Information Models in Multiplayer Gaming: Teaching New Players the Complex In-game Economy of Counter-Strike: Global Offensive

A practice-based exploration into real-time external information sources for Counter-Strike: Global Offensive.

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I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

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E) Abstract

An important aspect within multiplayer online games are the unwritten rules of play. Often unknown and unobserved from the outside, these rules make up the foundation in which online play takes place. With more and more new players entering these virtual worlds, opportunities for negative team behaviours are present when these new players do not abide by these rules of play. This may dissuade new players from joining these game communities, and it may also cause undue stress to new players trying to learn these rules of play. However, can this process of learning the unwritten rules be fast-tracked by the use of information models? In this area of academia, minimal research has been focused on the use of external information sources within the online gaming world. This exegesis therefore explores the theory surrounding virtual teams and the use of information models. The literature discussed is used as a basis for which this research can be supported. The first section regards the theoretical foundation in which this prototype has been created and also the process of data acquisition for the information model. The second section follows the practice space in which the prototype was designed and developed. Finally, the exegesis concludes that there is potential for the prototype created to aid new players in learning the unwritten rules of play.

1.0 Introduction

Just as society has its unwritten rules of conduct and behaviour, the world of online gaming is no different. However, just as a person who moves to a new country may struggle to learn the new customs and cultures, a new player joining an online game can find themselves in a similar position. There are already established rules and behavioural norms that are from the outside invisible to the untrained eye. Unfortunately, when these unwritten rules are breached, newer players are at risk from receiving negative behaviours from more experienced players who see the newer player as a detriment to their team's synergy. This research project aims to improve upon the pre-existing concept of using information models to aid players in learning a game's unwritten rules of play. The aim is to offer information which will improve not only a team's behaviour, but also aid a new player in giving them the ability to act as an experienced player when they engage with other players in a game.

Very little past literature on gaming has explored this area of research. Although the concept may be widely accepted within the gaming community that external sources exist and are extensively used, much of academia has left this facet of gaming in the dark. The majority of literature concentrates on neurological responses that the violence in video games has on a player's brain. This unfortunately results in very little research into the practical use or effects that external information sources have within the gaming community. Two prior studies have addressed this facet within a competitive Real-Time-Strategy or RTS called Dota (one of the most popular modern RTS games on the market). Using advanced mathematics, and what is known as min-max modelling (a method of offering minimum and maximum mathematical mechanics in gaming), a proposed information source was created to pick a player's optimal min-max move. However, both the models created did not account for the accepted unwritten rules of play within these virtual worlds. Meaning that, although the players move may have been optimal for the team's success, it may still result in a negative team reaction if it is a move that is not regarded as normal or team-like play. As discussed above, this field of research is relatively new and there is limited exploration of the area by academia. To ameliorate this known issue, the literature review provided aims to be less a platform to critique to be built upon, but instead acts as a tangential aspect of evidence to frame the research project undertaken. Unlike a traditional examination of literature, this research project will instead find supportive pieces in which a new area of research can cohabitate. This gap in particular is the use of external information sources within online multiplayer games.

The platform in which this research project is to take place is Counter-Strike: Global Offensive, otherwise known as CSGO (and this acronym will be used henceforth in this work when referring to this game). CSGO is a competitive first-person shooter game which allows a player to take control of an in-game terrorist or counter-terrorist. The game is played as a POV (Point of View) of the in-game characters and in a competitive CSGO game, two teams of five players are pitted against each other, taking turns defending and attacking an objective. There are multitudes of unwritten rules surrounding the play of CSGO – in particular, the complex in-game economy. This system of buying patterns and behaviours is one that is most often overlooked by many new players within CSGO. This can cause frustration for more experienced players, as mechanical skills take time to learn, while correct buying is more knowledge than it is skill. The common and simple mistake of improper buying can drastically turn the tables of a team's likelihood of success. Due to this researcher's personal and extensive experience of playing within the CSGO competitive scene for 5 years, this proved to be the best platform to conduct this research on. Having over four years of competitive play experience with CSGO, this platform in particular was the logical choice as it was a community the researcher knew, making the issues clearer to understand. This pre-existing knowledge of the game and the operator issues also aided the design thinking of this research project and ultimately helped contextualise many of the small details that an outsider to this game or community might have missed.

The primary research approach in this Master's Degree is to create a method which will help new players appear as if they have the buying behaviours of experienced players. The aim of developing this type of method is to create a result that will allow potential growth of positive team behaviours, and a potential reduction in negative team behaviours. Through the creation of a model based upon actual game data, an interactive artefact can be presented as an explorative piece of thinking. Engaging with the theory will allow an exploration of how a produced artefact can be used as a way to help newer players replicate the buying patterns and behaviours of more experienced players and demonstrate how the produced model may reduce issues that will be identified below in this work.

Therefore, the research question proposed is:

> How do team behaviours change when new players are offered a method to act similarly to experienced players?

A sub-question connected to the primary question is:

> Can this method aid in reinforcing positive team behaviours and reduce toxicity?

This research will be conducted as a practice-based research project. Chapter 2 – Literature Review will provide an extensive exploration into the existing literature with the aim of proving a substantial basis in which this research project can be contextualised. Chapter 3 – Methodology, and Chapter 4 – Process & Results, both aim to prove that the information and data acquired was essential regarding the in-game economy of CSGO. In doing so, the unwritten rules and the established buying behaviours of CSGO will be discussed and examined in depth. Chapter 5 – Prototyping further showcases the design development phase in which fidelity mock-ups and prototypes are generated in aid of the artefact. Chapter 6 – Discussion will dissect the proposed research questions and discuss how effectively the artefact has addressed them. Finally, Chapter 7 – Conclusion will give help to find direction and purpose for future researchers in continuing studies within this new field.

This project aims to positively contribute towards the continued research within this new field. This project also aims to build a platform in which future researchers can contextualise their own research. By exploring the research questions, the aim is to demonstrate that external models can benefit team behaviours and reduce toxic behaviour. The intention being, that this will help legitimise the field of external information sources within virtual teams. In doing so, the hope is to promote future research in this area. This is important, as virtual teams in particular are on the rise, not only within the online gaming community, but also in international business ventures, digital media projects, and academic collaborations. The study into virtual teams and the positives that external information models can have on them is just beginning, and the possibilities are endless.

2.0 Literature Review

Counter-Strike: Global Offensive

Counter-Strike: Global Offensive (CSGO) is a popular multiplayer first-person shooter (FPS) video game. FPS games are largely centralised around guns and shooting. It involves a real-life player taking control over a virtual player or soldier and fighting within a virtual battle arena. For the most part FPS games try and mimic reality, however, there are exceptions within sub-genres of games, such as fantasy FPS games. Within the FPS genre, players will play from their virtual characters immersive point-of-view – commonly known as POV. CSGO pits two teams against each other. The terrorists attack the objective; the counter-terrorists defend the objective. Players who play CSGO are put into the POV of the virtual terrorist character or counter-terrorist character. The movement is realistic with limited running speeds, realistic gravity, and realistic three-dimensional axis movement.

CSGO as a platform is widely recognised at a competitive eSports level and is also used on streaming services such as Twitch.tv (Escharts, 2018). This is a leading platform for gamers to stream their gameplay, and where viewers can go and watch players play the game in real-time. This is likened to how traditional sports would be viewed on a television broadcast. However, twitch and gaming are not often ruled by a schedule, which allows players to stream to viewers all over the world and at any time.

The first iteration of the game dates back to the early 2000s. Since its first release, many changes and design developments have been made to create the game that currently exists. Much like many other FPS games, CSGO cannot solely survive on a linear game mode platform. That is to say, that CSGO cannot just repetitively only host one style of game or game type as players will soon get bored of the repetitive nature of the game. Therefore, CSGO offers many various game modes which allow for a wider range of players to be attracted into buying and playing the game. Although there are various game modes on offer, many of the CSGO game modes are supplementary to the central and most popular game mode, which is competitive.

The competitive game mode is the one which is played by professional CSGO players. It is the iconic game which CSGO was founded upon. It consists of two teams: one terrorist team, and one counter-terrorist team. They are pitted against each other to attack or defend an objective for 15 rounds before changing sides. The

ultimate goal being to win the game by winning 16 rounds as a team. The CSGO competitive mode will be expanded upon further below.

Table 2-1 below lists each individual game mode available on CSGO in summation, including how players utilise these modes within the platform of the game:

Table 2-1: CSGO Game Modes

Game Modes	Player Uses
Offline	• Play against bots • Learn map rotations and movements • Practice set smokes and common angles to hold • Practice aims against bots • Allows players to play a variety of maps to train aim, gun spray, and movement mechanics before playing Competitive CSGO
Community Maps	• Third party servers • Variety of entertainment and fun-based maps • FFA Deathmatch, 1v1 Aim maps, RPG Servers, Hacker v Hacker • Gives CSGO replay-ability, and a further extension of players who aren't interested in Competitive CSGO
Casual	• 30 players split into two teams of 15 play against each other of competitive mode maps • Team damage is turned off • Economy is altered • Allows newer players to gain basic experience before entering Competitive CSGO
Deathmatch	• 30 players split into two teams of 15; each play against each other using competitive mode maps • Team damage is turned off • Players can pick any weapon • Allows players to warm up aim before entering a Competitive game of CSGO
Danger Zone	• 18 players in a battle royale style of game mode and map • Teams of 1-3 players • Does not fit thematically with the style of CSGO • Added in response to the popularity of battle royale multiplayer games such as Fornite
Wingman	• 2v2 Competitive game mode • Independent rank system which is separate from Competitive CSGO
Wargames	• A set list of casual fun games to mimic what players already have available on Online Community Servers • Commonly used by new players or players who do not have interest in the Competitive Game Mode
Competitive Casuals	• Newest edition of game mode to CSGO • Standard 5v5 Competitive CSGO rules apply • Competitive rank cannot be altered by winning and losing competitive casual • Different map selection • Used by CSGO to beta test new potential maps

The primary scope of this research project focuses on the competitive game mode, and it will therefore be allocated its own separate section in which this game mode is broken down in greater detail.

Counter-Strike: Global Offensive – Competitive

Overview

In the CSGO competitive game mode, two teams of five players are pitted against each other in a game which can last up to 30 rounds. The goal for each team is to be the first to reach 16 round wins which will mean victory of the entire game. There are 15 rounds for each half which means it is not possible to win an entire game within one half of play. It is possible for the game to end in a draw if each team wins 15 rounds each of the possible 30 rounds. There is no option for overtime or a golden round to decide the victor between the two.

Each round lasts 1 minute 55 seconds which can be extended by planting a bomb, making the maximum possible round time 2 minutes and 35 seconds long. Following the end of a game, half both teams will switch sides and the game economy is reset as if it was the start of a new game. This means that players cannot take equipment, weapons, or money across from one half to the other. Games can also end early if one of the teams votes to surrender and the decision is unanimously agreed upon.

Beginning a Match

Players can enter a competitive CSGO game within the in-game competitive lobby. In this lobby they can select which maps they wish to play, and they are also able to invite four other players into the lobby to create a full team for a competitive CSGO game. Players can alternatively queue as a solo player or in groups anywhere between two and five players. The remaining spaces of the team will be made up of other random players queueing at the same time to make up the required five player team limit.

Once the matchmaking has concluded, two teams of five random players will be put into a server together which is presented as a virtual world of one out of many CSGO competitive maps. The counter-terrorists will be tasked with defending the set objective, while the terrorists will be set with attacking the set objective. There is no preamble or guide as to how each team should defend, attack or buy, and ultimately players are left to their own devices. With supplied communication technologies such as in-game text chat, or voice coms, teams can communicate within themselves to organise positions, buys, and roles. However, it is important to note that these are often five randomly selected players, and the chatter can be very minimal during the first few rounds, as the players still are yet to get acquainted with one another.

Rank System

After playing ten competitive CSGO games, players are given a skill group rank which dictates at what skill level they are playing at. This is often the incentive for many players to play competitive CSGO, as they are wanting to slowly work their way up to the highest possible rank.

Competitive matchmaking is also controlled by players ranks, as the matchmaking servers match players primarily based on their player rank. This means that you do not get a team full of low rank players playing against a team of higher ranked players. Players are also limited to only partying up with other players who have a similar rank with them; this is to avoid low rank players playing with a higher rank friend that will help them win low rank games. However, this step can be bypassed if a player queues with a premade five player team. In this scenario, any variation of ranks can play together, however, the competitive matchmaking servers will place the team in a game against a team which has the same average which generally puts the mixed premade team at a disadvantage.

A player can increase their rank by winning multiple consecutive games in a row, and by performing well at the rank they are playing. Unfortunately, this leads to team dynamic issues where some players may make choices which further their individual score while putting their team at a disadvantage. These issues will be discussed further in the Research Issues.

Movement & Action Mechanics

Historically, CSGO runs off the Source Engine, which it has always done. The CSGO source engine is a 3D game engine developed by Valve through which the movements, visuals and in-game elements are coded and controlled. Much like many other FPS games, CSGO works within a 3D environment, and utilises the W, A, S and D keys on a keyboard for primary movements and is commonly referred to as WASD. The spacebar allows players to jump, the control key allows players to crouch, and the shift key allows players to silently walk. Players can also quick bind keys such as Jump+ThrowGrenade, or even quick buy binds allowing players to buy a pre-set list of gear by just pressing the bound key.

Economy

Players start each half with $800 and the default pistol which is the USP-S or P2000 for the CT side, and the Glock-18 for the T side. The maximum possible amount of money a player can amass is capped at $16000. Money is rewarded at the end of each round, regardless of whether a team won or lost. Teams are awarded $3250 for each round win and a variable of $1400 to $3400 for each loss round, dependent on the current loss bonus of that team.

Players are also awarded individual rewards such as kill bonuses which vary depending on the weapon, and also bomb plant and bomb defuse rewards. This is a primary area of focus for this research project and will be expanded upon in greater detail further within this paper.

Research Issue

To fully understand the research issue, it is important to explore the issues surrounding team dynamics and how improper purchasing can create problems. As mentioned in the introduction, the researcher has been involved in the game and the competitive community of CSGO for 5 years and has deep tacit knowledge of the gaming experience, team dynamics and community discussion issues. Problems begin to occur when players within the team start to buy game items as individuals without taking into consideration the needs of their team. For example, if there are three team members who do not spend any of their money on a buy at the start of the round but the other two team members spend their money, that team's potential buy round (a round where everyone on the team buys) is postponed till the two poorest players on the team have saved up enough money to buy again. To gain a competitive edge and help a team build its trust and cohesive synergy, correct buying strategies should be implemented by not just one player, but by all the players on a team.

One reason why these problems can be caused is because CSGO has a pre-existing internal rank system which spans over 16 competitive skill groups. This internal rank system incentivises players to play competitively to gain a higher rank as a public display of personal skill and achievement. However, issues can occur when players who wish to play the game competitively get placed in the same team as players who wish to play the game casually for fun. Due to this exact issue, Valve, the developers of CSGO, have come under fire from the games community who have asked repeatedly for a casual competitive mode which does not alter a player's competitive rank. Recently, CSGO did implement this game mode, but unfortunately, players cannot access or play on the normal competitive maps, which deters many from using the casual competitive mode.

At the beginning of every round there is 15 seconds dedicated for players to buy weapons, armour, and utilities. These 15 seconds are extremely crucial, as it is within this 15 second period where teams can come together or fall apart. With poor team communication, or poor game knowledge, teams can mess up their economy with only one or two people making incorrect buying decisions. This can push them back three rounds or longer before their economy rebalances itself, assuming that no other players make buying errors in these rounds. Due to the extreme consequences of improper buying, much of a team's communication and trust can hang in the balance within those first 15 seconds of each round.

Following an improper buy, a large variety of problems can occur. First of all, the player who purchased incorrectly could be subject to in-game verbal and textual abuse from other players in the team. By isolating one player the team is putting themselves at an even bigger disadvantage. This is ironic considering that the reason for isolating that individual teammate is the perceived team disadvantage that player has caused. Another outcome is that the player who incorrectly bought can be muted or kicked, which again puts the team

at a big disadvantage. At higher competitive ranks it is unlikely that a team will resolve or forgive mistakes, which again results in poor team synergy, negative personal game experience, and limited team trust.

Linking back to the researcher's experience within CSGO, they have come across countless problems that have occurred in a competitive CSGO match. Oftentimes a team's performance will be predicted within the first five rounds of a competitive match. Within the first five rounds it is crucial to develop a team structure and good team communication. This can stem from correct buying techniques and successful round wins. Many times, this researcher has had fellow teammates throw certain games psychologically and sometimes intentionally, due to poor buying strategies. Not that the particular buy influences their personal performance of a round, but more so the break in team trust. When players enter a competitive game, the majority of the players on your team will be strangers, therefore you can have no pre-determined bias of how the game will go. When a simple mistake like incorrect buying occurs, your trust within that particular teammate changes. This lack of trust will influence how you enter a site, how you trade kills, and how you move around the map as a team.

For example, when playing with one particular player who refused to buy with the team (on the terrorist team), play became very passive and slow. This allowed the counter-terrorist team time to rotate and reset their site holds if we got an opening kill. Although this may seem minimal, the break in team trust could draw the time it took for our team to take a site by over 30 seconds. Within that time, the counter-terrorist team had rotated and were already beginning a site retake before we had even planted the bomb.

Another example that was experienced when playing with a team of five random players occurred as the team entered a game in which one player would buy every round, which resulted in them never being able to get a full buy. It got to the point where we lost a few crucial rounds due to a weak site hold from this one particular player, who got overwhelmed by terrorists on a full buy. Unfortunately, some of the random players on this team did not take too kindly to their poor site performance, and began to argue and abuse them, which resulted in them abandoning the game, and our eventual loss of the game.

It does appear to be what is often colloquially referred to as a "double-edged sword," a situation where there is an opportunity for both an advantage and disadvantage to occur. Here the double-edged sword is poorly performing teammates. The solutions that many players default to is either abusing, kicking, or muting the underperforming teammate, all of which puts the team at an even worse disadvantage. This results in an ironic situation which can only be described as mutually assured destruction. Players don't want to win a game with a player who is seen to be working against the team, or freeloading off the team; nor do they want to lose. However, they would rather make this player suffer a loss, than win the game.

