many improvements on this for VBS.¹¹²

Given that BISIM utilised almost exactly the same AI that was created for older games in the Armed Assault series, it is unsurprising that the deficiencies seen in the commercial case studies are still in evidence. Edwards goes on to state that:

*Nearly all improvements in VBS are not the product of our internal design decisions but are paid for by a customer... The question is then, why have none of our customers ever paid us to improve our AI? Firstly, it's not because they think it's good... Exercises in which users need to battle against or control groups of AI are actually very rare. Users do complain about AI then, but as it's not a common objective for exercises and doesn't stop them meeting their more common ones, no one has felt it worth their while to pay for it to be improved.*

AI is one of the hardest things to program within a simulation. In most linear FPS games AI isn't too difficult as they just need to work in a single, repeatable situation. However, with AI for something like VBS it needs to work in a huge number of situations that you cannot totally account for. There's simply too many variables even to make a Section Assault drill to look correct without many (expensive) weeks of work... It's possible to do at the tactical level but it takes a long time to create the decision trees, the 'if or then' loops which the AI use to decide between different options. Add to that the fact that the vast majority of our employees have no military or war studies background and it can get very complex to work out what is correct... People playing for entertainment aren't so picky, but the time taken to make it acceptable to a military user is immense. You're looking at millions of pounds to do even

¹¹² Edwards (2016).
something simple as you need a full team and many months or even years.\textsuperscript{813}

BISIM do have a good understanding of the AI’s current weaknesses, but the costs associated with fixing these issues are prohibitive, although current initiatives are being undertaken in order to improve the situation.\textsuperscript{814} Ultimately, until significant further resources are committed to AI development these problems are likely to persist. Using autonomously functioning AI soldiers will remain largely untenable in all but the most basic of capacities, as only humans can bring elements of hiding, visual location and inaccurate fire into the virtual environment.

Problems also arise from a lack of time spent using VBS. If training and education with the software was allocated more time it could be executed far more effectively, as soldiers would have an increased understanding of how to use it optimally. According to NSC, Op JCOVE scenarios allow for 45-90 minutes of familiarisation time if using the mouse and keyboard, and 20-30 minutes if using Xbox style controllers.\textsuperscript{815} During this time, soldiers familiarise themselves with the controls by playing on the system in a comparatively unstructured manner; they can shoot each other, act like Rambo, and are allowed to mess around on the system as if it were a commercial game.\textsuperscript{816} NSC moved towards using Xbox controllers recently, as they observed that recruits generally found console input devices more intuitive than PC controls – the mapping of keys onto these controllers was influenced by familiar commercial games, including the Call of Duty series.\textsuperscript{817}

\textsuperscript{813} Ibid.
\textsuperscript{814} BISIM (2016b).
\textsuperscript{815} MacMillan (2016).
\textsuperscript{816} Ibid.
\textsuperscript{817} Gwilliam (2016).
This does however mean that many of the actions in VBS are unavailable, as Xbox controllers have a small number of keys compared to a keyboard. NSC argues that this is irrelevant, as the vast majority of the time complex actions are not required; soldiers only need to know how to take basic actions such as running, walking, shooting etc.818

Whilst there may be some truth to this justification, the lack of familiarisation time is criticised by various commentators:

‘Introducing games based training, per se, does not automatically generate positive results and in cases where the instructor is unfamiliar with the system or is give inadequate time to prepare, the results can actually be worse than conventional didactic lectures...

They don’t spend enough time on it. In the USA they spend a full day on training to use the system, menus, key

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combinations, how to do things – climb over obstacles, up ladders, pass through doors, enter vehicles... etc. In the UK they spend a 40 minute period and expect to be able to show a section attack at the end of it...’.  

Soldiers are clearly not given enough time to master the majority of the VBS interface; 90 minutes is inadequate, especially for the small proportion of soldiers who have no previous experience of video games. Simplifying the interface with an Xbox controller does allow trainees to get a better grasp of the now more limited functions, but concurrently prevents them from utilising the software to its maximum potential.

NSC consider the simulation of dismounted urban operations to be exceedingly challenging, arguing that maintaining adequate situational awareness in such environments is highly problematic due to the system’s inherent hardware limitations.\(^{820}\) Overcoming such obstacles requires enhanced visual displays – such as wraparound screen(s) – or highly experienced players.\(^{821}\)

Given that this problem was not evidenced in ArmA 3, it is arguable that the primary reason dismounted urban environments pose a challenge is that soldiers are

\(^{819}\) Curry et. al. (2015), p.17; Mouat (2015e).
\(^{820}\) MacMillan (2016).
\(^{821}\) MacMillan (2016).
too inexperienced with using VBS. If soldiers are not familiar enough with the software and do not have enough time to use its key functions, then the quality of both training and education will be reduced and training objectives can be compromised. Furthermore, scenarios inevitably require simplification in order to minimise the possibility that participants will bungle exercises due to a lack of familiarity. Compounding this issue, soldiers who do not understand the system are also less likely to buy-in, leading to their in-game behaviours being less realistic and thus compromising training objectives. It is perhaps unsurprising that in this context some scepticism regarding the effectiveness of VBS persists.

Other forces have also developed their own training and education methods for employing VBS. The US Army and Marine Corps generate training videos of engagements by re-enacting them based on available evidence and the testimony of participants. The generation of such learning materials essentially constitutes an entirely new form of AAR. One of their first attempts to use VBS in this manner was a recreation of the Battle for Combat Outpost (COP) Keating, October 3rd 2009. The video was:

‘...edited to condense its length and show the various high and low points of the battle... [the intent] was to graphically illustrate how the battle unfolded and how it was conducted so that military leaders could better understand what had occurred, and why, and learn from it... TRADOC [United States Army Training and Doctrine Command] also intended to later release the created VBS 2 COP Keating scenario so that VBS 2 users across the U.S. military could relive the battle...

... AARs moved from the traditional paper only format to a dynamic three-dimensional game environments format that could be rapidly visualised and relived by anyone who wanted to do so... A commercial off the shelf game had been used to

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823 Mouat (2015e).
transfer real battlefield knowledge and experience from those that had actually experienced it to those who needed to know what had happened and why in order to avoid making the same mistakes’.

Major Mouat believes that ‘in the US Marine Corps they make full use of the AAR capability to brief back what the students did – so they execute a mission, then have a coffee break and the instructors get them back and run through (sometimes in excruciating detail) what happened and why. We rarely use the AAR capability in the UK, because the instructors don’t feel they have enough time to do it’.

Once again, a lack of time dedicated to using VBS means that it is not being used at its maximum potential; evidence from other forces suggests that a higher quality of training can be achieved when the software is used more effectively.