Pre-Existing Models

The initial premise of a video game is to be entertaining and challenging, however the relationship between video games and external information sources is one that is relatively young. Historically, video games were designed for single players to journey through a prescribed and set out narrative or goal, which was dictated by the game developers. These primitive games were often limited in content and mechanical two-dimensional movement (Gunderson, 2012).

Slowly, as the machine's video games that were played on were developed, the boundaries of content and movement were broadened. Video games were now able to stray away from traditional linear narratives, such as eating all the dots, and moved towards more intricate and complex game design, such as open world map exploration (Juul, 2002). With non-linear maps, open worlds, and complex movement mechanics, video games now held opportunities for game developers to flesh out their game narratives and game play replay-ability by adding side quests, side stories, and optional achievements that did not aid the main narrative but added value to those who wished to master all the content that the video game possibly offered (Thygesen, 2014; Krall & Menzies 2012).

The more frequent use of open world maps, and the addition of more complex movement mechanics allowed players to complete the same narrative in a multitude of different ways (Thygesen, 2014). Essentially, no

player would complete the same game the same way as another player because there were too many optional ways to complete the game. This also allowed game developers the ability to now add harder challenges, such as bosses, to test the mechanical skills of more experienced players, without making the game narrative hard or impossible to complete for a newer less experienced player (Juul, 2002; Thygesen, 2014). These challenges, in conjunction with testing the mechanical skill of a player, would also allow the game to keep its replay-ability, as there was life in the game after the content of the main story ended (Thygesen, 2014).

These challenges and achievements are where the study of external information sources could possibly focus on in the future. This is because the completion of certain challenges results in item or badge rewards allowing a player to gain rapport and in-game recognition for completing these desirable tasks (Nicholson, 2014). As the number of players who have completed certain challenges slowly grows, the online game community becomes a community of practice where more and more players begin to slowly learn how to complete a task more and more efficiently (Nicholson, 2014). This process can unfortunately take a long time, and less dedicated players may even find themselves falling behind the more repetitive and dedicated player (Nicholson, 2014). On one side there will be a player base who has the game knowledge to complete these challenges, while the other side of the game's community must either learn to complete them by themselves or wait for a more experienced player to share their secrets.

An example of these side challenges can often be seen within the game Old School RuneScape (OSRS). A particular challenge is gear grinds, in which a player has to complete a boss, or continuously grind, meaning they may kill a boss in hope of getting a rate drop to upgrade gear. The game can of course be completed using basic and minimal gear; however, the completion of the game is made much faster with items which have higher specifications. This makes the gear grinds worth it, as the desirability to finish the game is extremely high. Unfortunately, for many inexperienced players, these gear grinds are often extremely complex and require hours of in-game experience fighting the boss, just to learn how to effectively kill it once. Most bosses will require players to play at a high state of mechanical game skill in learning boss rotations, movement mechanics, gear switches, prayer switches, and how to efficiently heal to even have a chance at killing the boss, which will often then give them an even smaller chance at receiving a rare gear upgrade. These boss fights are opposed to standard monster fights in OSRS where a player just requires one click to attack and kill the monster while not having to move. By comparison, there is a huge jump in skill and in-game knowledge between fighting a boss, over fighting a standard OSRS monster.

This jump in skill and knowledge is the primary scope that this research project aims to address. It is also the primary reason that many new and less experienced players resort to using external information sources. This is because these external information sources can aid a player's knowledge and ability to complete these in-game challenges. The use of these external information sources will usually give players information that they cannot get in-game and will often aid and build on the existing game experience by giving them a slight upper hand against other players or the game itself.

These external information sources can be on many various platforms, usually coming from online forums like Reddit, or even video streaming platforms such as YouTube or Twitch.tv. These sites are able to host community discussions or forum threads, in which the community can ask and share information. In turn they are often recipients of likes, upvotes, and commendations, which again incentivises people to contribute, as their positive behaviour is rewarded and reinforced by public affirmation. In these situations, it is noticeable to see a video game community merging across platforms to these third-party sites and platforms, utilising these public spaces to share their interest and information for the video games that they play.

Platforms such as YouTube allow players to play alongside a video and copy their movements and process live. For OSRS there is a large quest guiding community in which a player will record a quest from start to finish with no cuts, often times going over 60 minutes in length, so that other players can follow each process step-by-step (Slayermusiq1, 2018). Another facet of these videos comes in bossing guides, in which a player will complete a full boss fight, often going over 60 minutes in length, so players can follow each step to completing the boss fight (Slayermusiq1, 2018). Both of these platforms offer visual community, and solo-based external sources of information in which a player can interact with the video game outside the actual world of the video game itself.

Moving forward from these more traditional external sources, there has most recently been a development and drive for external apps which are extensions of existing video games. The three examples I will expand upon below are as follows.

Faceit:

A third-party service which hosts 128 tick servers, which are double the speed and registry of the CSGO runs servers which are 64 tick. This equates to more accurate movement, overall accuracy, and player hit registry. The service has its own client which players can team up in, enter competitive matches, and can queue against other players playing Faceit, just like the base CSGO game. However, they also run competitive tournaments, host better servers, have a better anti-cheat, and a stronger following due to the large number of CSGO professionals who use their service. In essence, it is like a premium version of the already existing CSGO competitive matchmaking servers.

The reason why the service has grown in popularity is due to its superior servers, which has been a constant issue with vanilla CSGO (Alexdicko, 2016; Loczi, 2016). Although players have often petitioned to get CSGO to switch their server tick rates to 128, it is speculated that the developers will not do so due to the possibility of some players being unable to play on 128 tick servers with cheaper computer hardware (Adinida, 2017). This actually drove a large number of people to use Faceit as you can use their services for free, you get access to better servers, and they generally have a higher standard of players (Loczi, 2016). There is also a paid version of Faceit which gives you premium benefits, however, a player does not need to pay any money to use Faceit as an added-value application to the base competitive matchmaking of CSGO.

Dreamteam.gg:

A CSGO looking for group (LFG) service which operates through a website and helps teams find players and players find teams. With a layout similar to that of a job search website, players can prescribe their skill levels, server locations, language, preferred game role, and how competitively they wish to play. A team can list an advertisement of sorts for openings, and players can advertise themselves as free agents willing to join any team.

This method of LFG is less intrusive and abrasive than the current matchmaking system used by the core game where it will place five random players in a team together to play in a competitive CSGO match. This current system in CSGO allows for groups of two, three or four participants to be placed with random players to complete the five-player team. It is through this method of matchmaking where a majority of issues arise from toxic behaviour when you have a common situation where a group of friends is teamed with one or two random players. The majority group can kick, mute, and verbally abuse the random players with little to no repercussions, as CSGO does not log the voice communications.

By contrast, the utilisation of Dreamteam.gg by players allows for people to be matched into teams of five where everyone knows each other and will work more cohesively together by often using a third party VOIP service like Discord. It can be assumed that the use of a service like Dreamteam.gg can reduce the possibility a player has of running into a negative social interaction, likely resulting in a more positive relationship between a player and the game. This is another example of how players utilise third party software, apps, or resources to enhance their gaming experience, whether it be in direct effect of how they play, or even having the ability to modify who they play with.

RuneLite:

Runelite is another third-party client which is used to play the game OSRS. RuneLite was originally an open source client which encouraged its users to code their own plugins and make their own changes to the vanilla client to improve the quality of life. Since then it has been locked to only allow the developers to work alongside the OSRS team, as it is now the most popular client, preferred over the vanilla client and other various third-party clients.

RuneLite hosts various quality of life plugins, such as boss guides, which will tell you where to stand, and what to pray, at various points in a boss fight. It also has item markers which highlight items of variable importance when they are dropped on the ground. They also have a plugin which solves clue scrolls and puzzles, which reduces the amount of time a player has to spend trying to solve these puzzles in completing game content. Even more so, it has better graphics, a loot tracker, player statistic overlays, and bossing guides, all of which make the life of an OSRS player easier and much more enjoyable.

It has been debated whether RuneLite is making OSRS into "EasyScape," taking away all the challenges from a player and rather turning them into an autonomous player only clicking where the client tells them to click. In this instance, the third-party client does drastically improve quality of life, and is preferable to many players as it is the most popular client available to any player for free. However, this still remains as a prime example of a community coming together to create an added-value client, based on the wants and needs of the larger community.

Although it was prefaced that there is minimal literature within this field of research, two previous studies followed similar concepts to the scope of this project of creating an external information source to aid a competitive video game. Conley and Perry (2013) created an engine that would recommend what hero a player should select using a min-max model based on sourced data from valves API from over 55,000 competitive Dota 2 matches. The engine would effectively pick a hero, based not only on what the enemy team players had picked, but also taking into consideration the heroes that the player's own team had picked. Conley and Perry (2013) went on to claim that this engine would give the team using it an advantage before the game even begins due to the drastic ramifications of a team that has more devised hero choices. This meant that the model not only considered which heroes the enemy players chose, but also which heroes a player's teammates chose.

There was however, one flaw within their study. Every few months the in-game meta, which are the community's accepted unwritten rules of play, would be drastically changed, which meant their model was only viable for the meta that they had programmed it for (Conley, Perry, 2013). However, Conley and Perry (2013) both concluded that comparing hero composition against whether a team won or lost would be a useful resource to competitive players of Dota 2.

Continuing on from this work, da Costa Oliveria, Placides, Baffa, and da Veiga Machado (2017) shifted the platform from Dota 2 to League of Legends (LOL). Again, affirming what Conley and Perry (2013) had found was accurate, specifically that hero composition within a team can be the key to winning matches (da Costa Oliveria et al., 2017). Like the previous study, min-max modelling and algorithms were used to compose players hero picks based from what heroes their team members and opposing team members had chosen. Unfortunately, also like the previous study, constant meta updates and content developments meant that the model created would become redundant quite rapidly (da Costa Oliveria et al., 2017). It is critical to note that although the model was limited to a short period of use, da Costa Oliveria et al. (2017) concluded by discussing how this style of modelling can be proficient within the scope of competitive and causal play of video games.

It can be assessed from this point from the above studies, that there was a sub-focus in correcting how players make decisions within the video game environment. Although both studies noted how experts can easily make these split-second decisions, they both imply that these information models can definitely aid the more casual of players in choosing appropriate heroes based on team and opposing team picks (da Costa Oliveria et al., 2017; Conley & Perry, 2013). It would be appropriate to conclude that from the foundations that da Costa Oliveria et al. (2017) have laid, that the use of information modelling for in-game decisions will aid players as opposed to hindering their performance.

Virtual Teams

Research indicates that the influence of video games is growing, as the age that children are being exposed to them becomes progressively younger each year (Nuangjumnonga & Mitomo, 2012). There is still limited research into the long-term effects that video games have on their players as this area of research is relatively

modern. However, research does still exist which suggests that video games can be used as a teaching tool to teach players various life skills other than virtually killing one another (Cascio & Shurygailo, 2003; Jang & Ryu, 2011; Siitonen, 2009 Mysirlaki & Paraskeva, 2010).

Mysirlaki and Paraskeva (2010) began their research by prefacing that in order for people to compete in the 21st century, skills like problem solving, critical thinking, experimentation, and collaboration are imperative. With technology getting more complex, as well as business networks growing, individuals are struggling to survive while collaborators cannot help but thrive (Mysirlaki & Paraskeva, 2010). With continuing development in information and communication technologies, like Voice over Internet Protocol (VoIP) services, the ease in how people can communicate and collaborate virtually has increased (Benefield, Shen & Leavitt, 2016). In consideration of these technological developments it can be of no surprise as to why virtual teams are an effective tool used throughout modern business organisations. Furthermore, as virtual teams are not geographically dependent, they can exist and work through diverse hours, locations, and environments that traditional teams cannot (Benefield et al., 2016; Cascio & Shurygailo, 2003).

It should however be prefaced as to what defines a virtual team. Mysirlaki and Paraskeva (2010) discuss that virtual teams begin to exist when a group must collaborate virtually to reach a shared goal which cannot be simply obtained by a sole member of the group. This group is therefore not held to the constraints of a traditional group and can therefore be untied from a time or place and can operate without the guidance of a dedicated leader (Mysirlaki & Paraskeva, 2010). Throughout the process it is not uncommon for the group to become a community of practice in which group roles are formed naturally without dictation or allocation, which often results in a higher standard of performance as the sense of belonging within a community correlates with high group performance (Mysirlaki & Paraskeva, 2010; Peyton, Young & Lutters, 2013; Sangster, Mendonca & Gray, 2016). In essence, it can be understood that virtual teams are groups of collaborators with shared goals, free from the constraints of time and place, operating with or without a leader, in which performance can almost be dictated by the familiarity of the group and its members.

Multiplayer Gaming

Exploring the literature, it was revealed there is a correlation between virtual teams, and teams within a multiplayer game, which draws parallel conclusions across definitions of both subjects. For example, Cascio and Shurygailo (2003) discussed the initial requirements for a virtual team where the members of the group must communicate and work towards a common goal while also being required to be flexible and reactive in order to reach that goal (Cascio & Shurygailo, 2003). From this definition, similarities can start to be drawn between virtual business teams, and virtual gaming teams. Jang and Ryu (2011) came to a similar conclusion when their research indicated that the process of completing projects in a virtual business team was comparable to the process of completing missions in a virtual gaming team. Mysirlaki and Paraskeva (2012) furthered this idea when they discussed how a shared goal of a virtual team is one that cannot be completed by any group member individually. This can be translated across to the virtual environment of CSGO. Much like a virtual business team, collaboration between members is imperative for success (Cascio & Shurygailo, 2003). Within a competitive game of CSGO, the collaboration of players to attack or defend together is more effective than one individual's effort. Therefore, the collaboration between players within a virtual world is also necessary for a team's success (Siitonen, 2009). Finally, just as players are delegated different roles in virtual business teams, an effective virtual gaming team strategy relies on the delegation of tasks that are suitable with each players skill set (Nuangjumnong, 2016). For instance, particular players will know different bomb sites, or strategies better than other players, and being able to delegate roles and tasks to the appropriate players will result in a more enjoyable team experience (Peyton, Young & Lutters, 2013).

With minimal distinctions found between business and gaming virtual teams, further research began to delve into what players could learn from these new collaborative environments (Ducheneaut & Moore, 2005; Mysirlaki & Paraskeva, 2010; Mysirlaki & Paraskeva, 2012; Nuangjumnong, 2016; Sangster, Mendonca & Gray, 2016). Likening virtual gaming team play to a sports team, Ducheneaut and Moore (2005) found that much like in real life, players of virtual games who refuse to play for the team are shunned rapidly. By receiving

positive feedback from other players for playing collaboratively, players can begin to build positive behaviour patterns for playing as team members, rather than individuals (Ducheneaut & Moore, 2005). Furthermore, most multiplayer online games will reward collaboration among players, as working as a team provides more rewards, such as winning the game, beating the boss, and completing the quest (Mysirlaki & Paraskeva, 2010). Nuangjumnong (2016) used social learning theory to discover that players would actually learn new behaviours by direct experience, or observation of others within a gaming environment. Therefore, watching and experiencing the positives of collaboratively working, over playing as an individual, can be learnt through watching and playing multiplayer online games. Mysirlaki and Paraskeva (2012) support this claim, as their study found that multiplayer online game communities create a learning environment which is not deliberate. It occurs naturally, and as it is a community of practice, through adoption of particular behaviours, new members become experienced members and the cycle of experience continues (Mysirlaki & Paraskeva, 2012).

Leadership

Historically, previous research suggests a similar pattern of findings, which is the indication that multiplayer online games have a positive impact on the development of leadership skills (Lisk, Kaplancali & Riggio, 2012; Nuangjumnong, 2016; Bostan & Kaplancali, 2010; Jang & Ryu, 2011). Initially, Jang and Ryu (2011) began a discourse of discussion over the consideration that multiplayer online gaming environments acted as a 'third place' where players could practice and improve their leadership skills. This was affirmed by Lisk, Kaplancali and Riggio (2012), who expanded on Kirriemuir's (2012) earlier literature which discussed how multiplayer online games act as a risk-free environment which encourages players explorative actions. These explorative actions within multiplayer games were further encouraged as players are provided with instant feedback which provokes further curiosity and explorative learning (Lisk, Kaplancali & Riggio, 2012). Therefore, this 'third place' acts as an ideal platform in which players are free to explore, and practice new leadership skills and techniques with minimal repercussions. More recently, Nuangjumnong (2016) made the comparison that both real world leaders and virtual leaders are bound by similar situational control scenarios.

It can be concluded that there are many similarities found within literature between offline and online leadership scenarios and behaviours exhibited by players within these virtual environments. It can therefore be suggested that there is a strong connection between leadership behavioural development and multiplayer online gaming. On this assumption of connection, the question still remains, how does gaming develop leadership?

When considering that many multiplayer online game teams are made up of random players, there is generally no agreed upon or persistent leader. Siitonen (2009) discovered when instances like this occurred, leadership roles would be circulated among team members. Critically, Van Dijk and Broekens (2010) furthered this discovery by considering that distributed leadership was a method of collaboration where leaders and non-leaders would swap roles to improve team performance when needed. Furthermore, they found that more successful teams tended to use this style of distributed leadership (Van Dijk & Broekens, 2010). Therefore, playing in a multiplayer online gaming team, even without a formal leader, will still expose a player to leadership scenarios and help develop their leadership skills.

Jang and Ryu (2011) explored previous research proposed by Yee (2006) and found support that suggested there is a positive relationship between offline leadership skills and online game experiences. They continued to find that players who belong to multiplayer online game communities gain more exposure to interacting with other players which led to improved leadership skills (Jang & Ryu, 2011). Once again building from these previous studies, Siewiorek, Gegenfurtner, Lainema, Saarinen and Lehtinen (2013) found that multiplayer online game environments can be efficient tools in helping students familiarise themselves with leadership scenarios inside a virtual work setting. It can therefore be assessed that the immersion and the connection made between the players of these multiplayer online games, works in a positive and effective manner to develop upon their leadership skills.

Social

Although it was often a common assumption and speculation that gaming was an anti-social activity, modern literature indicates that it is in fact a community that harbours real world social learning (Cole & Griffiths, 2007; Halloran, Rogers & Fitzpatrick, 2003; Williams, Ducheneaut, Xiong, Zhang, Yee & Nickell, 2006; McEwan, Gutwin, Mandryk & Nacke, 2012; Jang & Ryu, 2011; Lenhart, Kahne, Middaugh, Macgill, Evans & Vitak, 2008). It was suggested by Halloran, Rogers and Fitzpatrick (2003) that gaming had moved from an individual venture to one that provides its players with a social experience. Focusing primarily on the voice communication feature implemented across many multiplayer games, they suggested that players play games for social pleasure, to meet new people, and to build new friendships (Halloran, Rogers & Fitzpatrick, 2003). Expanding upon this concept, Ducheneaut and Moore (2004) began discussions on how game developers are actively designing virtual worlds that inspire and promote social interactions between players. This is due to its operating in part as an essential factor in the success of a popular virtual world, therefore indicating that multiplayer online games are today primarily structured to force social interactions between players (Ducheneaut & Moore, 2004). This is again reinforced by the study of Lenhart et al. (2008) which affirmed that although the public perception of a gamer is one that is antisocial, in reality, even the most active gamers still socially interact and engage as much as people who rarely game. Although the method of communication may differ from face-to-face interaction, "multiplayer gaming has become a social experience – one that can constitute a social pleasure" (Halloran, Rogers & Fitzpatrick, 2003, p. 1). Furthermore, by looking at the ways that games are now structured with text, voice, and player interactions, it becomes evident that developers are putting less emphasis on personal conquest against artificial intelligence and instead are focusing more on creating a virtual social event which promotes interactions that represent reality (Papargyris & Poulymenakou, 2005; McEwan, Gutwin, Mandryk & Nacke, 2012).

Given that multiplayer games act as spaces which promote social interaction and engagement, much of the literature affirms that these interactions act as a space for social learning (Ducheneaut & Moore, 2005; Huffaker, Wang, Treem, Ahmad, Fullerton, Williams & Contractor, 2009; O'Connor & Menaker, 2008; Jang & Ryu, 2011; Lisk, Kaplancali & Riggio, 2012; Benefield, Shen & Leavitt, 2016). In the majority of multiplayer games, communication is a necessity for your team's success – it is also the greatest tool a new player has in learning the mechanics and methods of the game (Ducheneaut & Moore, 2005). Interestingly, Benefield, Shen and Leavitt (2016) found that when a team on a multiplayer game fully optimises its interdependence in social interaction and collaboration, they will work more effectively. This positive interaction offers players the invaluable experience of working as a group towards a common goal. Lenhart et al. (2008) affirmed previous literature discussing how working towards a common goal in an online team can be directly compared to learning from an offline team in the workplace or community. Therefore, when players are positively awarded for working as a team, by winning the round, completing the dungeon, or beating the enemy team, they learn that collaborative play and teamwork is an essential factor towards personal success within these virtual worlds (Ducheneaut & Moore, 2004). As Lenhart et al. (2008) previously discussed, what players learn from positive reward and collaboration in an online team can be used in their offline lives as well.

Unfortunately, although many positives can come from sociability within these virtual worlds, they are still worlds fraught with danger. Kuznekoff and Rose (2013) discussed the hypernegative effect that can occur during social interactions in virtual worlds. Many multiplayer games have set time limits, effortless communication methods, and a low expectancy to meet the same player again, which can encourage overly negative interactions. In consideration of the above, and the fact that players can hide their real identity with ease, these virtual worlds create the ideal environment for some players to vent and react overly negatively towards other players who coexist within these virtual worlds (Kuznekoff & Rose, 2013). Subsequently, to further a team's performance, Siitonen (2009) found that although fun was an integral part of gaming, players thought that it should sometimes be inferior to playing efficiently. While these virtual worlds provide a space for social learning, they also open up players to overtly negative interactions which they would not be subject to when interacting face-to-face – this is connected to a phenomenon known as online disinhibition.

Online Disinhibition

Negative interactions are not an uncommon occurrence within a virtual world. Unfortunately, the large social appeal of virtual worlds inherently creates the perfect environment for this activity. Lapidot-Leffler and Barak (2014) discussed how online environments lower a participant's behavioural inhibitions. The study focused on the key importance of eye-contact in communication, and therefore there is a lack of eye-contact present within online communication. The results showed that the lack of eye-contact caused by virtual communication reinforced negative behaviour, so subsequently, they found that when eye-contact was enforced, the occurrence of negative interactions was significantly reduced (Lapidot-Lefler & Barak, 2012). Building upon this foundation, Kwak, Blackburn and Han (2015) examined how the ambiguity of a player's personality online and offline was so distant that they could often be oblivious to their own negative behaviours. They further discussed a similar link found by Lapidot-Lefler and Barak (2012), that players disconnect a relationship between real and virtual worlds, which leaves a common root from which negative online behaviours can stem. Similarly, in a much earlier piece of work from Suler (2004), it was discovered that a person's online self becomes compartmentalised. In other words, a player will entirely separate their real-life personality from that of their virtual personality. Suler (2004) went on to discover that the reason for this compartmentalisation was so that a person can negate responsibility of their online actions. This allows for players to behave in a manner that they may not see as appropriate within their real-life, but due to this complete disconnect, they are able to avert any responsibility for their negative actions (Suler, 2004). This whole disconnect was labelled within Lapidot-Lefler and Barak's (2012) study as 'online disinhibition,' in which the above discussion was defined as an online user lowering their behavioural standards of inhibitions within a virtual or online environment.

This disinhibition can lead to a multitude of issues and factors; firstly hypernegativity. Walther and Parks (2002) had previously discussed the implications of the hypernegative effect within a virtual world which took into consideration time restrictions, limited chance of future interactions, and how accessible computer mediated communication was. They hypothesised that after taking into consideration all of the above factors, that virtual worlds almost harboured the perfect environment for players to act and receive negative communications and behaviours. Kuznekoff and Rose (2012) would later go on to affirm this theory finding that effortless communication, low expectation of future interactions and limited boundaries actually promoted this type of negative behaviour. The above factors would inherently host an environment conducive to creating the phenomenon for the hypernegative effect that Walther and Parks (2002) had discovered a decade earlier.

The second factor is dissociative anonymity. This is the concept that virtual worlds allow a player to hide their real-life identity, or even alter their identity enough to appear as another person (Suler, 2004). This aspect allows a player to separate their actions online, again from their real life, which in turn gives players confidence in acting out, knowing that there is such a slim chance that they will have any future interactions with any of the other players that they meet online (Suler, 2004; Kuzenkoff & Rose, 2013). This is even more prevalent within a game like CSGO in which a player has no control over who they get on their team, if they have not already partied up in a full team of five players. "The condition of being unknown to others, is considered a major determinant of disinhibitive behaviour" (Lapidot-Lefler & Barak, 2012. p. 435). Again, the behaviour is further reinforced, as this cloak of anonymity gives a player exhibiting negative behaviour limited feelings of vulnerability or limited chances of self-disclosing real-life information.

Lastly, the factor of invisibility – this is often confused with dissociative anonymity. It is critical to note that these two factors must be distinguished when discussing virtual worlds. Invisibility is the idea that players do not need to concern themselves with their real-life image about how they look, or how they sound. Online worlds leave limited opportunity for actual interpersonal cues such as body language or facial expression, which allows players to focus primarily on the single dimension of a message or communication, as opposed to listening for voice inferences or body language cues (Suler, 2004). This allows players of any virtual world to act as a gate-keeper to their level of social presence, and visibility during any social interactions they may have with other players, through the use of chat messages, voice messages, video calls, or personal images, real or fake (Lapidot-Lefler & Barak, 2012). The issue or even benefit that is consistent with a virtual world player's

invisibility, is that the confidence and courage that a player displays can be used to say things that they otherwise would not in their real-life (Suler, 2004). On a positive note, these worlds can allow players who cannot handle real-life social interactions to instead have a platform on which to socialise and become part of a close-knit community (Suler, 2004). However, this also empowers players unable to act negatively in their real-life a platform to release their built up disinhibited negative behaviour on complete strangers, some who will be more affected by it than others (Suler, 2004).

In summary, it is evident that virtual worlds offer a complete plethora of social learning opportunities, however, these opportunities are fraught with the danger of exposing players to enclosed spaces which are almost perfectly designed to host an environment of negative and toxic play.

Trust

Building trust is an important aspect within any team working towards a common goal, regardless of it being within a virtual world or real-life. However, it is much more difficult, and much more important to build trust within a virtual team as there is limited chance of interpersonal communication (Cascio & Shurygailo, 2003). The lack of interpersonal cues, such as eye-contact, body language, and speech inference are common issues of communication when individuals communicate within a virtual space (Lapidot-Lefler & Barak, 2012; Suler, 2004). However, it is important to note that trust does not necessarily need to be built through communication within a virtual team, as Cascio and Shurygailo (2003) examined that the mere repetition of setting expectations and completing those set expectations were enough to build a strong trust within a virtual team. This can relate to a competitive video game in which a team can build trust through completing tasks, quests, and bosses together without necessarily communicating to each other frequently. Although it must be added that Williams, Caplan, and Xiong (2007) found that there were significantly higher levels of relationship trust between players who would communicate via voice communication compared to text, such as in-game messages or email. This is caused by a more intimate and interpersonal link between the players communicating, reducing the dissociative anonymity and the perceived invisibility of an online stranger; in other words, giving a voice to pixels (Suler, 2004).

Building from these previous studies, Ratan, Chung, Shen, Williams, and Poole (2010) remarked positively on how multiplayer online games actually provide more opportunities to build trust than other spaces on the internet. The virtual worlds of these online multiplayer games are host to various social institutions, like competitive teams, online clans, guilds, and community servers, in which a consistent group of familiar players all play together within the same instance of a game (Ratan et al., 2010). These facets all provide players with intimate opportunities of trust-building social interactions. This can even relate to a lesser instance, such as a random mixed five-player CSGO team, in which the participants are thrown together with the single goal of winning the competitive match. Even within these short periods of interaction, players can still build strong bonds of team trust, by setting out to collaboratively set tasks and meet team expectations (Cascio & Shurygailo, 2003). Furthermore, when this is implemented into a guild scenario, where a mix of players form a group to play together, with the addition of voice communication, and the previously mentioned task set and task complete theory, these virtual worlds host a perfect online environment for players to sufficiently build relationship strength and trust (Ratan et al., 2010; Cascio & Shurygailo, 2003). In summary of their study, Ratan et al. (2010) found that their research showed evidential support that the social institutions such as guilds, in conjunction with interpersonal interactions such as voice communication within online multiplayer games, strongly related to building a person's trust.

Virtual Worlds

As technology within gaming graphics develops further, virtual worlds are becoming much more than a fantasy world. Virtual worlds now offer space which can reproduce and challenge the understood rules of social interaction, while simultaneously influencing its users to learn creative verbal dialogue, and non-verbal expressions (Wright, Boria & Breidenbach, 2002; Papargyris & Poulymenakou, 2005). These virtual worlds are

important to understand as they provide the space in which millions of players opt to immerse themselves to interact with others, as opposed to interacting with them face-to-face (Cole, Griffiths, 2007). Multiplayer games often force players to rely on each other to progress further into the games content – "This teaches gamers to be dependent on one another, which reinforces their relationships providing a good understanding of teamwork" (Cole & Griffiths, 2007, p. 576). In consideration of their often-expansive communication channels, these virtual worlds also offer players the ability to interact with other players from around the world (Nuangjumnong & Mitomo, 2012). These virtual worlds are not geographically bound, nor are they spaces in which your real-life influences how other players view your avatar. It is evident to see that virtual worlds are becoming an important part of social culture and social entertainment, with players holding an increasingly influential role in creating the content that they play by interacting with one another (Kuznekoff & Rose, 2013). In summary, virtual worlds are spaces in which players can play, interact, socialise, create, learn, and immerse themselves within a sense of safe realism (O'Connor & Menaker, 2008; Kuznekoff & Rose, 2013; Cole & Griffiths, 2007; Wright, Boria & Breidenbach, 2002; Papargyris & Poulymenakou, 2005). However, what makes a virtual world more preferred for its users to interact with than reality itself?

O'Connor and Menaker (2008) found that virtual worlds provided a more efficient learning environment as players are given the ability to reply, repeat, and learn from similar scenarios. They are done in a way that is also risk-free and in an environment that encourages and rewards trial and error – thus stimulating a player's creativity, curiosity, and discovery learning (Lisk, Kaplancali & Riggio, 2012). In developing upon this idea, Nuangjumnong (2016) discovered that players were more likely to display trial and error behaviour, as the consequences within virtual worlds are not irreversible like those in reality. Therefore, the format and layout of these virtual worlds explicitly promote the behaviours of creativity, discovery learning from receiving rewards or punishments from various in-game actions (Nuangjumnong, 2016). Cole and Griffiths (2007) also furthered previous literature when they commented on how these virtual worlds act as a safe space for players to express themselves in ways that they would not normally do in their real life. Virtual worlds do not take account of a player's appearance, age, gender, sexual preference, or political ideologies for example, allowing players to become a new person, and have a fresh start within a seemingly realistic virtual space (Cole & Griffiths, 2007). Critically, Lisk, Kaplancali, and Riggio (2012) found that due to the openness and customisation of these virtual worlds, they are being used to create training programmes for offline skills. In summary, these virtual worlds act as hosts to "games that provide us with easier ways to experience what we cannot experience in real life" (Jang & Ryu, 2011, p. 622).

3.0 Methodology

A traditional thesis would dedicate a chapter on the method of research, giving explanation to those methods used to reach the final results produced by the entire process. In the instance of this paper, a practice-based research paradigm was used to respond to a proposed set of current issues, and concerns.

Practice-Based Research

A 2006 paper by Candy (2006) discussed practice-based research as a process in which new knowledge was gained through the act of practice, or through the outcomes of that practice. Outcomes included the production of artefacts of digital media which would be supported and contextualised through a description of words that would only give meaning with direct reference to the produced outcomes (Candy, 2006).

Previously, Scrivener and Chapman (2004) suggested a practice-based creative-production framework which goes as follows:

1. Identification of issues, concerns, or interests to be addressed by the project.
2. Review of historical theory, knowledge, and information relevant to the identified issue, concern, or interest.
3. Production of work, reflecting on the process and steps used in the creation of the artefact.
4. Post-project reflection.
5. Critical assessment of one's own reflection. (Looking toward the future).

With this list in mind, the following methods were utilised to ensure that the framework provided by both Candy (2006), Scrivener and Chapman (2004), were addressed and acted upon throughout the process of this practice-based research project.

Table 3-1: Practice-Based Research Framework

Methods	**Addressing**
Introduction	Identification of the current issues surrounding how virtual teams communicate and interact
Literature Review	Overview of the current theories and knowledge in support of this specific field of research
Process	The steps taken in production of the final artefact, and the issues, concerns, and critical reflection noted during the entirety of this process
Discussion	Reflection of the process and practice, showing the meaning and significance of the final artefact
Conclusion	Critical reflection upon the entire exegesis and discussion, looking forward and giving recommendations for future research

The intention of the following work throughout this exegesis is to present the process and outcomes undertaken throughout this practice-based research to reach my final prototype application. This is in hope that future researchers will reflect upon my practice to further pursue the overarching issue that has been identified throughout this exegesis.

4.0 Process & Results

In consideration of the platform that online multiplayer video games provide for players to learn and interact on, it can be expected that an external information application may help newer players integrate within a team of more experienced players. This in turn, reduces the likelihood of targeted negative social behaviour.

Following is a discussion into the journey taken in constructing an exemplary working prototype which showcases how such information could be explained through the use of an application. In-game economy, reward data, decision tree pathways, in-game meta, buy option equations, wireframes, and prototypes will be discussed and justified through the use of visual and written explanation. This will include commentary of ideas, and changes that were made throughout the journey of constructing a final working prototype.

In-game Economy

The in-game economy of CSGO has been meticulously constructed by the developers, Valve, in such a way that it mitigates two teams which are very unequal. The terrorist team is put at an economical advantage as they are the team which needs to actively attack, capture, and then defend a site execution. The counter-terrorist team are put at an economic disadvantage as they are given time at the start of each round to set up active defence positions.

The in-game economy, which had not drastically changed for around a decade, recently changed in late 2018 to make the first three rounds more competitive. Initially, the team that lost the first round was awarded $1400, and it was considered the first-round loss bonus. However, following the meta update, the team that lost the first round at the beginning of a game half would be awarded $1900 opposed to $1400 which would allow them to either force, or save one for a full buy. Context has been given to this economy change, as during the period of my research, the CSGO economy was changed again in early 2019 and re-balanced to a meta which is drastically different to the one stated above.

Reward Data

To fully understand how the in-game reward system operated within CSGO, I needed to record and make a visual representation of this data. This occurred in the form of a table which listed the potential rewards for players and their teams throughout the 30 possible rounds within a single game of CSGO. After giving consideration to the apparent complexities of the reward system revealed by the data table, specifically the reward variables of each round, I had to calculate how many possible round win and loss scenarios there could be within one game. Using the equation 2^30 (win/loss^possible rounds) revealed that there are over 1,073,741,824 possible round win and loss scenarios. In conjunction with this, there were over 1000 team and player reward variables each round (see Figure 4-1: Initial Rough Equations)

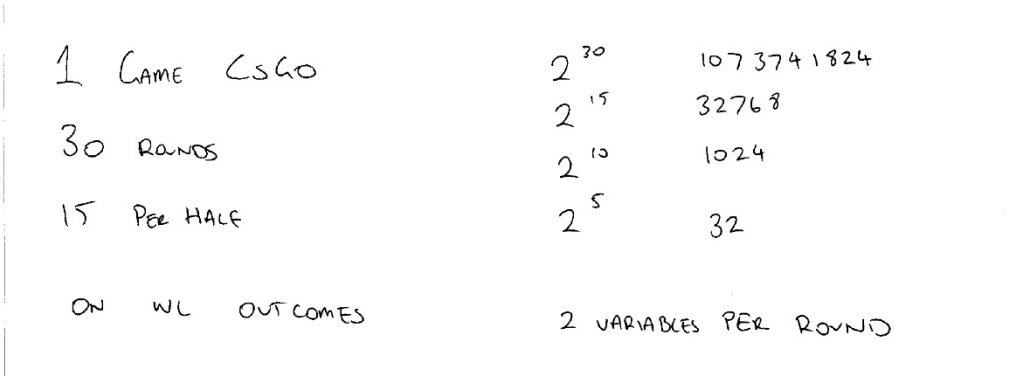


Figure 4-1: Initial Rough Equations

(Source: Charles D. Jordan, 2019)

This was the first issue I came across. In consideration of the duration and scope of this project, these variables would be too complex to account for. I made the decision to simplify and focus primarily on team win and loss rewards. The reason behind this decision stems from the ideology that although money is tracked and rewarded individually, when a player buys, they are buying for the team. In other words, their buy is to help the team, not themselves. Generally, there will be one leading player on a team who is called the 'Top Frag'. Although new players may aspire to one day fill this role, their mechanical skills of the game will fail them before their aspirations do. Therefore, with the assumption that a new player will receive little in the way of individual rewards, their main source of money throughout a game will come from team rewards.