NSC contractors state that replaying missions uses a lot of system resources and is a slow process, and this functionality is therefore rarely used. MacMillan argues that the detailed statistics provided by the AAR are largely irrelevant and do not in themselves teach soldiers anything useful – learning is primarily accomplished through the military instructor leading the training, who will pause the mission (temporarily halting the actions of the program) and instruct soldiers by flying the camera around and analysing the current situation. Although there is some truth to this assertion, as instructor led analysis is highly valuable, the fact remains that the PCs systems provided by NSC are a primary reason for not employing VBS’s additional functionalities – laptops lack the necessary hardware to run AARs properly. This is entirely not NSCs fault. Their systems are required to be portable, and high-end laptop computers are extremely expensive, and this necessarily leads to hardware limitations. It is however reasonable to suggest that if the full suite of AAR functionalities were available they would provide some additional training utility.

PC hardware limitations also impact upon the terrain. Whilst in an ideal world the terrain available would be both large-scale and highly detailed – reaching the

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825 Ibid, pp. 103-104.
826 Mouat (2015b).
828 Ibid.
maximum potential of VBS – the financial and logistical considerations of the British Army necessitate compromises. Laptops cannot handle the complexity of VBS at high settings, and so Op JCOVE terrain is generally displayed in low detail.\textsuperscript{829} Indeed, until 2013 all British Army training events were run on one single terrain, as the facilitating NSC personnel were intimately familiar with it.\textsuperscript{830} Gwilliam argues that whilst large-scale detailed terrain would be beneficial, it is not necessary in order to run effective training events; functional fidelity can be achieved with relatively low detailed environments given the training objectives.\textsuperscript{831} Furthermore, the most requested terrain by units using the software was Salisbury Plain Training Area – soldiers wanted the virtual environment to simulate the physical training they would be undertaking later in their training cycle.\textsuperscript{832} Responding to this demand, NSC created their own version of Salisbury Plain, which was smaller but considerably more detailed.\textsuperscript{833} This meant that different versions could be used depending on which was most appropriate for the current training objective.

Outside of Op JCOVE – and setups in a few specific locations such as the VBS suite in Catterick, which was gifted to the Royal Dragoon Guards – there are no dedicated VBS suites in the British Army.\textsuperscript{834} Given such minimal access to PC suites which can play VBS it is understandable that British soldiers have limited exposure to the software. Although VBS is available to any soldier who requests a copy, in practice the difficulty of finding a PC setup which meets the prerequisite hardware specifications to run the game often precludes its usage. To alleviate this problem, soldiers often appropriate PC systems which were procured for use with completely different training initiatives. For example, the Battlegroup Command and Control Trainer (BC2T) was originally purchased in 2003 to train lower echelon commanders and staff in battle planning and execution.\textsuperscript{835} Due to its complexity and protracted set-up times the system saw relatively little use, but it was installed in

\textsuperscript{829} Gwilliam (2016).
\textsuperscript{830} MacMillan (2016).
\textsuperscript{831} Gwilliam (2016).
\textsuperscript{832} MacMillan (2016).
\textsuperscript{833} \textit{Ibid}.
\textsuperscript{834} \textit{Ibid}.
\textsuperscript{835} Lockheed Martin (2016).
over 50 locations across the UK. A number of keen officers recognised that the BC2T PCs would also be suitable for running VBS, and decided to repurpose the systems on their own initiative. Such officers have been known to spend the duration of their posting building and refining a VBS training system which can be used with the minimum of instruction, and this affords them the opportunity to execute comparatively advanced training methodologies. However, these officers will often spend a year learning how to use the software, a year developing it, and then leave their posts, since the British Army regularly rotates officers to different locations. When they were gifted a set of VBS computers the Royal Dragoon Guards sent three soldiers on a course to learn how to use the software; however, all three soldiers were moved to different positions and now the unit lacks the expertise to use VBS properly. The benefits of individual soldier’s experiences and expertise are lost in the vast majority of cases, as initiatives spearheaded by such individuals are not officially part of the training regime. Therefore, most units do not have easy access to the PCs required to run VBS, and even those with access frequently lack officers with solid experience of practically employing the software.

Although ostensibly the ease of access issue can be solved by acquiring more PC suites, Major Mouat states that the MoD procurement system makes this a very troublesome proposition. In summary, he contends that to justify the purchase of any training system with taxpayer money, the MoD requires it to meet a specific training need. Unfortunately, VBS provides a toolbox, and as such is designed to be used in many ways and meet a multitude of training needs as a supplement to existing methods. From a procurement perspective this is highly problematic, as justifying VBS as the most effective tool for each separate element of training is impossible. ‘For each individual bit of training people can ask, could this be done more effectively? The answer is often yes if they have a bespoke expensive system to do it, which they will actually never get. Piggybacking on VBS gives a 70%”

836 General Dynamics (2016); Mouat (2015e).
837 Mouat (2015e).
839 Ibid.
841 Mouat (2015e).
842 Mouat (2015e).
solution’. VBS is thus seen as unnecessary in the context of perfect training methods, even though these do not actually exist. MoD procurement is simply not intended to countenance generic systems which provide partial solutions, and it is therefore extremely difficult to obtain the prerequisite funding needed for the construction of further VBS suites.

One of VBS’s greatest strengths is that it allows for training and education to be delivered in a dynamic environment. Developing a knowledge bank of TTPs learned through training is undoubtedly important, but VBS allows instructors to undertake scenarios which require soldiers to make educated decisions relating to which tactics are appropriate in a particular situation, and then evaluate and justify these decisions during AARs. Finkel argues that the aim of exercises should be to learn, not to win, and that ‘In order to learn, the trainee has to fail, be surprised, be challenged mentally… For achieving that, all measures are employed, including guiding subordinates to fail through their unit’s difficulties to perform’.

This is an area of significant weakness in current British Army training. Currently soldiers rarely engage in training against adaptive enemies. The idea of participating in a scenario where trainees are defeated by the enemy force is not an approach which the army embraces. This inherently limits the utility of VBS training, as it dilutes one of the software’s greatest strengths, the ability to actually battle against a competent opposing force without any physical danger to either side.

The British use of VBS can be contrasted with the RNLA. The Dutch forces believed that formal classroom teaching of tactical theory was insufficient to acquire competent professionals capable of dealing with changing and unpredictable battlefield scenarios. They embraced VBS, understanding that it could allow them to present students with a series of tactically challenging situations which could only be solved through thorough analysis, planning, and repeated execution against an active opposition. The software allowed instructors to take a crawl/walk/run

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843 Ibid.
844 Finkel (2015).
846 Mouat (2015e).
848 Ibid.
approach by tailoring the competency of the enemy to suit training needs. Trainees were pitted against an actively resisting enemy force played by instructors or other trainees, and scenarios were designed to ‘elicit tactical mistakes to trigger discussion among the students, allowing them to understand the practical applications of a specific tactic’. Members of the squad would then reflect upon their experiences before an expert would present his view on their performance and reflections. VBS was employed to engage trainees in active learning, whereas previous instruction was oriented largely towards conveying theory by a long series of potentially tedious PowerPoint slides. Initially the courses were designed for officers; however, it was found that this approach also benefited NCOs and junior soldiers acting as squad commanders.