Decision Tree Pathways

Setting my terms of reference for the project towards solely focusing on team round rewards, a secondary visual method of mapping win and loss pathways was constructed. This visual construction would help by mapping out each individual round pathway and point as to allow for each specific point in a game being considered as an individual round. This allows for a more specific buy depending on the previous round history of wins or losses.

For example, if the score is 2-2, there would be more than one round history that would lead to that eventual outcome. Each of the following round histories would result in different team money and different buys for the current fifth round: W-W-L-L, W-L-W-L, W-L-L-W. The use of a visual pathway would allow me to make sure each round was treated specifically, and each buy for that pathway was customised to best suit the team money of that round. This was opposed to creating a generic buy if the overall score was 2-2.

With the decision tree pathways constructed, this allowed me to start to work around how many rounds were necessary to map out my exemplary prototype. Given that a game of CSGO could have over 1 billion round pathways, I did not believe I had the research time available to cater for a full game of CSGO. After tracking the basic win/loss bonuses on total team money over each consecutive round, I settled on making my prototype to cover the first 7 rounds of a CSGO half. The reason behind choosing 7 rounds is that by the 7th round, at a

minimum, a team should have had at least one full buy round. Therefore, as this model was aimed at getting a team to their first buy round in the most efficient manner, at this stage the framework did not need to be as expansive as to cover every single round of the game. However, in future, this may be a concept that should be expanded upon.

Figure 4-2: Initial 5 Round Win/Loss Decision Tree

(Source: Charles D. Jordan, 2019)

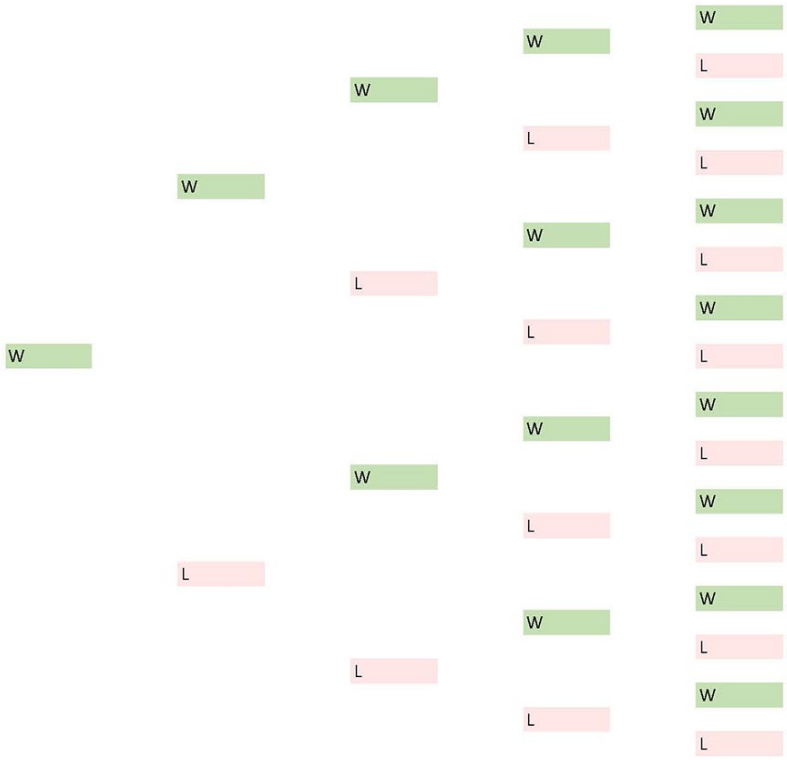
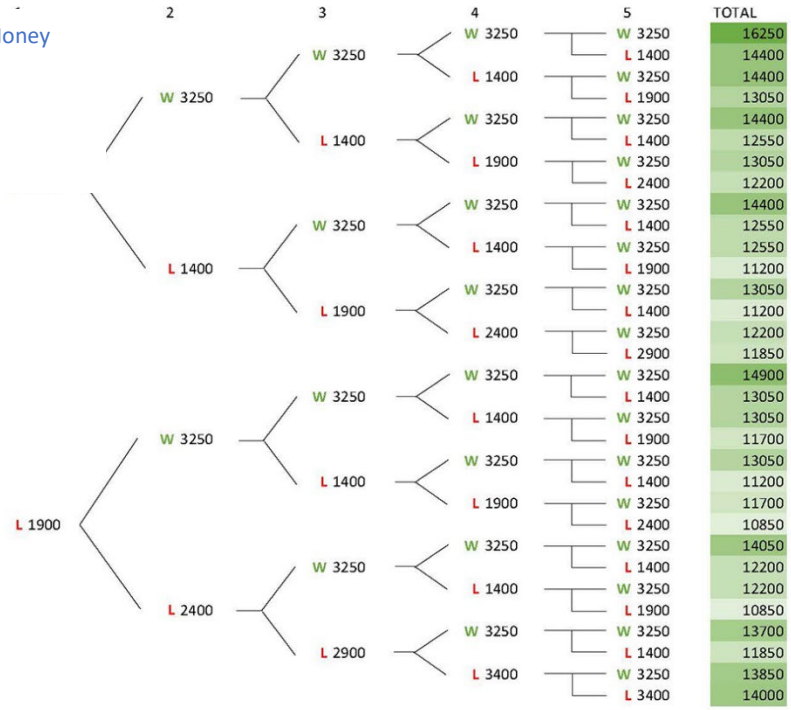


Figure 4-3: 5 Round Win/Loss Decision Tree with Money

(Source: Charles D. Jordan, 2019)



In-game Meta

The in-game meta is the current unwritten rules of play which are largely accepted by a game's community. These rules can exist, from what characters to play, what weapons to buy, and even how a player should manoeuvre around the virtual game worlds. These unwritten rules of play are often rulings that are picked up by newer players over their time of playing a game. However, this research project aims to enhance and speed up this learning process.

With the completion of the decision tree pathways, an in-game meta needed to be established which would allow generic common buys to be applied to individual rounds. This would also streamline thought processes, creativity and thinking, and eliminate a lot of uncertainties and weapon variables that a new player can be overwhelmed by. Furthermore, this would also allow newer players to spend less time trawling through a plethora of weapons and utility load outs available for purchase. This would then allow them to spend more time learning the weapons which are most commonly used by the majority of the experienced competitive player base. The in-game meta constructed can be broken down into four categories:

Full Save:

A full save will generally occur when a team has lost a round following a force buy. Ultimately, a team will choose to sacrifice one round which will allow them to be at an equal playing field economically in the round that follows. This is opposed to double force buying which would put them at an economic disadvantage for multiple rounds until they decided to double save. This equates to a team almost certainly losing five+ rounds before a full buy, as opposed to only 3 rounds. Figure 4-4 expresses how much money a team needs to have saved before they can implement an effective full save. This means that a full save will most often occur when a team is eligible for a third-round loss bonus which is $2400.

Force Buy:

A force buy is exactly what its name suggests. A team will spend as much money as they can knowing that they will have to save two rounds in a row no matter what their money situation is before they can full buy again. This buy strategy is also seen on the first and last round of the half as each team's economy is reset at the start of a half.

Eco Buy:

An economic (eco) buy similarly resembles a full save, however an eco-buy is more likely to occur throughout the course of a game than a full save. During an eco-buy, a team will buy and ensure they have enough money left that their current loss bonus will allow them to full buy the following round. By using the Figure 4-4 below, a terrorist team who may gain a $2400 bonus from losing the current round, will ensure that they have at least $1300 left each so that they can full buy the following round. On the other hand, a counter-terrorist team will gain a $2400 bonus from losing the current round; this will ensure that they have at least $1700 left so that they can full buy the following round.

Full Buy:

A full buy indicates that both teams have enough to buy a main primary automatic rifle and full armour. This is $3700 for the terrorist side, and $4100 on the counter-terrorist side. The extra money left is usually used for utilities such as tactical grenades and defuse kits.

As a general rule for CSGO economy basics, a team should always full buy or force buy off a win. This is because a team should always try and keep their winning streak, meaning that they need to be as well-equipped as possible following a round win. With this in mind, my thinking was able to be streamlined into primarily focusing on ensuring that a losing team had enough money to get back on a full buy as soon as possible.

It is important to note that a full buy should generally only occur when the poorest teammate can afford to full buy. Until this point, it is in the best interest of the team to eco-buy; meaning that they can have a cohesive full buy round which gives a team a higher advantage.

Figure 4-4: Loss Bonus v Money needed for each effective buy

(Source: Charles D. Jordan, 2019)

Loss Bonus	Loss Bonus	Buy Type	T	CT
1900	1400	Full Save	N/A	N/A
2400	1900		1800	2200
2900	2400	Force Buy	Force 1st + DS	Force 1st + DS
3400	2900		400 + DS	Force 1st + DS
3900	3400	Eco Buy	N/A	N/A
			(2300) + 1400	(2700) + 1400
		Full Buy	3700 + 1200	4100 + 1400

Buy Option Equations

To efficiently create the content and information that would sit within the exemplary prototype, the buy money for each round needed to be calculated. This was a timely process as you could only figure out the buy money for an individual round after you have worked out the buy money, round reward, money spent, and money after for each individual round that came previously to the round you were calculating the buy money for. This again applied back to the previous notion discovered, that each pathway point needed to be treated as an individual piece of content and information which was reactive to what occurred historically. With this in mind, I followed each individual pathway down the tree, mapping out what a team should buy in consideration of what the historical round win/loss, round reward, buy money, and money after buy was. Below is a list of the data columns used, and the purposes they held in the construction of the data set below.

Round Reward

The round reward indicates the team reward gained from either winning the round, or the money the team gained from their current loss bonus.

Buy Money

Buy money is what a team has available at that current round to purchase weapons and equipment with. This is a combination of the round reward with what money a team has left over following their last buy.

Money Spent

The money spent is total sum of money that has been used to purchase weapons and equipment.

Money After

The money after is what a team has left following the equation of:

'Buy Money' minus 'Money Spent' = 'Money After'

The money after was then used with the following pathway's round reward to figure out how much a team could buy.

Extra (Win)

How much extra a team could spend if they were to win the following round.

Extra (Loss)

How much extra a team could spend if they were to lose the following round.

The final equations utilised throughout the entirety of the data set goes as follows:

'Money After' + 'Round Reward' = 'Buy Money'

'Buy Money' – 'Money Spent' = 'Money After'

Using the following steps to follow each individual pathway down resulted in the following data set creation.

Figures 4-5 through to 4-10 showcase the data set used which allowed me to the plug-in information to each individual page of the prototype. This data set helped eliminate the need to calculate and fill out buy information during the creative design phase of the project. This data set also gives evidence towards how expansive this project has been and how each round is treated as an individual round in relation to the rounds that have occurred previously.

Round	Round Reward	Buy Money	Money Spent	Money After	Extra (Win)	Extra (Loss)	Armour	Primary	Secondary
1	0	800	-650	150			Kevlar	-650	
W	3250	3350	-1900	1450	600	-1250	Kevlar	-650 MP9	-1250
W W	3250	4700	-4100	600	-250	-2100	Kevlar + Helmet	-1000 M4	-3100
W W W	3250	3850	-3750	100	-750	-2600	Kevlar	-650 M4	-3100
W W L	1400	2000	-1900	100	-750	-2100	Kevlar	-650 MP9	-1250
W W W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
W W W L	1400	1500	-1250	250	-600	-1950	Kevlar + Helmet	-1000	P250 -250
W W L W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
W W L L	1900	2000	-250	1750	900	50			P250 -250
W W W W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
W W W W L	1400	1500	-1250	250	-600	-1950	Kevlar + Helmet	-1000	P250 -250
W W W L W	3250	3500	-3250	250	-600	-2450	Kevlar + Helmet	-1000 Famas	-2250
W W W L L	1900	2150	-250	1900	1050	200			P250 -250
W W L W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
W W L W L	1400	1500	-1250	250	-600	-1950	Kevlar + Helmet	-1000	P250 -250
W W L L W	3250	5000	-4100	900	50	-1800	Kevlar + Helmet	-1000 M4	-3100
W W L L L	2400	4150	-4100	50	-800	-1150	Kevlar + Helmet	-1000 M4	-3100
W W W W W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
W W W W W L	1400	1500	-1250	250	-600	-1950	Kevlar + Helmet	-1000	P250 -250
W W W W L W	3250	3500	-3250	250	-600	-2450	Kevlar + Helmet	-1000 Famas	-2250
W W W W L L	1900	2100	-250	1850	1000	150			P250 -250
W W W L W W	3250	3500	-3250	250	-600	-2450	Kevlar + Helmet	-1000 Famas	-2250
W W W L W L	1400	1650	-1250	400	-450	-1800	Kevlar + Helmet	-1000	P250 -250
W W W L L W	3250	5150	-4100	1050	200	-1650	Kevlar + Helmet	-1000 M4	-3100
W W W L L L	2400	4300	-4100	200	-650	-1000	Kevlar + Helmet	-1000 M4	-3100
W W L W W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
W W L W W L	1400	1500	-1250	250	-600	-1950	Kevlar + Helmet	-1000	P250 -250
W W L W L W	3250	3500	-3250	250	-600	-2450	Kevlar + Helmet	-1000 Famas	-2250
W W L W L L	1900	2150	-250	1900	1050	200			P250 -250
W W L L W W	3250	4150	-4100	50	-800	-2650	Kevlar + Helmet	-1000 M4	-3100
W W L L W L	1400	2300	-2250	50	-800	-2150	Kevlar + Helmet	-1000 MP9	-1250
W W L L L W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
W W L L L L	2900	2950	-2250	700	-150	0	Kevlar + Helmet	-1000 MP9	-1250
Round	Round Reward	Buy Money	Money Spent	Money After	Extra (Win)	Extra (Loss)	Armour	Primary	Secondary
W L	1400	1850	-1500	350	-500	-1850	Kevlar + Helmet	-1000	Five-Seven -500
W L W	3250	3600	-3250	350	-500	-1850	Kevlar + Helmet	-1000 Famas	-2250
W L L	1900	2250	-500	1750	900	50			Five-Seven -500
W L W W	3250	3600	-3250	350	-500	-2350	Kevlar + Helmet	-1000 Famas	-2250
W L W L	1400	1750	-1500	250	-600	-1950	Kevlar + Helmet	-1000	Five-Seven -500
W L L W	3250	5000	-4100	900	50	-1800	Kevlar + Helmet	-1000 M4	-3100
W L L L	2400	4150	-4100	50	-800	-1150	Kevlar + Helmet	-1000 M4	-3100
W L W W W	3250	3600	-3250	350	-500	-2350	Kevlar + Helmet	-1000 Famas	-2250
W L W W L	1400	1750	-1500	250	-600	-1950	Kevlar + Helmet	-1000	Five-Seven -500
W L W L W	3250	3500	-3250	250	-600	-2450	Kevlar + Helmet	-1000 Famas	-2250
W L W L L	1900	2150	-250	1900	1050	200			P250 -250
W L L W W	3250	4150	-4100	50	-800	-2650	Kevlar + Helmet	-1000 M4	-3100
W L L W L	1400	2300	-2250	50	-800	-2150	Kevlar + Helmet	-1000 MP9	-1250
W L L L W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
W L L L L	2900	2950	-2250	700	-150	0	Kevlar + Helmet	-1000 MP9	-1250
W L W W W W	3250	3600	-3250	350	-500	-2350	Kevlar + Helmet	-1000 Famas	-2250
W L W W W L	1400	1750	-1500	250	-600	-1950	Kevlar + Helmet	-1000	Five-Seven -500
W L W W L W	3250	3500	-3250	250	-600	-2450	Kevlar + Helmet	-1000 Famas	-2250
W L W W L L	1900	2150	-250	1900	1050	200			P250 -250
W L W L W W	3250	3500	-3250	250	-600	-2450	Kevlar + Helmet	-1000 Famas	-2250
W L W L W L	1400	1650	-1500	150	-700	-2050	Kevlar + Helmet	-1000	Five-Seven -500
W L W L L W	3250	5150	-4100	1050	200	-1650	Kevlar + Helmet	-1000 M4	-3100
W L W L L L	2400	4300	-4100	200	-650	-1000	Kevlar + Helmet	-1000 M4	-3100
W L L W W W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
W L L W L W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000	Five-Seven -500
W L L W W L	3250	4100	-4100	0	-850	-700	Kevlar + Helmet	-1000 Famas	-2250
W L L L L L	3400	4100	-4100	0	-850	-700	Kevlar + Helmet	-1000 M4	-3100
Round	Round Reward	Buy Money	Money Spent	Money After	Extra (Win)	Extra (Loss)	Armour	Primary	Secondary
L	1900	2050	-250	1800	950	100			P250 -250
L W	3250	5050	-4100	950	100	-1750	Kevlar + Helmet	-1000 M4	-3100
L W W	3250	4200	-4100	100	-750	-2600	Kevlar + Helmet	-1000 M4	-3100
L W L	1400	2350	-2250	100	-750	-2100	Kevlar + Helmet	-1000 MP9	-1250
L W W W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
L W W L	1400	1450	-1150	300	-550	-1900	Kevlar	-650	Five-Seven -500
L W L W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L W L L	1900	2000	-250	1750	900	50			P250 -250
L W W W W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
L W W W L	1400	1450	-1150	300	-550	-1900	Kevlar	-650	Five-Seven -500
L W W L W	3250	3550	-3250	300	-550	-2400	Kevlar + Helmet	-1000 Famas	-2250
L W W L L	1900	2200	-500	1700	850	0			Five-Seven -500
L W L W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L W L W L	1400	1500	-1150	350	-500	-1850	Kevlar	-650	Five-Seven -500
L W L L W	3250	5000	-4100	900	50	-1800	Kevlar + Helmet	-1000 M4	-3100
L W L L L	2400	4150	-4100	50	-800	-1150	Kevlar + Helmet	-1000 M4	-3100
L W W W W W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
L W W W W L	1400	1450	-1150	300	-550	-1900	Kevlar	-650	Five-Seven -500
L W W W L W	3250	3550	-3250	300	-550	-2400	Kevlar + Helmet	-1000 Famas	-2250
L W W W L L	1900	2200	-500	1700	850	0			Five-Seven -500
L W W L W W	3250	3550	-3250	300	-550	-2400	Kevlar + Helmet	-1000 Famas	-2250
L W W L W L	1400	1700	-1500	200	-650	-2000	Kevlar + Helmet	-1000	Five-Seven -500
L W W L L W	3250	4950	-4100	850	0	-1850	Kevlar + Helmet	-1000 M4	-3100
L W W L L L	2400	4100	-4100	0	-850	-1200	Kevlar + Helmet	-1000 M4	-3100
L W L W W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L W L W W L	1400	1500	-1500	0	-850	-2200	Kevlar + Helmet	-1000	Five-Seven -500
L W L W L W	3250	3600	-3250	350	-500	-2350	Kevlar + Helmet	-1000 Famas	-2250
L W L W L L	1900	2250	-500	1750	900	50			Five-Seven -500
L W L L W W	3250	4150	-4100	50	-800	-2650	Kevlar + Helmet	-1000 M4	-3100
L W L L W L	1400	2300	-2250	50	-800	-2150	Kevlar + Helmet	-1000 MP9	-1250
L W L L L W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
L W L L L L	2900	2950	-2250	700	-150	0	Kevlar + Helmet	-1000 MP9	-1250
Round	Round Reward	Buy Money	Money Spent	Money After	Extra (Win)	Extra (Loss)	Armour	Primary	Secondary
L L	2400	4200	-4100	100	-750	-1100	Kevlar + Helmet	-1000 M4	-3100
L L W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L L L	2900	3000	-1900	1100	250	400	Kevlar	-650 MP9	-1250
L L W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L L W L	1400	1500	-1500	0	-850	-2200	Kevlar + Helmet	-1000	Five-Seven -500
L L L W	3250	4350	-4100	250	-600	-2450	Kevlar + Helmet	-1000 M4	-3100
L L L L	3400	4500	-4100	400	-450	-300	Kevlar + Helmet	-1000 M4	-3100
L L W W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L L W W L	1400	1500	-1500	0	-850	-2200	Kevlar + Helmet	-1000	Five-Seven -500
L L W L W	3250	3250	-3250	0	-850	-2700	Kevlar + Helmet	-1000 Famas	-2250
L L W L L	1900	1900	0	1900	1050	200			
L L L W W	3250	3500	-3250	250	-600	-2450	Kevlar + Helmet	-1000 Famas	-2250
L L L W L	1400	1650	-1500	150	-700	-2050	Kevlar + Helmet	-1000	Five-Seven -500
L L L L W	3250	3650	-3250	400	-450	-2300	Kevlar + Helmet	-1000 Famas	-2250
L L L L L	3400	3800	-2900	900	50	200	Kevlar	-650 Famas	-2250
L L W W W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L L W W W L	1400	1500	-1500	0	-850	-2200	Kevlar + Helmet	-1000	Five-Seven -500
L L W W L W	3250	3250	-3250	0	-850	-2700	Kevlar + Helmet	-1000 Famas	-2250
L L W W L L	1900	1900	-1900	0	-850	-1700	Kevlar	-650 MP9	-1250
L L W L W W	3250	3250	-3250	0	-850	-2700	Kevlar + Helmet	-1000 Famas	-2250
L L W L W L	1400	1400	-1150	250	-600	-1950	Kevlar	-650	Five-Seven -500
L L W L L W	3250	5150	-4100	1050	200	-1650	Kevlar + Helmet	-1000 M4	-3100
L L W L L L	2400	4300	-4100	200	-650	-1000	Kevlar + Helmet	-1000	Five-Seven -500
L L L W W W	3250	3500	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L L L W W L	1400	1650	-1500	150	-700	-2050	Kevlar + Helmet	-1000	Five-Seven -500
L L L W L W	3250	3400	-3250	150	-700	-2550	Kevlar + Helmet	-1000 Famas	-2250
L L L W L L	1900	2050	-250	1800	950	100			P250 -250
L L L L W W	3250	3650	-3250	400	-450	-2300	Kevlar + Helmet	-1000 Famas	-2250
L L L L W L	1400	1800	-1500	300	-550	-1900	Kevlar + Helmet	-1000	Five-Seven -500
L L L L L W	3250	4150	-4100	50	-800	-2650	Kevlar + Helmet	-1000 M4	-3100
L L L L L L	3400	4300	-4100	200	-650	-500	Kevlar + Helmet	-1000 M4	-3100
W L W L L L	2400	4300	-4100	200	-650	-1000	Kevlar + Helmet	-1000 M4	-3100
W L L W W W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
W L L W L W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000	Five-Seven -500
W L L W W L	1400	1450	-1150	300	-550	-1900	Kevlar	-650	Five-Seven -500
W L L L W W	3250	3950	-3250	700	-150	-2000	Kevlar + Helmet	-1000 Famas	-2250
W L L L L L	3400	4100	-4100	0	-850	-700	Kevlar + Helmet	-1000 M4	-3100
Round	Round Reward	Buy Money	Money Spent	Money After	Extra (Win)	Extra (Loss)	Armour	Primary	Secondary
L	1900	2050	-250	1800	950	100			P250 -250
L W	3250	5050	-4100	950	100	-1750	Kevlar + Helmet	-1000 M4	-3100
L W W	3250	4200	-4100	100	-750	-2600	Kevlar + Helmet	-1000 M4	-3100
L W L	1400	2350	-2250	100	-750	-2100	Kevlar + Helmet	-1000 MP9	-1250
L W W W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
L W W L	1400	1450	-1150	300	-550	-1900	Kevlar	-650	Five-Seven -500
L W L W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L W L L	1900	2000	-250	1750	900	50			P250 -250
L W W W W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
L W W W L	1400	1450	-1150	300	-550	-1900	Kevlar	-650	Five-Seven -500
L W W L W	3250	3550	-3250	300	-550	-2400	Kevlar + Helmet	-1000 Famas	-2250
L W W L L	1900	2200	-500	1700	850	0			Five-Seven -500
L W L W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L W L W L	1400	1500	-1150	350	-500	-1850	Kevlar	-650	Five-Seven -500
L W L L W	3250	5000	-4100	900	50	-1800	Kevlar + Helmet	-1000 M4	-3100
L W L L L	2400	4150	-4100	50	-800	-1150	Kevlar + Helmet	-1000 M4	-3100
L W W W W W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
L W W W W L	1400	1450	-1150	300	-550	-1900	Kevlar	-650	Five-Seven -500
L W W W L W	3250	3550	-3250	300	-550	-2400	Kevlar + Helmet	-1000 Famas	-2250
L W W W L L	1900	2200	-500	1700	850	0			Five-Seven -500
L W W L W W	3250	3550	-3250	300	-550	-2400	Kevlar + Helmet	-1000 Famas	-2250
L W W L W L	1400	1700	-1500	200	-650	-2000	Kevlar + Helmet	-1000	Five-Seven -500
L W W L L W	3250	4950	-4100	850	0	-1850	Kevlar + Helmet	-1000 M4	-3100
L W W L L L	2400	4100	-4100	0	-850	-1200	Kevlar + Helmet	-1000 M4	-3100
L W L W W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L W L W W L	1400	1500	-1500	0	-850	-2200	Kevlar + Helmet	-1000	Five-Seven -500
L W L W L W	3250	3600	-3250	350	-500	-2350	Kevlar + Helmet	-1000 Famas	-2250
L W L W L L	1900	2250	-500	1750	900	50			Five-Seven -500
L W L L W W	3250	4150	-4100	50	-800	-2650	Kevlar + Helmet	-1000 M4	-3100
L W L L W L	1400	2300	-2250	50	-800	-2150	Kevlar + Helmet	-1000 MP9	-1250
L W L L L W	3250	3300	-3250	50	-800	-2650	Kevlar + Helmet	-1000 Famas	-2250
L W L L L L	2900	2950	-2250	700	-150	0	Kevlar + Helmet	-1000 MP9	-1250
Round	Round Reward	Buy Money	Money Spent	Money After	Extra (Win)	Extra (Loss)	Armour	Primary	Secondary
L L	2400	4200	-4100	100	-750	-1100	Kevlar + Helmet	-1000 M4	-3100
L L W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L L L	2900	3000	-1900	1100	250	400	Kevlar	-650 MP9	-1250
L L W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L L W L	1400	1500	-1500	0	-850	-2200	Kevlar + Helmet	-1000	Five-Seven -500
L L L W	3250	4350	-4100	250	-600	-2450	Kevlar + Helmet	-1000 M4	-3100
L L L L	3400	4500	-4100	400	-450	-300	Kevlar + Helmet	-1000 M4	-3100
L L W W W	3250	3350	-3250	100	-750	-2600	Kevlar + Helmet	-1000 Famas	-2250
L L W W L	1400	1500	-1500	0	-850	-2200	Kevlar + Helmet	-1000	Five-Seven -500
L L W L W	3250	3250	-3250	0	-850	-2700	Kevlar + Helmet	-1000 Famas	-2250
L L W L L	1900	1900	0	1900	1050	200			
L L L W W	3250	3500	-3250	250	-600	-2450	Kevlar + Helmet	-1000 Famas	-2250
L L L W L	1400	1650	-1500	150	-700	-2050	Kevlar + Helmet	-1000	Five-Seven -500
L L L L W	3250	3650	-3250	400	-450	-2300	Kevlar + Helmet	-1000 Famas	-2250

Figure 4-5: Data Set Part 1

(Source: Charles D. Jordan, 2019)

Figure 4-6 Data Set Part 2

(Source: Charles D. Jordan, 2019)

Figure 4-7: Data Set Part 3

(Source: Charles D. Jordan, 2019)

Round	Round Reward	Buy Money	Money Spent		Armour		Primary		Secondary	
1		0	800	-650	Kevlar	-650				
W		3250	3350	-2050	Kevlar + Helmet	-1000	Mac10	-1050		
W W		3250	4550	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W W		3250	4100	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W L		1400	2250	-2050	Kevlar + Helmet	-1000	Mac10	-1050		
W W W W		3250	3650	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W W W L		1400	1800	0						
W W L W		3250	3450	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W W L L		1900	2100	-900	Kevlar	-650			P250	-250
W W W W W		3250	3900	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W W W L		1400	2050	-2050	Kevlar + Helmet	-1000	Mac10	-1050		
W W W L W		3250	5050	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W W L L		1900	3700	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W L W W		3250	3700	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W L L W		1400	1850	-1700	Kevlar	-650	Mac10	-1050		
W W L L L		3250	4450	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W L L L		2400	3600	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W W W W W W		3250	3450	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W W W W W L		1400	1600	-1250	Kevlar + Helmet	-1000			P250	-250
W W W W L W		3250	3250	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W W W W L L		1900	1900	-250					P250	-250
W W W L W W		3250	4600	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W W L W L		1400	2750	-2650	Kevlar	-650	Galil	-2000		
W W W L L W		3250	3250	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W W W L L L		2400	2400	-1250	Kevlar + Helmet	-1000			P250	-250
W W L W W W		3250	3250	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W W L W W L		1400	1400	-1250	Kevlar + Helmet	-1000			P250	-250
W W L W L W		3250	3400	-3350	Kevlar	-650	AK-47	-2700		
W W L W L L		1900	2050	-250					P250	-250
W W L L W W		3250	4000	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W L L W L		1400	2150	-250					P250	-250
W W L L L W		3250	3850	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W W L L L L		2900	3500	-3000	Kevlar + Helmet	-1000	Galil	-2000		

Round	Round Reward	Buy Money	Money Spent		Armour		Primary		Secondary	
W L		1400	2700	-2050	Kevlar + Helmet	-1000	Mac10	-1050		
W L W		3250	3850	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W L L		1900	2550	-1250	Kevlar + Helmet	-1000			P250	-250
W L W W		3250	3350	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W L W L		1400	1550	-1250	Kevlar + Helmet	-1000			P250	-250
W L L W		3250	4550	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W L L L		2400	3700	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W L W W W		3250	3600	-3350	Kevlar	-650	AK-47	-2700		
W L W L W		1400	1750	-1700	Kevlar	-650	Mac10	-1050		
W L W L W		3250	3550	-3350	Kevlar	-650	AK-47	-2700		
W L W L L		1900	2200	-900	Kevlar	-650			P250	-250
W L L W W		3250	4100	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W L L W L		1400	2250	-250					P250	-250
W L L L W		3250	3250	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W L L L L		2900	2900	-2500	Kevlar + Helmet	-1000	MP7	-1500		
W L W W W W		3250	3500	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W L W W W L		1400	1650	-900	Kevlar	-650			P250	-250
W L W W L W		3250	3300	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W L W W L L		1900	1950	-250					P250	-250
W L W L W W		3250	3450	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W L W L W L		1400	1600	-1250	Kevlar + Helmet	-1000			P250	-250
W L W L L W		3250	4550	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W L W L L L		2400	3700	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W L L W W W		3250	3650	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W L L W W L		1400	1800	0						
W L L W L W		3250	5250	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W L L W L L		1900	3900	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
W L L L W W		3250	3500	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W L L L W L		1400	1650	-1250	Kevlar + Helmet	-1000			P250	-250
W L L L L W		3250	3650	-3000	Kevlar + Helmet	-1000	Galil	-2000		
W L L L L L		3400	3800	-3700	Kevlar + Helmet	-1000	AK-47	-2700		

Round	Round Reward	Buy Money	Money Spent		Armour		Primary		Secondary	
L		1900	2050	-250					P250	-250
L W		3250	5050	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W W		3250	4600	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W L		1400	2750	-2650	Kevlar	-650	Galil	-2000		
L W W W		3250	4150	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W W L		1400	2300	-2050	Kevlar + Helmet	-1000	Mac10	-1050		
L W L W		3250	3350	-3350	Kevlar	-650	AK-47	-2700		
L W L L		1900	2000	-250					P250	-250
L W W W W		3250	3700	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W W W L		1400	1850	0						
L W W L W		3250	3500	-3350	Kevlar	-650	AK-47	-2700		
L W W L L		1900	2150	-250					P250	-250
L W L W W		3250	3250	-3000	Kevlar + Helmet	-1000	Galil	-2000		
L W L W L		1400	1400	-1250	Kevlar + Helmet	-1000			P250	-250
L W L L W		3250	5000	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W L L L		2400	4150	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W W W W W		3250	3250	-3000	Kevlar + Helmet	-1000	Galil	-2000		
L W W W W L		1400	1400	-1250	Kevlar + Helmet	-1000			P250	-250
L W W W L W		3250	5100	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W W L W W		1900	3750	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W W L W L		1400	1550	-1250	Kevlar + Helmet	-1000			P250	-250
L W W L L W		3250	5150	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W W L L L		2400	4300	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W L W W W		3250	3500	-3350	Kevlar	-650	AK-47	-2700		
L W L W W L		1400	1650	-1250	Kevlar + Helmet	-1000			P250	-250
L W L W L W		3250	3400	-3350	Kevlar	-650	AK-47	-2700		
L W L W L L		1900	2050	-250					P250	-250
L W L L W W		3250	4550	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W L L W L		1400	2700	-2650	Kevlar	-650	Galil	-2000		
L W L L L W		3250	3700	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L W L L L L		2900	3350	-3350	Kevlar	-650	AK-47	-2700		

Round	Round Reward	Buy Money	Money Spent		Armour		Primary		Secondary	
L L		2400	4200	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L L W		3250	3750	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L L L		2900	3400	-3350	Kevlar	-650	AK-47	-2700		
L L W W		3250	3300	-3000	Kevlar + Helmet	-1000	Galil	-2000		
L L W L		1400	1450	-1250	Kevlar + Helmet	-1000			P250	-250
L L L W		3250	3300	-3000	Kevlar + Helmet	-1000	Galil	-2000		
L L L L		3400	3450	-3350	Kevlar	-650	AK-47	-2700		
L L W W W		3250	3550	-3350	Kevlar	-650	AK-47	-2700		
L L W W L		1400	1700	-1250	Kevlar + Helmet	-1000			P250	-250
L L W L W		3250	3450	-3350	Kevlar	-650	AK-47	-2700		
L L W L L		1900	2100	-250					P250	-250
L L L W W		3250	3550	-3350	Kevlar	-650	AK-47	-2700		
L L L W L		1400	1700	-1250	Kevlar + Helmet	-1000			P250	-250
L L L L W		3250	3350	-3350	Kevlar	-650	AK-47	-2700		
L L L L L		3400	3500	-3350	Kevlar	-650	AK-47	-2700		
L L W W W W		3250	3450	-3350	Kevlar	-650	AK-47	-2700		
L L W W W L		1400	1600	-1250	Kevlar + Helmet	-1000			P250	-250
L L W W L W		3250	3700	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L L W W L L		1900	2350	-900	Kevlar	-650			P250	-250
L L W L W W		3250	3350	-3350	Kevlar	-650	AK-47	-2700		
L L W L W L		1400	1500	-1250	Kevlar + Helmet	-1000			P250	-250
L L W L L W		3250	5100	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L L W L L L		2400	4250	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L L L W W W		3250	3450	-3350	Kevlar	-650	AK-47	-2700		
L L L W W L		1400	1600	-1250	Kevlar + Helmet	-1000			P250	-250
L L L W L W		3250	3700	-3700	Kevlar + Helmet	-1000	AK-47	-2700		
L L L W L L		1900	2350	-900	Kevlar	-650			P250	-250
L L L L W W		3250	3250	-3000	Kevlar + Helmet	-1000	Galil	-2000		
L L L L W L		1400	1400	-1250	Kevlar + Helmet	-1000			P250	-250
L L L L L W		3250	3400	-3350	Kevlar	-650	AK-47	-2700		
L L L L L L		3400	3550	-3350	Kevlar	-650	AK-47	-2700		

Figure 4-8: Data Set Part 4

(Source: Charles D. Jordan, 2019)

Figure 4-9 Data Set Part 5

(Source: Charles D. Jordan, 2019)

Figure 4-10: Data Set Part 6

(Source: Charles D. Jordan, 2019)

5.0 Prototyping

Wireframes

Upon completion of the data collection phase, the wire-frame design phase could commence. However, before the creative design process could begin, the information that was to be displayed had to be considered. Table 5-1 shows the complete list of potential information which was condensed into a second list of essential information.