The Dutch employed VBS to train cognitive decision making skills; their scenarios were designed so that each ‘new scenario should make students think about local circumstances, terrain, and the presence of the enemy. The student should never apply standard tactics without thoroughly thinking through all relevant factors and threats that each unique scenario can present’. With little theory given to them, trainees were forced to think and be active in terms of solving the problems presented to them, which eventually imbued them with a deeper understanding of the rationales behind the concepts they were meant to be learning. Soldiers pitted against actively resisting opposition are required to make complex decisions rather than simply practising doctrinal principles. VBS is ideally suited to such a learning approach, and the Dutch forces have arguably achieved higher quality training with the software in comparison to their British counterparts.

851 Ibid.
852 Ibid., pp.5-6.
853 Ibid., p.9.
854 Ibid., p.7.
855 Ibid., p.10.
Combat Model Comparisons

The Physical Component
Whilst VBS does have a variety of advancements and additional functionalities in comparison to ArmA, there are no fundamental changes between how the two environments represent the physical nature of the virtual battlefield. Therefore, conclusions relating to the physical component drawn in the ArmA chapter remain largely valid. Whilst there may be slight differences in terms of the fidelity of the physics, factors such as weapons lethality, the usage of body armour, fatigue etc., are handled similarly in both games. Although VBS has more models and can simulate larger environments based on real-world topographical data, both pieces of software can generate an environment suitable for simulating platoon-level engagements.

There are however some differences in the physical environments which have the potential to more significantly impact on outcomes. Lower levels of graphical fidelity do have the potential to reduce the effectiveness of concealment. In a lower fidelity environment there are generally fewer objects present in order to reduce stress on the computer’s processor, and those which are present are rendered in less detail, leading to them sometimes being displayed with jagged edges and unnatural outlines. As a consequence, differentiating between targets and surrounding objects can be an easier process on the computer monitor than in the real world. However, in practice there is no evidence to suggest that problems employing concealment in VBS scenarios have significantly increased casualty rates during training missions, as this issue would certainly have been raised at some point in the various studies previously examined. Therefore, even though this may be an issue it must be assumed that functional graphical fidelity level is largely achieved.

The simulation of wounds on the battlefield is an area in which VBS has more advanced functionality than ArmA. Soldiers can be the victims of wounds as severe as amputation. Wounds require treatment, and will furnish significant penalties on the avatar in terms of weapon accuracy, an inability to run, and blurry vision in the case of head wounds.\textsuperscript{856} The main difference between the two games is the

\textsuperscript{856} BISIM (2015g); BISIM (2015q).
approach taken by players towards these casualties. ArmA players are somewhat blasé towards friendly casualties, as this is not an aspect of combat they are particularly aiming to engage with – spending long periods of time dealing with the wounded would detract from their primary goal, simulating engagements against enemy forces. In a military environment however, it is mandatory that soldiers take equivalent actions to deal with wounded comrades in the game as they would in real life, and the additional capabilities of VBS help to facilitate this. Injuries thus increase the overall length of engagements, as reduced movement capacity and the practicalities of dealing with injured soldiers give players important responsibilities beyond completing the primary mission objectives.

It is important to recognise that intentionally reducing physical realism is considered to be acceptable if doing so will help to achieve training goals. VBS contains functionalities such as situational awareness cues, which are visual UI cues that help players determine who controls which avatar as well as the direction of incoming enemy fire.857

![Image](image.png)

*Figure 58 - The red arrow is highlighting a situational awareness cue.*858

These cues serve the same purpose in VBS as they do in commercial games; they mitigate the lack of situational awareness in virtual environments brought about by

858 BISIM (2015r).
the limitations of the monitor/speakers hardware setup. In Op JCOVE training events, NSC made sure when aiming towards a friendly soldier callsigns would float above the heads of each avatar to aid recognition – this is similar to the approach taken in *Battlefield 3*.\(^{859}\) Their inclusion in VBS demonstrates that instructors are still required to take a pragmatic approach towards realism – certain compromises need to be made in light of the limitations of the simulated environment, as these would otherwise negatively impact on the overall outcomes of engagements by preventing soldiers from performing at their maximum level of competency. Major Mouat also argues that ‘when you are using the simulation it is sometimes worthwhile to exaggerate bad behaviour. So, if I shoot a friend or I narrowly miss a friend by accident it is sometimes worth having a large red arrow coming out of the sky and making a scene to alert the soldier that they have screwed up.’\(^{860}\) The need to take such actions in order to train further reduces the utility of AI, as programming such nuances into their behaviours would be highly problematic. These intentional falsities also demonstrate that functional fidelity does not just imply the meeting of a minimum standard; it is the targeting of fidelity to result in the most effective training.

This practical approach to functional fidelity is also evident in terms of command and control in the military setting. Soldiers in most of the academic studies in the first section of this chapter did not actually make use of radio nets, but simply played the game in the same room and talked to each other. Such a setup does not allow for multiple different channels of communication, as was seen in ArmA clan play, and one study even commented on the fact that opposing forces could potentially overhear each other’s communication as the two groups were playing in the same room separated only by thin screens (the instructors playing enemy forces were ordered to disregard information gleaned in this manner).\(^{861}\) The reasons for undertaking training this way are twofold. Firstly, the arrangement of most computing facilities means that soldiers are required to play in close proximity to each other; they are not playing in separate locations over the internet. Secondly, command and control is not a significant explanatory factor, and so this element of

\(^{859}\) MacMillan (2016).
\(^{860}\) Mouat (2015d).
combat does not require as high a level of fidelity in order to achieve training goals. As long as soldiers can communicate with each other effectively how they achieve this is largely irrelevant, and should not impact on the training outcomes.