Table 5-1: Potential v Essential Information

Potential Information	**Essential Information**
Game Score	Game Score
Equipment to Purchase	Equipment to Purchase
Money to Spend	Money to Spend
Money Spent	Money Spent
Next Buy Round	
Round Reward	
Win/Loss Histogram	Win/Loss Histogram
Loss Bonus Scale	Loss Bonus Scale
Classification of Buy	Classification of Buy
Enemy Buy	
Weapon Information	

Navigation Buttons	Navigation Buttons
Reset Buttons	Reset Buttons
Money Needed to Full Buy on Win/Loss	
Round Number	Round Number
Equipment Images	Equipment Images

The design thought behind this process was to minimise the potential visual confusion of new players and maximise their information retention while also keeping the exemplary prototype visually digestible. The reason for this min/max mindset was chosen in consideration of the short buy time before each round (15 seconds). A new player to the game needed to be able to read and understand the information about the buy from the prototype, and then execute it within the in-game buy menu. A complex visual layout would slow down this process, which is also why the prototype follows a linear design of visual construction throughout every round. Players are able to focus on one area of the prototype and know exactly where the most essential information appears, and if they need additional information, they can look closer into the prototype design to find it.

With the above thinking complete, Figure 5-1 shows a series of sketches which were developed to form the beginnings of my visual design from spreadsheet data to exemplary prototype. I began to formulate a basic design which sets the basis for the final prototype. It is important to note that the information in the beginning design varies from that in the final prototype. During this beginning process, I experimented with visually removing and adding various items from the essential information list above.

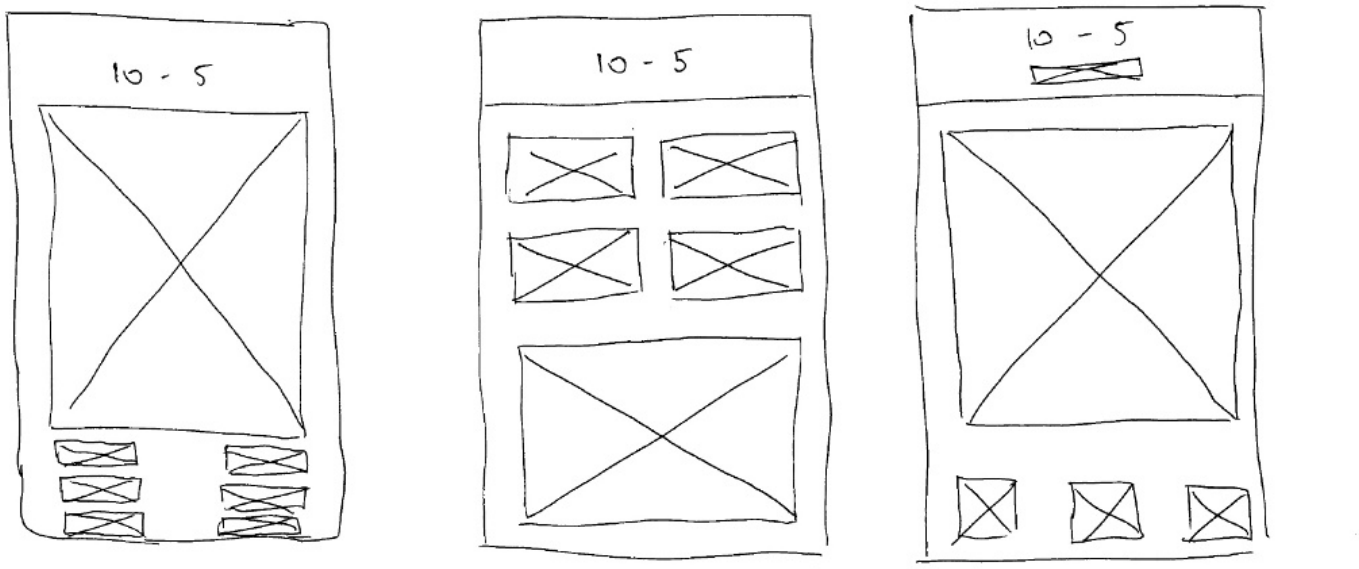


Figure 5-1: Initial Hand-Drawn Sketches

(Source: Charles D. Jordan, 2019)

Following these hand drawn sketches, I moved to make digital copies and further develop the prototype design space which can be seen in Figure 5-2. The low-fidelity space allows the concept to become digitally created and gives a better impression of what the end product will be developed into. There were 10 iterations of low-fidelity designs that were created which primarily focused around the visual aesthetics of space for the information model on a mobile application platform. Although I did not conduct user testing during the scope of this practice-based research, I was able to discern designs which would be easier to interact with on a mobile platform, as opposed to those that would be more difficult. During each step of design, I would try and take one aspect of the previous design I liked across and eliminate one aspect I did not. This resulted in 10 stages of elimination and retention. The final design proving to be the basis of my final exemplary prototype.

This low-fidelity process was important to go through as the contrast between the opening low-fidelity design, and the final example is drastic. Most importantly, the low-fidelity space allowed me to form the basis of negative space, as well as minimalist design with high information retention. In this research project, the low-fidelity prototyping helped give an inexpensive, fast method of visually clarifying the design and the expected functionality of the prototype (Babich, 2017). However, as the designs are still within a basic and conceptual stage, they can create some uncertainty when it comes to how the prototypes work as there is extremely limited interactivity, relying primarily on the imagination of the user (Babich, 2017). This is the importance of high-fidelity prototyping as it moves from this conceptual stage of design and presents a realistic visual design with real content that can be expected within the final prototype (Babich, 2017).

Hi-Fidelity Prototype

Following my final low-fidelity design, I moved onto the high-fidelity mock-ups in Figure 5-3, and put my primary focus on minimalist colour and design thinking. With that in mind, I looked into how I could use colour to make my design appear clean and modern. I tried to keep neutral colours and work around the thematic CSGO colour style. I wanted to avoid colours that would distract from the information or be thematically off point. I began with an industrial palette which would allow me to create a very minimalist design, and also help clean up the visual aesthetics of the entire design. After settling for a darker blue to thematically tie in with the Counter-Terrorist side, I ran into my first big mistake.

I began by following the same design from my low-fidelity model, which in hindsight was a mistake as I missed key opportunities to change design features to coincide with various colour changes. This is because the high-fidelity stage is often close to the design of the final prototype. Therefore, more emphasis should be given to developing the navigation and user interaction in the high-fidelity stage as opposed to focusing on aesthetic design (Babich, 2017). During one of my final high-fidelity designs, I decided to experiment with eliminating the borders and stacking my information from most to least important. This epiphany completely changed the aesthetic layout of my design. This new design was cleaner and allowed me to retain a lot of information without causing visual clutter which would be hard to interpret. This new design also allowed new players to work top down and presented all the essential information first, so that they could quickly buy and leave the rest of the information if they did not need it. Finally, the colour changed to thematically fit with this design. It was finalised as dark blue for counter-terrorists, and a sandy yellow for the terrorists, which ties in with both teams' colours within a competitive game of CSGO. Having settled upon my final design, I needed to move forward onto the interactive design, and the final stage of my exemplary prototype.

Figure 5-2: Low Fidelity Mock-ups

(Source: Charles D. Jordan, 2019)

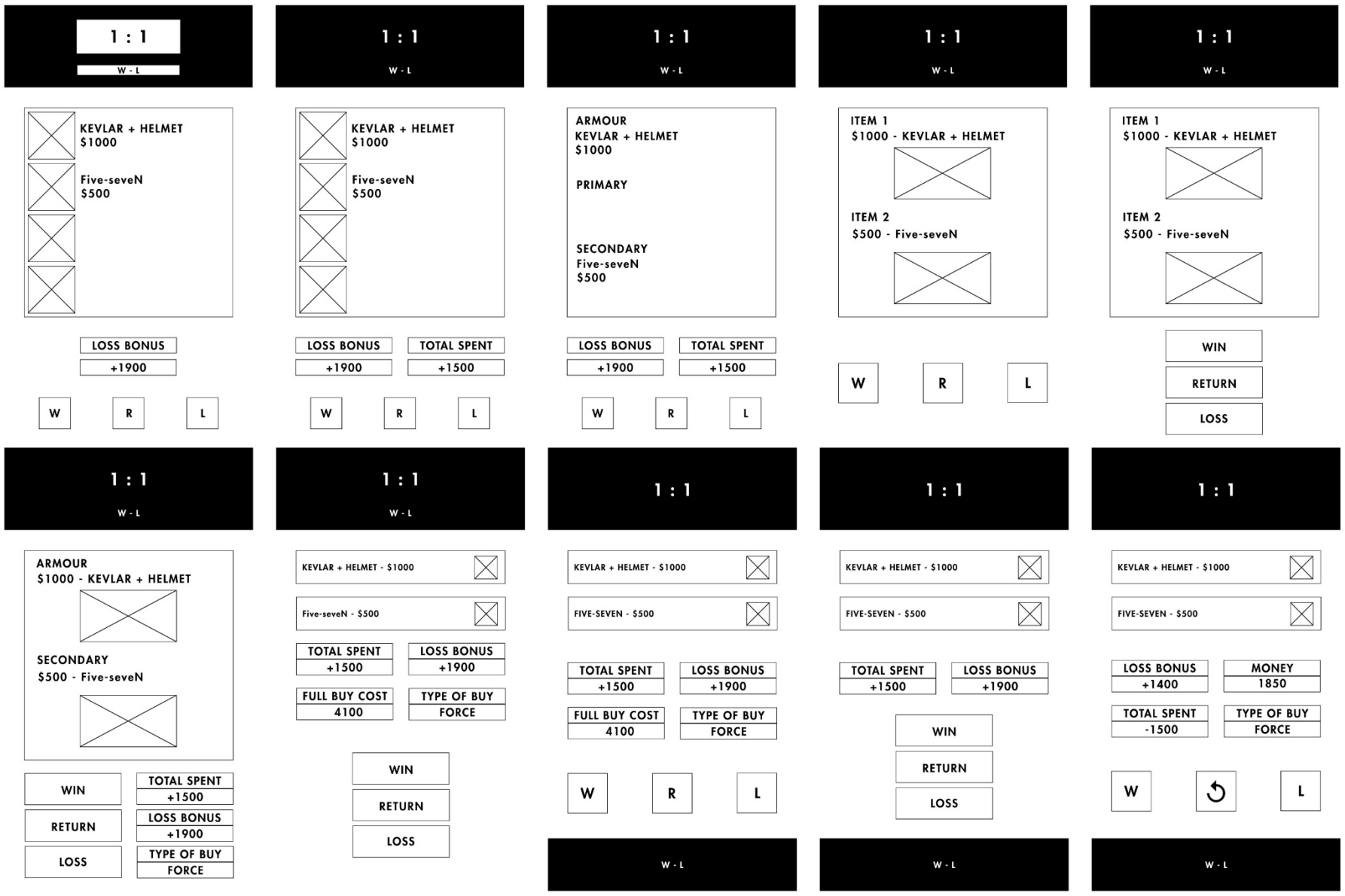


Figure 5-3: High Fidelity Mock-ups

(Source: Charles D. Jordan, 2019)

Interactive Prototyping

The first stage of the interactive prototyping process was to create the visual assets which would sit within the space of the prototype. This was essentially broken into two artistic elements; the navigation buttons, and the flattened images that represented the purchasable weapons and equipment of each round. Using the application Adobe Illustrator, I was able to draw free-hand each flattened weapon image which produced seven items for both the Counter-Terrorist and Terrorist sides – there were 14 vector images in total. Figure 5-4 shows how both sides were coloured in coordination with their respective thematic aesthetic, as explained below.

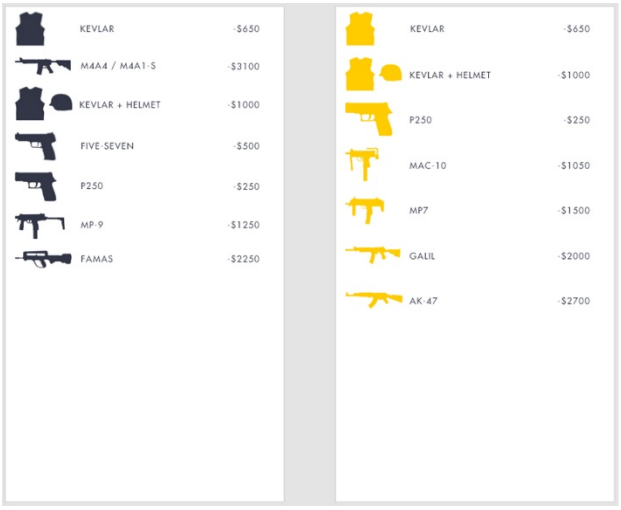


Figure 5-4: Vector Images

(Source: Charles D. Jordan, 2019)

The navigation buttons were constructed within Adobe XD, excluding the step back button which was drawn with a present left arrow from Adobe Photoshop. Due to the minimalist design of the prototype, the specific pathways to navigate from page-to-page were listed as W (Win) and L (Loss). The respective buttons would then take the user to the corresponding page taking into consideration what their current page was.

Figure 5-5: Prototype 1 Navigation Buttons

(Source: Charles D. Jordan, 2019)

The interactive prototyping process was broken into two stages. Firstly, I needed to test the basic navigation of my design to make sure it was functional, or whether I needed to go through another stage of hi-fidelity prototyping. The primary focus of this stage was learning to use the Adobe XD platform and developing an idea of how-to lay out the exemplary prototype within the landscape of the programme. Initially the layout progressed chronologically from left to right like a book. This caused issues in my second stage of prototyping as linking pages became increasingly difficult over my short first-stage test period. Figure 5-6 exemplifies the visual difficulties within linking the pages horizontally.

Figure 5-6: Prototype 1 Navigation Links

(Source: Charles D. Jordan, 2019)

In conjunction with the layout issues of the prototype, I also made some small design changes to reflect minimalist design and further optimise the navigation of the exemplary prototype, which can be seen in Figure 5-7. Specifically, I changed the step back button design to conform more closely to a stereotypical back space symbol. This was opposed to the refresh symbol which could indicate a full page reload or even a full reset. In addition to this first change, a dedicated reset button was incorporated to add functionality to players wishing to restart the application without having to step all the way back. These changes were made after basic interaction with the prototype, for instance, when I was on the third round of my first prototype there was no way to get back to the start other than manually going back round-by-round. Both these visual and navigational changes aided the prototype in being more accessible and would be easier to understand and use within a shorter period of time for a new user.

Figure 5-7: Final Prototype UI Design

(Source: Charles D. Jordan, 2019)

Before building the full working prototype I realised I had failed to design a home page, or entry point for new users of the prototype. Again, referring back to previous discussions upon the accessibility of this mobile application, the UI and navigation needs to be easy and fast. The simple implementation of a home page not only makes the information model easier to navigate, but it also aids the time in which a user who is playing the game can navigate and access the correct and essential information. This point is furthered by the colour coded UI designs featured in Figures 5-9 and 5-10.

Due to both the basic nature and the minimalist design nature this prototype was following, a quick and simple home page was drafted and implemented as an entry point for the users of the prototype. The home page features just two buttons, Counter-Terrorist and Terrorist. These two buttons would take users to their respective teams' information for the first buy round.

Figure 5-8: Home Page Design

(Source: Charles D. Jordan, 2019)

One final addition had to be decided upon before development of the second and final prototype. The application just had one colour aesthetic at that moment which drew inspiration off the Counter-Terrorist team from CSGO. However, to create a visually comprehensible design, I decided to draw inspiration from the Terrorist team's colour palette from CSGO for that half of the prototype. This resulted in a sandy yellow and a dark blue, distinguishing the two halves of the application visually without the need for text. Thus, this change helped me keep the design minimalist and overall reducing unnecessary visual content which would clutter each page.

Due to the preparation from the first stage of prototyping and the above steps, the actual development and construction of the exemplary prototype went through relatively smoothly. There were no following changes, nor any issues that arose from the final development stage of the prototyping.

I began the prototyping by placing the home screen and vector image templates next to it to use as reference images to be copied across pages. From there, the first-round pages for both the Counter-Terrorist and Terrorist sides were constructed. Systematically, I started with the Counter-Terrorist side and worked through round by round, referencing back to my data table to ensure I did not miss any rounds, or make an error regarding the information as per each page. After completing each round, I would go back through the line of the entire round's pages and double check the images, content, and accuracy of information. This process was subsequently used throughout both the Counter-Terrorist and Terrorist information pages. This ensured the work was true and accurate, however, it was extremely time consuming, as each page was constructed individually. Although the basic framework could be duplicated across pages, the actual information was so specific that each page had to be started from scratch in terms of informative content.

Figure 5-9: Final Prototype CT Design

(Source: Charles D. Jordan, 2019)

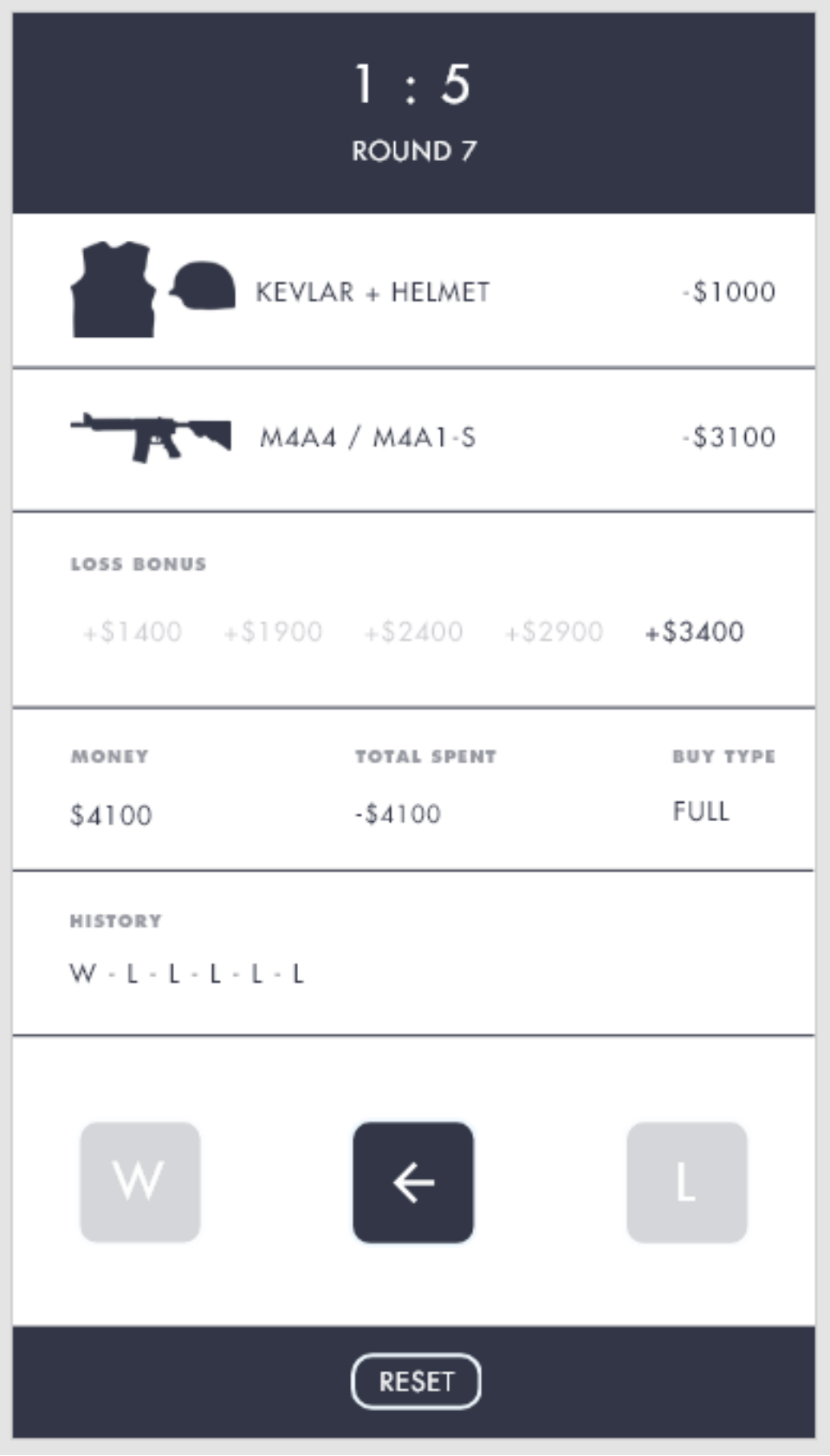


Figure 5-10: Final Prototype T Design

(Source: Charles D. Jordan, 2019)

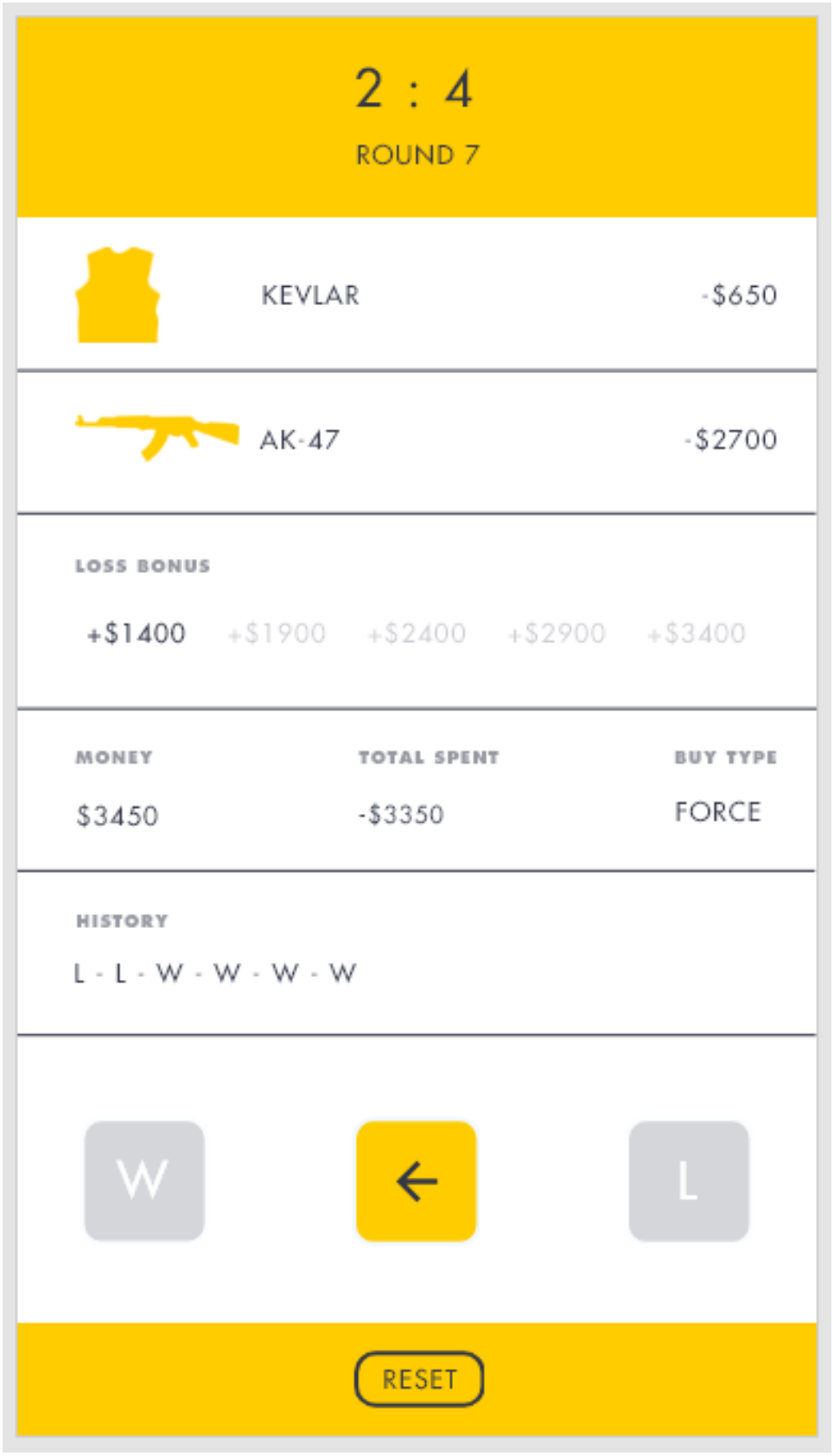


Figure 5-11: Final Adobe XD Page Layout

(Source: Charles D. Jordan, 2019)

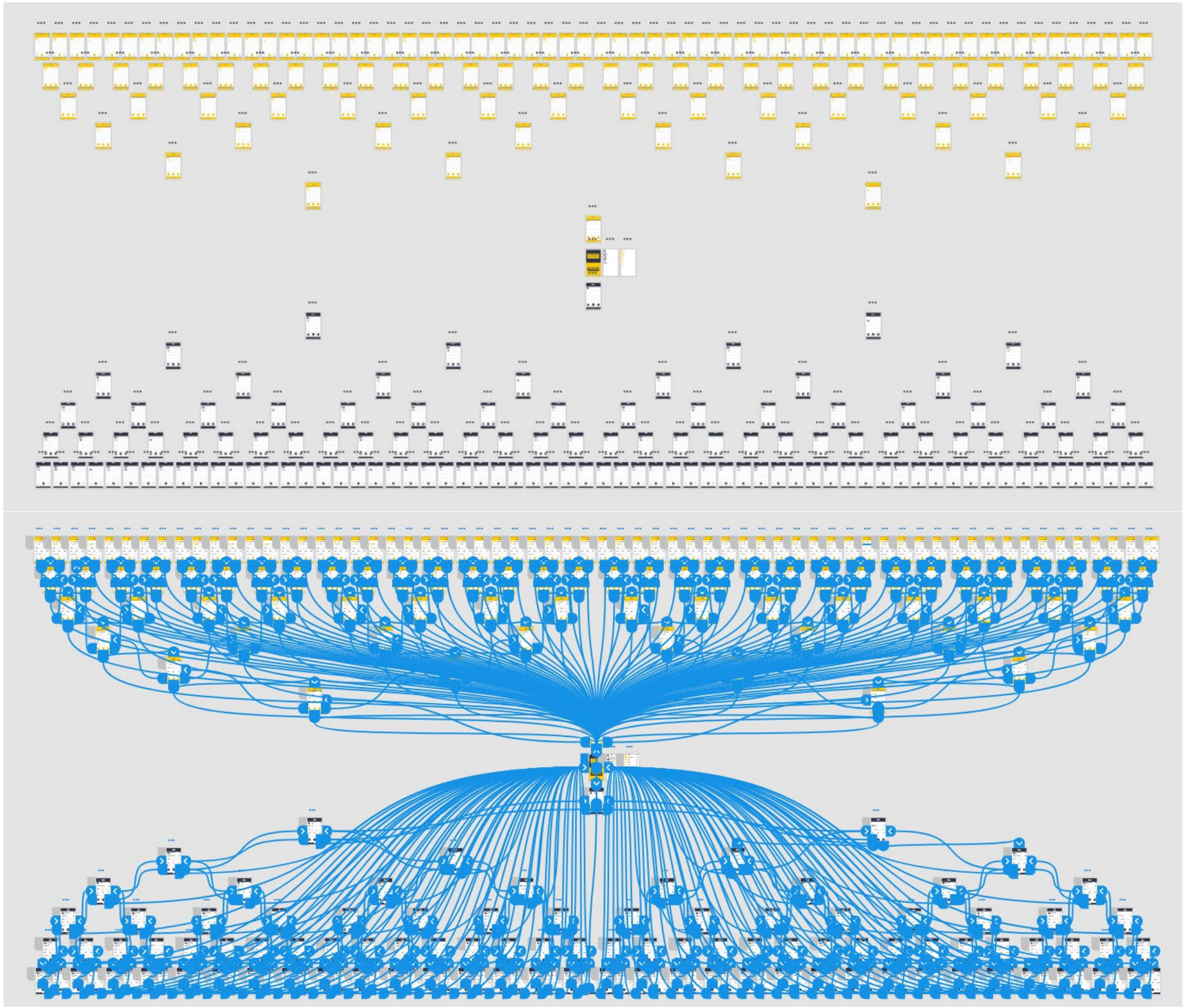


Figure 5-12: Final Adobe XD Page Links

(Source: Charles D. Jordan, 2019)

6.0 Discussion

This body of work explored the research question:

> How do team behaviours change when new players are offered a method to act similarly to experienced players?

A sub-question was:

> Can this method aid in reinforcing positive team behaviours and reduce toxicity?

The scope of this practice-based research project was to consider the possibility of the changing of team behaviours when new players were offered a strict method to act similarly to experienced players. Furthermore, following this assessment, could it also be the case that when offered to new players this method may reinforce positive team behaviours and reduce toxicity, which new players are often subjected to. The section below aims to discuss how the tool created and the literature provided an answer to the research question.

It was found through the analysis of existing literature that there is a state of online virtual worlds which are inherently disinhibited (Lapidot-Lefler & Barak, 2012). It was Lapidot-Leffler and Barak (2012) who initially discussed how the low levels of interpersonal cues, such as eye contact, negatively influenced the manner of behaviour in which players conducted themselves online. Often causing players to compartmentalise their own persona, separating the morals and ethics of their real-life persona from their online persona (Lapidot-Lefler & Barak, 2012). This disconnect from their persona was labelled within Lapidot-Leffler and Barak's (2012) study as Online Disinhibition. Expanding upon this concept, it was assessed that the dynamics of a team's behaviours would be negatively altered if a newer player found themselves in a virtual game space while also holding little respect for the current in-game meta (which are the unwritten rules of play). It was proposed that the use of an external information source such as a programme, website, or an application, could be used as a tool to help a new player to understand and replicate the in-game buying behaviours and the meta of experienced players. The platform specifically chosen to explore this was a CSGO competitive match, and specifically the meta of the in-game economy for an individual's team buys. The practice-based tool produced as part of this research was designed to allow newer players to buy in a similar fashion to that

which an experienced player would without having the pre-existing experience or time spent learning the basics of the in-game meta or economy. While newer players may lack the mechanical skills to competitively perform in aim duels, through the use of this tool they would have the necessary information to buy correctly and in coordination with their teammates.

Was a method made?

Predating this research project, there was limited literature covering the thinking that an external information source could be used to efficiently aid a new player in learning a new game's in-game meta. In the research of da Costa Oliveria et al. (2017) and in earlier research by Conley and Perry (2013), it was found that both information models can aid the more casual of players in making split-second important decisions which more experienced players could make independently. In a way, these information models can offer a method to level the playing field of some in-game knowledge disparities. However, again, it is important to note that this has been common practice and is used internally to buy widely throughout the gaming community. For example, these sources can be found in the likes of forums and communities, or help such as Reddit, or even as third-party game clients such as RuneLite. These sources of information have been used as a base to build game communities, while also aiding newer and less experienced players in tackling the more difficult feats within a game. This ultimately promotes a healthy growth in new users and the game's development. Very rarely do these information sources allow a player to play the game while accessing the information as it is often one or the other, especially when the platform is a multiplayer game, as there is no option to pause within a multiplayer game environment. This means players who often refer to these third-party information sources have to either do so before the game commences or do so during a game, which would make their in-game character inactive. If a player leaves the game environment, it is referred to being AFK, otherwise known as 'away from keyboard.' The issue with this, is that a player's inactivity during a multiplayer game can lead to infuriating team members further.

As discussed by both Conley and Perry (2013) and da Costa Oliveria et al. (2017), external information models can positively aid casual players in making split-second decisions that experienced players would be able to make independently. The foundations that both these studies laid helped the scope of this current project greatly. Both previous studies primarily focused on interpreting API data which indicated what the most appropriate min-max action a player could make when choosing a character in-game. The min-max (min-max is a method of offering minimum and maximum mathematical mechanics in gaming) model was based upon which characters a player's own team had picked and which characters the enemy team had also picked (da Costa Oliveria et al., 2017; Conley & Perry, 2013). However, this system does not account for team behaviours or the current in-game meta of the game. This means that a player using the proposed min-max model was not necessarily devoid from being subjected to toxic behaviour. Building upon this idea, it was chosen that an interactive information model would be made that would aid a new player in picking appropriate weapons in real-time without the player having to leave the competitive CSGO game environment. In furthering previous research from Conley and Perry (2013) and da Costa Oliveria et al. (2017), this information model would focus on the in-game meta of the game. This choice was affirmed as Cascio and Shurygailo (2003) had determined that the conformity of completion of expected tasks and goals within a virtual team, helps strengthen a team's trust.

At this stage it is important to note that the platform that this information model exists on is a mobile application. The reasoning for this decision is that a mobile application is easily accessible for users to navigate and interpret in real-time while in-game. In the hope that this ultimately eliminates the potential for a player to go AFK, as the information model can be easily glanced at while within the multiplayer gaming environment. When envisioning the practical use of the information model, I believed that a mobile application would be more effective than a website as a mobile application could be accessed externally while a player is in the middle of a game. This was critical, as new players are under stress to correctly buy within the few seconds specifically allocated before each round starts. It is also important to note at this stage that this research is not trying to state that mobile applications are the only approach to a rendered and functional information model (other instances could include a website or booklet, etc). However, mobile applications do offer the best glanceability and instantaneous access, given the time constraints within the buying period of a CSGO

competitive game. Taking into consideration the information and platform (CSGO) that this research project is focusing on, a mobile application was the most practical medium for the information model to exist on. Therefore, this prototype should be interpreted by future researchers as explorative thinking and as an example of how these information models can exist on digital platforms. This project acts as a beginning point for future exploration into how information models can be utilised, not just for gaming, but for how users communicate information virtually in the future. This point will be discussed further within the conclusion in Section 7.0.

Returning back, as stated previously, da Costa Oliveria et al. (2017) and Conley and Perry (2013) were given access to valves API data on Dota. This in-game data allowed them both to create min-max information models. Given that CSGO does not make this kind of in-game economy data as readily available, this research project took a different approach. This meant that the initial phase of the practice-based research began with data acquisition for the information model.

The reward system within a CSGO competitive game is extremely complex, making the process of learning more difficult for new players. This is because they are likely to upset their teammates and experience negative behaviour towards themselves when they buy improperly and don't abide by the set in-game meta. This is because an improper buy can set a team back two rounds to regather money again for a full team buy. These two lost rounds can be the difference between a team winning and losing in a close match, and this poor buying behaviour will be seen as a player buying and playing against their own team. As the foundation step of this research project lies within the in-game economy, a basic mathematics equation was used as the starting point. The number of in-game economy variables needed to be assessed as a basis to work out which in-game rewards would be necessary to implement into the application.

The equation used initially was (2^30)*1000, which dictates the 2 possible team options of winning and losing within a 30 round game of CSGO competitive, and in addition, the possible but not maximum 1000 variables which can occur in each of these rounds. This indicates that there are over 1 trillion possible variables when it comes to monetary rewards. Given this data, the project was able to narrow its scope to focus primarily on round rewards for a team winning or losing a round. This meant that the equation could return to the initial equation of 2^30. This initial equation process allowed the project to refine its scope, which allows for a more accurate representation of explorative research and thinking.

Following the refined scope on reward data, decision tree pathways proved to be the most efficient method for an IFTTT (If this, then that) thought process. Each round result would lay a pathway for two alternative lines, meaning that the number of alternatives each round would double. This meant that the same equation of 2^(round number) would equate to the number of variables that had occurred in a game up to that round. This thought process was useful for the overall design process of the information model as it allowed the project to stay within the necessary and reasonable scope of the research project.

Decision tree pathways were chosen as they allowed the creation of a two-dimensional flat visualisation of how the information model would exist within the platform of an application. The pathways visualised how each page linked together, and how each page interacted with the surrounding pages. Most importantly this process allowed the research project to focus on each page as an individual scenario. This is opposed to linking a generic buy to a given score or round number. This allowed the output of the application to be much more refined and accurate, as opposed to presenting information which was generic and could loosely fit most situations. The decision trees allowed the thought process of specific buys which more closely replicates the buying behaviours of more experienced players.