The Moral Component
The majority of conclusions drawn in the ArmA chapter also remain valid when assessing the moral component of VBS. As with all the other games which have so far been examined, recreating the psychology of combat remains an elusive goal. A developer of VBS2 and long-time ArmA player reiterates this point, ‘qualitative elements such as morale cause significant problems. The fear is the element that cannot be captured. People’s motivations and fears are completely different in the combat environment as opposed to sitting in a lab moving a computer mouse around’.862

As with all other games, engagement on the physiological level is essentially non-existent. In some instances instructors have attempted to remedy this by taking soldiers on a cross-country run, and then immediately sitting down to play the game in full combat gear in order to provide some level of physical exhaustion, but this is a pale imitation of the true stresses of combat.863

As has been evidenced through this chapter, the issue of buy-in – which is fundamentally a psychological problem – has serious implications in relation to group cohesion, an element of combat which will only be present in virtual environments if soldiers are taking their training seriously. In the case of units who only sent one or two members of their platoon to undertake VBS training, any level of cohesion is impossible. Two prerequisites are required to demonstrate cohesion amongst soldiers in a virtual environment. Firstly, they must consider themselves obligated to demonstrate the same level of professional competency in this form of training as they would in any other, or on the battlefield itself. Secondly, they must have achieved a certain level of proficiency in regards to using the software itself – cohesion has been demonstrably undermined in circumstances where soldiers were

863 Ibid.
not given enough time to practise using the software prior to assessment.\footnote{Whitney\textit{et al} (2013), p.24.} In such cases, soldiers can struggle to cohesively execute drills and tactics because they lack competence using the virtual environment, rather than due to problems with their understanding of how to execute the tactics themselves. Since cohesion is one of the most important moral factors in the combat model instructors need to be aware of and mitigate these issues by dedicating proper time to acclimatisation, whilst also understanding that situational awareness in the virtual environment will never match that of the real world due to the inherent limitations of the hardware. Ultimately, scenarios undertaken in VBS are unlikely to display the extremely high levels of cohesion demonstrated in real-world training/engagements, but what is achieved should be sufficient to reasonably replicate the observed outcomes.

In terms of ROE, VBS does offer increased functionalities for interacting with civilians on the battlefield. Avatars can communicate with civilians via Arabic gestures, and non-lethal munitions are available to incapacitate them should the need arise.\footnote{BISIM (2015m); BISIM (2015n); BISIM (2015o).} However, due to the frequently unrealistic responses of the AI to in-game events, civilians need to be controlled manually by players if their actions are to accomplish anything useful. They are therefore included in military training scenarios only if their presence is specifically called for to achieve the training goal.\footnote{Mouat (2015d).} It could be argued that creating situations involving an insurgent hiding amongst civilians would be a valuable and realistic training scenario, and whilst this could not be undertaken with AI, it should, in theory, be relatively easy to accomplish with people controlling the civilians. However, since directing staff would be required to play any civilians in order to assure their behaviour was appropriate, such scenarios are not carried out. This ultimately leads to most simulated engagements taking place in urban areas which contain no civilians, and it is arguable that this completely changes their nature; a significant civilian presence, and the ROE restrictions this imposes, is a fundamental characteristic of combat in these areas which should not be overlooked. Since most low-level infantry combat training scenarios focussing on tactical understanding do not strictly require a civilian presence, they are one of the first things to be dropped, and are thus largely
absent from simulated training in the British Army.

The conclusions that can be drawn in relation to the other moral factors – suppression, and surprise and shock – are essentially identical to those drawn in the ArmA chapter; without fear, the impact of these factors is highly limited. Major Mouat argues that including the same suppression mechanics as civilian games – which blur the screen and reduce the capacity of the avatar to move or shoot accurately – could be beneficial in the military context, but that there would be a potential trade-off in terms of buy-in.\textsuperscript{867} Since this effect only recreates some of the resultant outcomes of fear rather than actually providing fear itself, it could be seen as an unrealistic artificiality. Player acceptance of such artificiality would likely vary on a person by person basis, and young soldiers immersed in a macho military culture would like to believe they would be immune to the effects of suppression. Indeed, it is possible the military would wish to encourage this self-belief and confidence, even if it is not warranted in most cases. As with gamers, military users ‘…will see that this effect is not how a combat environment actually is, or how combat environment actually feels. They are thus likely to disengage if these effects are put in front of them’.\textsuperscript{868} Buy-in thus explains why military establishments have not widely employed this functionality, even though it is included in VBS.

The Conceptual Component
The ability of soldiers to execute doctrine and tactics effectively can be compromised by a variety of factors, most of which have already been touched on in this chapter, so only a brief summary will be necessary at this point. A lack of competence at operating computer hardware and controlling their avatar may impact upon performance; essentially, soldiers need training in VBS before it can be effectively utilised as a training tool. In addition to this, for VBS training to be effective both instructors and trainees need to fully engage to make the experience worthwhile.

The need to achieve specific learning objectives in training sessions means that the British Army does not actually aim to recreate combat outcomes as observed in

\textsuperscript{867} Ibid.
\textsuperscript{868} Edwards (2014).
contemporary engagements. This is hugely significant from a conceptual standpoint. The only elements required to be present in a particular scenario are those which are necessary to reach the training objective; whilst teaching a specific lesson *may* require a large-scale environment with many objects present, an encounter in a small environment involving just a few soldiers and potentially even entirely devoid of enemy troops may be equally as viable.

The mindset of military users is completely different from civilians. To the armed forces, properly demonstrating the execution of well-established doctrine and tactics is far more important than accurately replicating the observed outcomes of contemporary engagements. Indeed, British Army training appears to be far more focused on the accurate representation of doctrine than having soldiers actually fight each other dynamically, which could require them to come up with creative ways to defeat the enemy. Doctrine and tactics is still a hugely significant factor, but for completely different reasons than were demonstrated in the combat model. In real-world engagements – or even those undertaken in other virtual environment by serious gamers – doctrine and tactics are a means to an end in order to increase the fighting power of a unit; however, during military training they are the end itself. The outcomes of the scenario are still fundamentally decided by the doctrine and tactics employed, but this does not necessarily lead to the same outcomes as those observed in the combat model.

In real-world engagements enemy forces have shown themselves to be highly motivated, and despite a clear lack of competency in certain areas they have been capable of providing Western infantry with significant challenges. The British military generally does not even attempt to simulate proficient enemy forces or the challenges they present, as competent enemies are often considered to be superfluous in the context of helping inexperienced officers to develop their doctrinal understanding. Although various studies – and even currently serving members of the British Army – argue that this approach is flawed, it nevertheless accurately reflects training regimes as they currently stand. Paradoxically however this approach does mean that the outcomes of VBS engagements (in terms of casualties) are closer to those of the combat model than those observed in ArmA 3, where
casualty rates to friendly forces were increased in clan battles due to both sides being relatively competent. The combat model observed that enemies in recent engagements are highly unlikely to provide accurate fire on the battlefield, and although the inaccurate fire witnessed from opposing forces in VBS is purposeful rather than due to incompetence, the end result is still similar. Training engagements in VBS are thus more likely to produce the extremely one sided outcomes seen in contemporary engagements in comparison to the previous case studies.

From the conceptual standpoint the realism and outcomes of scenarios in VBS are linked to a significantly different set of factors than those encountered in previous chapters. Serious gamers spend a large amount of time interacting with virtual environments, grappling with their understanding of military doctrine and tactics and then perfecting their execution. Military forces on the other hand have to deal with buy-in, and problems relating to the effective utilisation of the environment itself given their time constraints. This explains why gamers in some instances employ ArmA in a manner that is more realistic than the military. They have the will and the time to run exercises over extended periods of time, and they face an active and competent opposition. The realism of VBS scenarios is predicated upon how VBS is employed by users, which in turn is determined by training goals. Given that these two groups have entirely different motivations and are trying to solve two entirely different problems, it is not surprising that their approaches and outcomes differ substantially.

**Duration**
The overall duration of engagements in VBS scenarios the British Army runs is almost entirely determined by two factors which are outside the remit of the combat model – the amount of time soldiers are actually given to use the software, and the requirement to maximise training efficiency. The combat model provided an assessment of the factors which are relevant within the environment, but the duration of military simulations is almost entirely a product of external factors.

The lack of time given to VBS usage has already been examined throughout this chapter. Dedicating time to slavishly recreating minute elements of the combat
experience – seemingly one of the passions of serious gamers – serves no purpose in a training context, as elements such as fieldcraft, drills, and basic procedures are trained via traditional methods. Given the myriad demands on their time soldiers need to be trained as efficiently as possible. Every component of a scenario is included on the basis that it contributes directly towards reaching the training goal, and any other additions are extraneous. Instructors want to accomplish their goals as quickly as possible so that trainees can progress to the next phase of training.869

The factors examined in the combat model are pertinent to explaining the observed outcomes of actual engagements, but simulation of engagements in their entirety is not even attempted during army training. This means that military scenarios are considerably shorter than both those observed in the real world and those run by ArmA clans who attempt to provide a broader representation of the battlefield in its entirety, and are willing to spend time recreating realistic procedural actions such as scouting and manoeuvring cautiously across the battlefield. The military on the other hand generally have only a few hours to run through a scenario and then undertake an AAR.

**Conclusions**

This chapter has demonstrated conspicuous deficiencies in British Army training methodologies. Whilst there are limitations inherent to the simulation software itself, at the present time these are not the most significant impediment to effective training. The state of the literature reveals that neither academics nor armed forces have managed to reach a consensus as to how to utilise VBS in a manner which maximises its potential. British Army doctrine in relation to VBS usage is currently disjointed, and valuable experience and understanding is going to waste when officers rotate to different positions. British methodologies could be improved by replicating the successes of other forces. The US and Dutch militaries have both employed VBS for training and education, and there is much that could be learnt from their experiences. In particular, the Dutch JOT approach appears to be a compelling template for success in terms of significantly developing soldier’s cognitive skills.

The amount of time armed forces can devote to VBS usage is always going to be limited due to the many pressing commitments of infantry training regimes, and this compounds the importance of using VBS properly. Given the results of the various academic studies and the experience of the British Army it is feasible to suggest a correlation between the quantity of time invested in VBS training and the usefulness of output which roughly follows a gompertz curve, as shown in Fig.59.870

![Figure 59 - Correlation between time spent training and training efficacy](image)

Studies involving soldiers who spend very little time using the software are plagued with issues stemming for a lack of familiarity with its usage, and are plotted in green. Very little training benefit can be reliably demonstrated in these circumstances.

870 A gompertz curve is a sigmoid function where growth is slowest at the start and end of a time period.
Current British Army usage – plotted in black – shows that initiatives such as JCOVE which involve a moderate amount of time investment and are run by experienced contractors have increased efficacy. However, the sweet spot – shown in red – shows the optimal cost/benefit balance in relation to time and training value. Whilst above a certain level there are likely to be diminishing returns, the British Army is currently not spending the time on VBS to reach the optimum level. This is compounded by the aforementioned general lack of expertise in training methodologies, meaning that even the time they do spend is not as productive as it should be.

The following policy recommendations are put forward to provide guidelines for future British Army employment of VBS based on this research, in order that they may increase training benefit from using the software. The practical implications of implementing these suggestions will not be examined, as these go beyond the remit of this thesis; however, such an assessment would also be an appropriate topic for future research.

VBS has shown itself to be a worthwhile tool which can be used in a wide variety of training applications. In order to employ it to its full potential the British Army needs to maintain some degree of in-house expertise and develop a structured methodology which can be applied to VBS training. Previous individual initiatives have shown promise, but lack of official endorsement in conjunction with soldiers being posted to different positions inevitably prevented them from gaining any real traction. Given budgetary constraints upper bounds are placed on what third party contractors can accomplish, and these limitations could be to some extent overcome with a consistent internal effort to promote proper VBS usage. Whilst developing such expertise would likely have substantial upfront costs it would provide the British Army with training capabilities beyond those currently evidenced, and as knowledge of how to use the system would be passed on to new recruits rather than being lost, the initial costs would be recouped over the long term.

As a prerequisite to increasing expertise as well as encouraging widespread adoption, soldiers need greater access to VBS suites. This is a problematic proposition, as
significant logistical obstacles will need to be overcome in order to make this a reality. The current trend of mobile VBS suites operated by contractors has fundamental flaws in its implementation. Contractors should occupy more of a supporting role primarily providing technical rather than practical expertise. The Army is unlikely to invest heavily into building large numbers of VBS suits, or developing the technical computer programming skillsets required to modify the software and generate complex terrains and scenarios – contractors will therefore remain relevant in terms of providing an up-to-date mobile hardware solution. However, there needs to be the facility within the military to understand these systems, and to have sufficient continuity in order to operate them. Currently, only contractors provide this continuity, as they can make sure the same employees are on hand to run different events. Accommodating this requirement for consistency within a military where soldiers are regularly posted to different positions is a problematic proposal. However, this issue need to be addressed if the British Armed forces wish to employ VBS effectively.

In the context of current British Army training methodologies VBS has limited training utility for dismounted applications, and this explains why it sees little use in this capacity. However, this research has demonstrated that the British Army has not yet fully explored VBS’s potential as a dismounted trainer. The experiences of other forces – in particular the Dutch RNLA – and even clan gamers demonstrates that VBS can simulate platoon-level combat with a reasonable level of realism, and the simulation of dynamic engagements in a non-lethal environment is one of its greatest strengths as a tactical trainer. Defeating active competent opposition requires the dynamic application of doctrinal principles, exactly what tactical training aims to teach, and this methodology is at present underutilised by the British Army.

Curry et. al. state that ‘The next essential element is more formal objective evidence that game based training in a military context is actually effective’.871 The current state of research is inadequate, and training based on anecdotal assertions of effectiveness is inadvisable. Further studies based on proper trials conducted by the military should be undertaken to build on those by the Canadian and Dutch forces,

providing crucial empirical evidence to assess current methodologies, advance military understanding of how to effectively blend live and simulated training, and generate a proper cost benefit analysis. In order to avoid some of the pitfalls associated with current studies, this assessment should be led by independent academics following sound analytical frameworks; Downes-Martin highlights many of the pitfalls which need to be avoided in his presentation ‘How Not To Not Analyse Wargames’. 872

Conclusion

This thesis examined the extent to which COTS FPS video games can simulate contemporary platoon-level infantry combat, with a view to enhancing the efficacy of military training methodologies. The resulting dissertation contributes an assessment of said efficacy, firstly through the application of an innovative conceptual combat model that provides a schema to systematically evaluate the realism of contrasting virtual environments; secondly, through a case study examination of commercially popular FPS video games which purport to be realistic, applying the schema in order to assess the veracity of these claims; and thirdly, through an exploration of past and present military COTS FPS video game usage, alongside a case study assessment of current British Army training practices using VBS. This conclusion will utilise the findings to set forth direct answers to the research question and sub-questions posited at the outset. It will then assess the theoretical implications and limitations of these findings, as well as possible directions for future research.

Primary Research Question

The thesis examined the primary research question:

- How realistically can contemporary platoon-level infantry combat be simulated using First Person Shooter (FPS) video games?

Over the last decade FPS video games have become a prominent feature of modern life, and they are here to stay. They generate revenues which exceed those of any other form of commercial entertainment; in 2014, the CEO of one of the world’s largest gaming companies stated that the most recent release in the Call of Duty franchise was, ‘the biggest entertainment launch of 2014 in terms of revenue, surpassing all movie, music and book launches’ which had taken place that year.\(^{873}\) Due to the pervasiveness of these games, millions of young people play FPS titles. However, the most popular are pale imitations of real-world combat, meaning that the vast majority of players will only ever engage with simulated environments that are extremely unrealistic.

\(^{873}\) Mantarro (2014).
There is an inherent tension between the entertainment and professional user bases due to their contrasting requirements, and the problematic relationship between COTS video games and the military – which has been demonstrated throughout this thesis – highlights the magnitude of the challenge faced by developers attempting to simultaneously reconcile entertainment, realism and effective training. The commercial user base generates so much profit that any single product developed to serve multiple markets inevitably prioritises their requirements over those of professional users. This means that if the military wishes to take advantage of COTS products in order to benefit from the associated reduction in training costs, they are required to make certain compromises in terms of the fidelity of the simulation. It is simply not economically viable for them to pay a developer to eradicate all of the flaws associated with repurposing a commercial game.

Whilst military establishments would undoubtedly prefer soldiers to play FPS games such as VBS or ArmA in their spare time, the majority of those who do play games choose to play unrealistic mass market products, which provide minimal training benefit. However, the pervasiveness of these games lends new recruits a certain level of familiarity with their operation. NSC’s use of Xbox controllers shows how professional users have recognised and adapted to these trends. Even though these controllers are – from an objective standpoint – not the most appropriate or effective method of interfacing with simulations such as VBS, tapping into the pre-existing expertise of trainees can help to accomplish training objectives by reducing the time required for familiarisation. The utilisation of Xbox controllers shows that professional users are capable of going with the tide and embracing the advantages of commercial gaming, rather than pushing against it. It is also worth noting that NSC has specifically sought out employees with previous backgrounds in ArmA in order to harness their pre-existing expertise, thereby demonstrating that there are some valuable transferrable skills between the commercial and military spheres.

The realism of FPS video games in a military sense is ultimately a product of the software’s capabilities and the methodological approach taken towards its usage. There is a clear disparity between how realistically combat could be simulated in theory, and how realistic professional users need scenarios to be in practice.
Paradoxically, this means the strongest drive to create the most realistic combat environments actually comes from the commercial gaming sphere. Of all the groups studied, niche gamers had the greatest dedication to realism; they were committed to seeking out and implementing contemporary infantry doctrine as accurately as possible within the constraints of the environment, and if necessary would even modify their software in order to achieve more realistic combat outcomes. For them, realism is not a means to an end, it is the end itself. It is also highly significant that military and ex-military personnel are a core part of these groups, and their expertise contributes directly to increasing the realism of niche simulations such as ArmA.

Within the military, the primary training goal is to successfully accomplish learning objectives, and functional fidelity does not always coincide with creating realistic environments as determined by the combat model. Sub-optimal usage of the software can also jeopardise the ability of instructors to achieve their training goals, as well as compromising the realism of the simulation. Whilst recognition of this problem has led to the employment of experienced third party contractors to conduct training events, this involves greatly increasing costs, negating one of the fundamental advantages of employing simulated environments in the first place.

Ultimately, the previous paragraphs demonstrate that realism is far more nuanced than professional users playing games seriously whilst enthusiasts play them for fun.

Both spheres were however handicapped by the inherent limitations of computer hardware. These limitations are central to explaining why simulations struggle to replicate the moral component of combat; the hardware interface simply cannot provide an adequate level of immersion to properly dupe player faculties and engender fear to any significant degree. This problem is not unique to simulated environments, as even in live training factors such as suppressive fire are markedly less impactful than they are in actual combat engagements – the replication of the moral component is a fundamental problem faced in all types of training.874

874 Rowland (2006), pp.70, 72, 82-83.
Sub-Questions
In order to effectually answer the primary research question, four sub-questions were designed to inform and support the analysis.

1. Which identifiable elements of combat are most significant in explaining the dynamics and observed outcomes of discrete infantry engagements, and how widely are these understood amongst military establishments and games developers?

One of the main purposes of the combat model was to provide a comprehensive analysis of contemporary engagements, in order to identify which factors explain their dynamics and observed outcomes. It identified a total of 13 distinct factors and estimated their relative importance in relation to the two most significant observed outcomes – asymmetric casualty levels and duration – and the results of this assessment can be found on pages 111 and 117 of this thesis. With regards to battlefield casualty levels; doctrine and tactics, training, group cohesion, and the psychology and physiology of the combatant are the most powerful explanatory factors, and the conceptual component of warfare is considered to be of principal importance in relation to this outcome. In terms of duration, the factors responsible for increasing the lengths of discrete engagements – cover & concealment, the psychology and physiology of the combatant, group cohesion, logistics, and dispersion – generally outweigh those responsible for decreasing engagement length. There is no specific relationship between the physical component of warfare and the observed increase in duration, although the conceptual factors appear to correlate with both increasing asymmetry and decreasing duration.

Whilst the significance of these factors is generally understood within the military, they are not widely appreciated outside of this sphere. Where they are not classified, military doctrinal publications are dense, require considerable study, and are largely opaque to those who do not have a reasonable prior understanding of military affairs. Most commercial developers have no inclination to study them, as their simulations are designed to attain mass market appeal by pandering to the popular perception of combat as a heroic adventure. Even in BISIM – whose sole clients are military establishments – few members of staff have a genuine understanding of combat, and one of those who does considers this to be a considerable problem that has led to ‘a
disconnect between Bohemia and their customers. There are very few middlemen, and they don’t speak each other’s language. Games development studios simply do not have the prerequisite expertise to understand combat, as it is exceedingly rare for the skillsets of academics, combat veterans and computer games developers to overlap. This is one of the key advantages for military contractors such as NSC. The company specifically cultivates both these strands of expertise; they employ reasonable programmers with the capability to modify VBS, but also seek out veterans, furnish them with extensive training in how to use the software, and employ them to manage training events. Often the veterans they pursue will be experienced ArmA clan gamers, as they are members of a niche community which also strives to employ FPS games in a militarily realistic manner.

2. **How do game developers create virtual environments that players perceive to be real?**

Computer hardware interfaces are employed to create immersive environments that engender a suspension of disbelief, with the aim of deluding the user’s brain into believing the experience they are undergoing is to some extent genuine. They simulate the sights and sounds of the battlefield via a monitor and headphones which provide visual and aural feedback, and the avatar’s movement is controlled through a mouse and keyboard. However, developers constantly struggle to overcome the fundamental limitations of these interfaces. A monitor and headphones cannot hope to provide feedback which matches the multifaceted sensory experience of the human condition. Abstractions are constantly required to provide players with an underlying understanding of the world surrounding their avatar, which would be largely instinctive to a person in corporeal reality. These abstractions are almost uniformly imperfect, and often create further problems due to their implementation. The requirement for a HUD to give visual cues that provide basic levels of situational awareness limits the degree of immersion that such simulations can achieve, and whilst it would be technically easy to disable the HUD in order to increase immersion, the toll this would take on player’s situational awareness of the game world is untenable. Clan modifications to the HUD demonstrate that in the face of hardware limitations, serious gamers are willing to further distort the verisimilitude of the individual’s gameplay experience in order to increase the

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realism of the simulation with regards to the factors evidenced within the combat model – achieving realistic combat outcomes is a high priority amongst these communities.

The main problem resulting from these limitations is that regardless of player mindset, no COTS FPS video game has succeeded in replicating the psychology of combat, a factor which the combat model identified as fundamental to the realism of any infantry combat simulation. This inability to replicate battlefield psychology is indicative of a general shortcoming displayed by training in terms of simulating the moral component. This inherent limitation has been recognised and generally accepted in both the commercial and military spheres. On the commercial side, this does not pose a problem – there is no interest in simulating fear and stress, as this would inevitably reduce the product’s appeal. On the other hand, armed forces would prefer to simulate these factors, but are unable to overcome the inherent limitations of the software and hardware in order to do so.

These deficiencies do not mean that developers have completely failed in their goal of creating somewhat realistic virtual environments. In terms of mass market titles, the general perception of realism has been so extensively warped by various forms of popular entertainment that the majority of players consider combat as depicted in FPS games to be relatively realistic – at least from a technical perspective. There is in actuality some truth to this claim, as the physical component of combat was the most successfully reproduced across all the case study games. Players also perceive niche games to be more realistic than their mass market counterparts – despite a continuing inability to capture the moral component of combat – as they take technical realism to its logical extreme by providing larger environments, more weapons, and greatly expanded functionalities. Given that niche games inherently attract the most hardcore of gamers, their serious approach to utilising the software further enhances the perception of realism amongst aficionados.

In the military context, the onus of creating a realistic environment to some extent shifts from the developers to the users. Soldiers do not perceive the virtual environment to be real so much as they make a conscious decision to buy into the
experience in pursuance of its value as an instrument of training. Whereas
commercial users consider realism to be almost entirely based on the deliverance of
realistic physical properties, military users are required to develop methodologies
which employ environments with these properties in a manner that generates realistic
combat outcomes as defined primarily by doctrinal publications.

3. Given their prior understanding of combat dynamics, do games
developers accentuate or actively distort some of the previously
identified factors in order to create a commercially successful product?

Given that accurately replicating combat dynamics is not a high priority for most
game developers, their basic understanding of these issues is generally deficient.
Creating an enjoyable gameplay experience which avoids frustration and generates a
strong affinity with the target market is by far their chief concern. Because of this,
the commercial case studies in Part 3 have shown a consistent trend towards active
distortions of the soldier’s experience; whenever there is a clash between realism and
enjoyment, enjoyment wins out.

Since developers have a shallow understanding of the moral and conceptual factors,
it is perhaps unsurprising that they are generally depicted sporadically and/or
erroneously. Unless their inclusion would significantly boost the product’s
profitability – which is highly improbable – developers have no real motivation to
incorporate them properly. This is also true for wounding and injuries, which were
neglected and abstracted to such a degree that they bore almost no resemblance to
the combat model. Although niche games are somewhat less prone to distortions
relating to the physical factors, their developers still focus primarily on delivering a
more accurate physical representation of the battlefield rather than attending to the
moral or conceptual factors. All the aforementioned factors are therefore distorted by
virtue of largely being ignored.

Mass market commercial titles have also conclusively failed to simulate the physical
component factors with any accuracy – despite developers extolling this as an area of
accomplishment. In actuality, their pretensions to realism occupy a narrow technical
sphere, which has little overlap with the physical factors as identified in the combat
model. The impact of specific physical factors such as cover & concealment, logistics, and dispersion were purposely degraded in order to reduce the duration of engagements whilst increasing their intensity. This contributed towards numerical preponderance playing an increasingly important role given that highly accurate and lethal direct fires could be swiftly employed.

Niche games did however show a great deal of improvement in replicating certain factors. In relation to the physical component, developers implemented changes to the physical properties of the environment which resulted in increased realism; the importance of cover & concealment and dispersion were reestablished, and logistics also played a somewhat more significant role, although logistical problems were still not as prevalent as those faced in the real world. Conceptual factors such as doctrine and tactics also increased in relevance, although this was not directly due to the inherent properties of the environments themselves; the players using the most physically accurate simulations – both serious gamers and military users – possess a proper understanding of current doctrine and tactics which they endeavour to enact during play.

4. **How do commercial games – principally designed to make money – balance the requirements of gamers and professional military users?**

As a generality, COTS FPS video games have failed to balance the requirements of gamers and professional military users in a single product designed for use in both markets. The history of military experimentation with such products is littered with numerous abortive experiments, a testament to the difficulty of catering to markets with completely diverging requirements. Given that the military market is significantly smaller than the mass commercial market it is obvious in hindsight that any attempts to collaborate with developers who were not closely supervised were destined to fail; products created with the intention of selling to both markets inevitably neglected military requirements in favour of increasing their appeal amongst the gaming public. The aforementioned lack of understanding and active distortion of combat dynamics only served to exacerbate these problems, but, after nearly a decade of faltering initiatives, VBS proved to be an exception by successfully bridging the gap.
The split between BIS and BISIM provides further evidence that balancing the competing requirements of gamers and professional military users through a single product is highly problematic. Even two experienced development teams working on the same software could not find sufficient common ground to maintain a stable working relationship. Whilst VBS itself demonstrates that commercial games can be viably employed as military training tools, the concurrent sale of one identical product to two different spheres is untenable due to the inevitable conflict of interests which arises when one products is sold to two different markets. VBS was developed specifically for industry users, and was not made available to the general public, and this allowed BISIM to focus purely on meeting military requirements at reasonable cost, funded by software licensing agreements with different armed forces. VBS succeeded because BISIM recognised that whilst ArmA’s functionalities would need to modified and expanded if the software was to be fit for purpose, they would not need to create an entirely bespoke product. This research has clearly demonstrated that much of the core functionality of ArmA was retained in VBS, but using the pre-existing code of ArmA allowed BISIM to develop a military version for a fraction of the cost which would be required to develop a game from scratch.

Theoretical Implications
The creation of a conceptual combat model designed to be comprehensible to those outside of the OR sphere is a new addition to the current literature. Providing simulation professionals with a deeper understanding of combat dynamics should allow them to identify shortcomings in their approach to simulation, shifting their focus from the technical aspects of realism to grappling with the more meaningful moral and conceptual factors. The combat model does not propose any revolutionary ideas in terms of underlying combat dynamics, but in codifying the relative importance of factors in relation to combat outcomes it goes beyond previous assessments, which are generally reluctant to provide such a schema.

In bringing together many different studies, the model provides a concise overview of current academic and military thought, allowing readers to attain an understanding
of combat dynamics which would otherwise require intense study of a multitude of disparate sources. This synthesis owes much to the work of contemporary theoreticians such as Biddle, King and Grossman. Biddle’s largely operational level theories have been adapted to provide insight into the tactical context and importance of doctrine, and King and Grossman’s work on unit cohesion and infantry psychology are fundamental to understanding the moral component of combat.

While Lanchestrian style combat models were discredited in relation to predicting combat outcomes in the real world, they seemingly have far more applicability in regard to simulated environments. The simplistic assumptions which underpin Lanchester’s laws are reasonably representative of virtual environments, and this suggests that a key deficiency of the formulas is that they, as with virtual environments, do not take the moral and conceptual components into account.

Whilst training methodologies and outcomes have been examined by the academic community in relation to other armed forces – the RNLA in ‘Bloody Serious Gaming’ by van der Hulst et al., and the Canadian forces in Roman & Brown’s ‘Games – Just How Serious Are They?’ – the British Army has been the subject of only limited research in the article, ‘Commercial-Off-the-Shelf-Technology in UK Military Training’, by Curry, Price and Sabin, and the article itself also highlights the lack of quantitative evidence outside of the aforementioned studies.\(^\text{876}\)

Academics can provide a far more extensive objective assessment of how effectively VBS is being used, and the need for such evaluations to take place has been underscored by this thesis, as it has exposed significant deficiencies in British military policy regarding the practical usage of VBS.

**Limitations and Future Research**
The combat model has been designed primarily to assess asymmetric engagements, as subsequent to the First Gulf War Western forces have been principally engaged in this style of infantry combat. The relative importance of the factors could shift if the nature of infantry combat either evolves in an unexpected direction or reverts to the pitched battle engagements seen in the 20\(^{th}\) century. Should the nature of combat

\(^{876}\) Curry et. al. (2015), p.20.
substantially change then elements of the model would need to be updated in order to reflect the current realities of the battlefield. However, the bulk of conclusions relating to the moral and conceptual components are likely to remain relevant short of a paradigm shift in military affairs.

Western doctrinal research was heavily influenced by US publications, as they are readily available online. Given that the VBS case study focused on the British Army, it would have been ideal to base the combat model on British doctrinal publications; regrettably, these documents are classified, and as such are ineligible for use. British doctrine would have provided a better point of comparison between the combat model and the VBS case study, but this obstacle was insurmountable in the context of a PhD thesis.

The combat model provides a platform to evaluate the strengths and weaknesses of different COTS FPS video games; however, this capability is not vital given current trends in infantry training. Whilst experimentation with COTS products has been a hallmark of the past twenty years, this process has recently been curtailed due to homogenisation around VBS. Furthermore, the commercial case studies have demonstrated that at present very few products are worthy of a detailed assessment, given that even a cursory evaluation reveals they are subpar in comparison to VBS; only when a genuine competitor emerges will this capability of the model become relevant.

The case study of VBS focused on British Army usage to keep the scope of the research manageable in conjunction with the logistical implications of travelling across the world to generate an in-depth comparative study spanning multiple different armed forces. Given the groundwork established in this thesis such a study would be a logical step in terms of furthering this field of research, as currently there is very little academic literature which seeks to assess the relative effectiveness of simulation training methodologies across different armed forces. Such a study would be invaluable from a military perspective, providing an appraisal of best training practices which would benefit armed forces as a whole. Moreover, other forces
spend more time using VBS as a dismounted trainer, and so further research would also provide an improved assessment of VBS use in this context.

**Concluding Thoughts**

A US rifle platoon commander recently stated that ‘Development of objective metrics in order to compare the training cost and effectiveness of simulations and live training are desperately needed in order to confirm the usefulness of simulations and increase utilization...’. 877 He argued that despite the anecdotal evidence ‘without data derived from a scientific and methodological analysis of training effectiveness, simulation is likely not going to be utilized to its maximum potential nor funded adequately in order to achieve desired effects. 878 It is the hope of this author that this thesis has achieved some of these goals, and paves the way for future research addressing this urgent military requirement.

The assessment of realism undertaken in this thesis has significant practical applications amongst both military and simulation professionals. Developers continually strive to create ever more realistic environments; however, they do not have a proper understanding of realism in the military context, which carries completely different connotations from the commercial context. Even when specifically targeting products to the military market developers adhere to the concept that realism is achieved principally through creating technically accurate simulations. The vast majority of programmers and game designers have an understandably limited comprehension concerning the realities of infantry combat, and this thesis should impart upon such individuals an appreciation of moral and conceptual factors currently outside their sphere of understanding. Genuine awareness of these factors and the problems they present is the first step towards finding a solution which would improve how such factors are actualised within virtual environments. Although this represents a considerable challenge, more accurate representation of these factors will greatly enhance the utility of simulated environments within the military sphere.

Infantry soldiers have a solid understanding of combat dynamics; however, their

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877 Eady (2014).
878 Ibid.
comprehension of how to use simulated environments as effective training aids is limited, and this hampers their ability to develop effective training methodologies. This thesis provides soldiers with a detailed understanding of simulated environments as well as their limitations, the benefits they afford as training tools, and outlines some of the techniques which can be employed to utilise them productively. The methodological assessment is by no means definitive, and future academic analysis into the developing usage of VBS amongst armed forces across the globe will assuredly have much to contribute on this topic. Increasing academic research into this field is essential in order to bring infantry training into the twenty-first century, combining tried and tested methods with those spearheaded by newly emerging technologies, with the ultimate goal of saving Western lives on the battlefield.
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