With the data acquisition completed, it was necessary to filter out all the data that had been collected, so that only the most valid and pertinent information made it into the application. The defining of this "useful" information is integral to the needs of the newer players as unnecessary information will just be distracting and act as 'noise' as well as cluttering the overall UI design. Although this project was not focused on User Interface design (UI) or User-Experiences (UX), it was still important that a prototype was produced that respected the base aspects of UI/UX. This allowed for the information provided within the application to be situated so that it could be clearly read, understood, and experienced. Another critical factor previously

discussed, was that this type of method was to operate in real-time with the player while they played the game. This meant that it needed to have an immediacy in its ability to present information that could be quickly scanned and understood by a player.

With this stage complete, the initial steps for wireframing began with rough drawings. These drawings were later migrated into digital copies. Working within a digital space allows for more fine tuning and small detailed tweaks – these cannot be obtained through hand-drawn sketches. With readability being the primary focus of this stage, minimalism was a huge influence in how the overall design of the application worked out. Players are not given much time to buy their items at the start of a round, and the navigation menu within the CSGO buy menu can be complex for new players. Accordingly, this minimal design choice further enabled the abilities of players to easily buy in real-time without disrupting their team gameplay.

The final stage before prototyping was the high- and low-fidelity designs. Moving into the high-fidelity designs provided another opportunity to improve the readability of the information within the application. By using flat icon vector images of the items, as opposed to just the names of each item, it ultimately allows a user to glance at the information on the application without having to read it in depth to figure out what the current buy is. These images will not only aid readability but also improve the response time with users, ensuring they are able to buy in real-time while playing the game. Small features such as these vector images were added in the later stages of the design process. These small features would not have been spotted if the initial foundations of the design process and wireframing had not been done.

Finally, the prototyping space took place on Adobe XD. This prototyping software allows the creation of a UI/UX experience based on vector images. The prototypes created by Adobe XD are a great step in the development process of a web or mobile-based experience. This is because they allow the creation of a design space in which users can interact and navigate with the prototype in real-time as if it were the final product. This is important as it allows developers to create prototypes which mimic the final output and test them before the coding process even begins. In this instance, Adobe XD allows for an interactive information model prototype to be created. This means therefore, that the prototype was able to be made into a working and responsive research artefact. The creation of the artefact allows for theory and explorative thinking to become a physical model which users can interact with. The creation of this application is merely an example of how the above-mentioned data set and information models can be displayed as an interactive model for users. Again, it must be noted that this is not to limit the scope of future thinking, but rather as an example of how malleable these information models can be. There are no limits to this explorative thinking as this is a relatively untouched area of research which has yet to be fully explored.

How does this method allow for new players to act similarly to experienced players?

Before delving further into this section, it must be noted that the aim of this information model is not to bring new players mechanically up to the same skill level as the experienced players that they are teaming with. It is instead to make their buys appear similar to what is an expected norm for experienced players. It lives within the in-game meta, or in other words, the unwritten rules of conduct and play within the CSGO competitive game world.

It was established that there are four types of buys which are commonly accepted through competitive CSGO matches from a casual to professional level. These four buys go as follows: full buy, force buy, eco buy, and full save (Villaneueva, 2018; Byrrice, 2018) (See Chapter 4.0 – Process & Results, Section “In-Game Meta” for a detailed breakdown and explanation of these terms). Using these four categories, a construction of generic buys that sit within each of these categories was made. These buys were chosen based on what is commonly used by the majority of experienced players and professional level players (Villaneueva, 2018; Byrrice, 2018). Full buys allow players to purchase full armour and an assault rifle. Force buys usually limit players to SMG’s and full armour. Eco-buys usually allow a player to purchase a pistol and armour. Finally, a full save limits a player to just the spawn pistol, which is weak against a full armoured opponent, however, it can still be a dangerous tool in the hands of a mechanically skilled player.

If new players are able to follow these buy options, they will automatically get recognition for the fact that they are buying the correct weapons. This shows that they have some understanding of the game and are abiding by the in-game meta of buy categories. However, these buy options alone are not enough. A new player could not be given these buy options and then be expected to effectively implement them within a competitive game of CSGO. Therefore, once these buy types had been established, the order and rounds in which they would most effectively be used had to be established. This helps avoid the situation where new players over-buy on important eco or save rounds.

This is where the in-game meta, or unwritten rules of competitive CSGO buying comes in. The essential idea behind the in-game meta is for a team to get to a full buy round in the most efficient time possible while also losing as few rounds as possible. There are some basic rules of play, which are as follows:

- A team always buys after they win a round.
- A team should always full save after a second loss.
- A team should always buy or force on the first loss of a winning streak.
- A team which loses the pistol round should save to buy on the third round.

(Byrrice, 2018).

These four rules are the foundation of the complex CSGO in-game economy. It is important to note that there are exceptions to these rules, especially when a team's money is high or low due to a winning or losing streak. However, this is where the decision trees aided the structure of the information model. With the help of the decision trees, each round is seen as an individual entity, meaning that the model accounts for every team round reward and the total team money gained.

With the above taken into consideration it can be assessed that the in-game meta of competitive CSGO economy is a complex aspect of play. This is the reason as to why an application was chosen, as it is a platform which allows the simplification of complex equations into an easy and readable information source. This ultimately promotes a player's ability to purchase correctly in real-time without having to navigate away from the in-game environment. Having now established the common buy types, and the current in-game meta, a new player can take this information model into a competitive game of CSGO and safely use it to replicate the buying behaviours of an experienced player. Regardless of mechanical skill, an experienced player will not be able to deny that a new player who is buying correctly is working with the team economy. In turn this will help promote positive team behaviours within CSGO competitive teams which will be discussed below.

How does this model promote positive team behaviours?

Prior to discussing that this model promotes a positive shift in team behaviours, it must be assessed that a team within a CSGO competitive match is classed as a virtual team. If this is assessed, it can be stated that a CSGO competitive team is subject to having specific team behaviours. A brief definition of a virtual team is provided by Mysirlaki and Paraskeva (2010) who claimed that for a virtual team to begin to exist, a group must virtually collaborate to reach a shared goal. This goal is one which cannot simply be obtained by a sole member of the group, but rather is achieved by coming together as a collective (Mysirlaki & Paraskeva, 2010). These groups can exist on a virtual platform allowing the group to be free from locational, time, and leadership boundaries which are factors of traditional teams. A CSGO competitive team is generally made up of five random players who all queue for a competitive match at the same time. The CSGO matchmaking system will assign five players to two teams and will then place all 10 players into a server for a warmup before starting the game. These 10 players all share the same goal of winning the competitive match, and each player knows that they must rely on their teammates over the upcoming 16 to 30 rounds of play. These players do not have to be in the same room, or on the same network, or even in the same time zone, but the one common feature that they do share is their desire to play the competitive game mode of CSGO. With this assessment, it is evident that a competitive CSGO team meets the criteria set out to classify it as a virtual team.

Secondly it is an important distinction to understand how multiplayer games operate and function within the platform of these virtual worlds. Unlike a traditional team that works primarily at an interpersonal and face-to-face level, CSGO virtual teams collaborate within the virtual world of a multiplayer game environment. These virtual worlds provoke a player's curiosity to experiment and try new tactics and techniques within a relatively safe learning environment. O'Connor and Menaker (2008) initially discussed how viable virtual world environments were for allowing players to learn new behaviours, as they are able to respond, repeat, and therefore learn for the replaying of similar scenarios within the confines of a risk-free environment. This shows that players within a CSGO game space are almost encouraged by sheer game design to exhibit trial and error behaviours which stimulate creativity, curiosity, and learning by discovery (Lisk, Kaplancali & Riggio, 2012). Additionally, it can be noted that at the end of each round, players spawn in the same spawn locations and are given the same amount of time to buy each round. This addition coincides with Nuangjumnong's (2016) thoughts on how players are prompted to display trial and error behaviours as the consequences in a virtual world are not irreversible in comparison to those in reality. CSGO fulfils these requirements in offering its player base an environment which does encourage risk-taking behaviours, but also behaviours which derive from curiosity and creativity.

Taking into consideration the above distinctions, it must be brought back to attention as to how this model helps improve team behaviours. The model offers a method for newer players to replicate the buying behaviours of an experienced player. Teammates of this player will be able to recognise that this player is not working against them, but rather buying with the team and respecting the unwritten rules of play which are the in-game meta. Cascio and Shurygailo (2003) distinguish that the limited interpersonal contact of virtual teams can hinder the building of trust. This is evident in a competitive CSGO game as teams are generally comprised of five random players. With no past experience of play with each other, they have no reason to trust their teammates until their teammates prove their trust. However, without these interpersonal cues it is still possible to build team trust. For example, there is a set expectation that all players abide by the in-game meta of buying. If all teammates conform to this meta on the first buy round, they automatically earn recognition and trust that they are working as a team towards a common goal (Cascio & Shurygailo, 2003). For a new player with no knowledge of this meta, building trust to improve team behaviours would be difficult. However, the method illustrated in the produced prototype application will allow them to follow their teams' buys and make buys in coordination with their teammates while also allowing them to abide by the established in-game meta. This in turn, based on the established literature around virtual teams and multiplayer behaviours, reasonably argues that the promotion of building team trust, improves the chance of a shift towards positive team behaviours.

Additionally, by sharing collaborative goals such as winning rounds, and ultimately winning the game, also aids in improving a team's social interaction. A positive social interaction within a team environment is a feature of positive team behaviour. Game developers emphasise the creation of virtual hangout spaces when they design games (Ducheneaut & Moore, 2004). This allows for virtual spaces where players can socially interact with one another. CSGO plays host to features such as in-game messaging, and team voice communications. It is therefore an inherently social space. The building of team trust will be a positive improvement to the team's social dynamic. When a team is interdependent and has a high level of trust, they will have an improved positive shift in their social interaction (Benefield, Shen & Leavitt, 2016). While this model promotes the building of trust, it acts like a domino effect by improving how a team socially interacts with each other. In addition, when players receive and give positive social feedback for playing as a team, the team begins to build positive behaviour patterns which promote playing as team members rather than as individuals (Ducheneaut & Moore, 2004). It is not hard to conclude that a team that trusts each other, communicates more freely with one another.

In conclusion, the model's design and method offers a strong mechanism to improve team behaviours. Specifically, it is a helpful tool for newer players who can focus on learning the in-game mechanics of the game, while letting the application sort out the complex in-game economy for them. The model allows a new player the ability to replicate common buy types and follow the in-game meta which the more experienced members of the team will be following. This conformity of buys will aid in building trust within an environment which severely lacks interpersonal communication cues. In the addition of building trust, the

shared collaborative goal of wanting to win the game, as well as the newfound trust in the team, will promote more positive social interactions within the team. Therefore, the assessment can be made that the model's design and method positively impacts and promotes a positive shift in team behaviours.

Can the model therefore reduce toxic behaviour?

Although there are major positives which come from virtual teaming and collaborating in an online space, toxicity still exists within these very social worlds. Hypernegativity is a major facet which occurs during social play on these virtual worlds (Kuznekoff & Rose, 2013). In fact, worlds such as CSGO subconsciously promote this kind of behaviour as each competitive team is made up of five random players. These players have a set and limited amount of time together, and an effortless communication system, and they are unlikely ever to meet again (Kuznekoff & Rose, 2013). In addition to these features found within a CSGO competitive game, the nature of the match itself is highly competitive, as winning or losing can change a players in-game rank. Therefore, it is common to find that the social awareness of another player's feelings is often secondary to playing efficiently and winning (Siitonen, 2009). Because of this hostile and competitive environment, many small details and actions can set off a toxic or negatively behaved player. A common target of these toxic attacks are new players who do not buy properly. Even the most experienced and reserved experienced players will know the anger of being on a team with a new player who refuses to buy properly. The action of improper buying is seen as a slight and a handicap towards the teams' chances of winning. In this context it is understandable how even the most veteran of players can sometimes act with hostility towards these new players.

A secondary facet of toxic behaviour is dissociative anonymity, which is the fact that these virtual worlds allow players to hide their real-life identity (Suler, 2004). This means that there are very few repercussions to any negative behaviour that players exhibit online. CSGO only allows players to access another players profile if they are playing on the same server. However, a player can set their profile to private which locks anyone from viewing the profile's information. This sets up a perfect opportunity for players to exhibit dissociative anonymity behaviours, which is that: "The condition of being unknown to others, is considered a major determinant of disinhibitive behaviour" (Lapidot-Lefler, Barak, 2012. p. 435). This shroud of anonymity allows players to exhibit toxic behaviour, such as verbal abuse, more freely without the feelings of vulnerability of self-disclosing their real-life identity.

Returning to the proposed question, the application provides a method of buying which is similar to what is expected within the in-game economy. If a player were to buy against their team, the response from the teammates would be negative and toxic, resulting in the player being shunned with immediacy (Ducheneaut & Moore, 2005). However, because the application provided simplifies the buying options for a newer player, and in fact, helps them replicate an experienced player's buying behaviours, they will be seen to be working towards the common team goal. This is in contrast to a new player who joins a CSGO competitive match and blindly buys against their team, which can easily be interpreted by the team as a toxic player who is refusing to abide by the unwritten rules of in-game buying. This application can help a new player avoid situations like the one described above, and instead help them grow and nurture positive team behaviours and positive team play, which in turn will result in them and their team getting more in return for participating in the collaborative space that is CSGO competitive.

One final thought must be made. The model aims to reduce the toxic behaviour that a new player is subject to. Unfortunately, improper buying is not the only trigger which causes a new player to be subject to toxic behaviour. Factors like poor in-game movement, poor communication, and poor crosshair placement can be a trigger to set off toxic teammate behaviour. While this model can prove to reduce toxic behaviour that a new player is subjected to, it is not going to completely eliminate the problem that is toxic online behaviour.

7.0 Conclusion

The area of research this project focused on is largely untouched and unexplored within the academic field. However, it is important to note how widely used this area is within the internal gaming community. Historically guidebooks were published aiming to help players through difficult quests within games. This has now largely been replaced by forums such as Reddit, or even YouTube tutorial videos. Other examples, such as game clients, and now third-party LFG (Looking for Groups) sites are in full abundance across a wide array of multiplayer video games. This area is important, as eSports is a rapidly growing entertainment industry boasting millions of dollars' worth of prize money across tournaments each year. It was initially da Costa Oliveria et al. (2017) and Conley and Perry (2013), who began to look into this field using a min/max model to calculate appropriate character choices within a game of Dota. Building on from where these academic pioneers left off, this research project aimed to look into the dynamic shift of team behaviours when players have access to an external information model.

It was initially proposed from the outset of this project to discover how team behaviours change when a less experienced player is offered a method to act similarly to an experienced player. Furthermore, could this method be produced as a tool to reinforce positive team behaviours, and reduce the toxic behaviours that new players are so commonly subjected to. By using a practice-based research method proposed by both Candy (2006), and Scrivener and Chapman (2004), this research project would produce an artefact based upon theory to address the proposed research questions. The project produced a final artefact in the form of a mobile application. This artefact operates as a tool for a new player that is interactive and responsive, allowing a user to act in a manner similarly to experienced players. The produced artefact also provides a rendered experience that can offer future researchers the ability to interact and study the uses of this model.

The key issue that had to be addressed was whether this artefact did indeed address the proposed research questions. This was addressed within four parts: Was a method made? How does this method allow for new players to act similarly to experienced players? How does this model promote positive team behaviour? Can the model therefore reduce toxic team behaviour?

It was addressed that through the data acquisition and design development, that the mobile application sourced a probable and effective method which new players could use within the framework of a competitive CSGO game. The glanceability of the mobile application made it the appropriate platform to work on for this specific project. However, this model in particular could live on other platforms such as a web browser, or an infographic, for example. It would be important to note at this stage that the latter options would prove to be less efficient due to their lack of accessibility while operating within a competitive CSGO game.

Following on, it was then proved that a mobile application (and the embedded information model) which was designed to lead new players through each specific round of buying, would aid them in appearing as an experienced player. It is critical to note that although this model teaches new players how to buy, it does not teach them the mechanical skills of the game which are also another facet which can lead to toxic behaviour. So, although it can be assessed that this model will offer new players a method to have appropriate and similar buying behaviours as experienced players, it does not necessarily make the new player as mechanically skilled as an experienced player.

Once it had been assessed that the method can allow newer players to act similarly to experienced players, it had to be assessed whether the model would help in promoting positive team behaviours. Using existing literature as a tangential platform, the link was made which qualified a CSGO competitive team to be a virtual team. CSGO competitive teams would therefore also be subject to team behaviours just like any other virtual team. It was found that the repeated behaviours of correct buying would aid in building a team's trust. The act in itself of buying with the team, and in line with the expected in-game meta, it is enough to foster a strong growth of trust and social interaction within a virtual team (Cascio & Shurygailo, 2003; Ducheneaut & Moore, 2004). While these virtual teams sorely lack interpersonal communication cues, they are able to effectively build trust through setting and meeting team expectations, and in turn promoting positive team behaviours such as trust and social interaction.

With the three prior questions affirmed, the final one addresses the primary issue which is toxic behaviour within video games. As it was stated previously, this method would positively improve team behaviours. However, incorrect buying is not the only facet of toxic behaviour within the CSGO competitive community. Other factors such as poor movement, poor mechanical skills, poor communications, or selfish behaviour can result in a player being subjected to toxic behaviour. While this model will improve team behaviours and it can be said by doing so, it will reduce toxic behaviour, it will not solve the issue as a whole. At this stage it is important to readdress the fact that this research project did not set out to resolve toxic behaviour within multiplayer gaming. Instead this project addressed a common area of knowledge disparity which was also a primary cause for toxic behaviour and tried to solve the issue present. It can therefore be assessed that this method reduces the possibility that a new player will be subjected to toxic behaviours related to the purchasing mechanic inside CSGO, while also promoting positive team and social interaction behaviours.

With the above in mind, it must be discussed as to the significance of these findings. What this research project concluded is that information models such as the one created, offers a method that can help improve the team behaviours within virtual teams. This is supported by previous theories regarding team dynamics, and virtual team patterns. With society moving closer and closer towards a fully digital future and workforce, research into how these virtual teams communicate will become increasingly useful in improving the efficiency of these virtual teams. For example, this research project helps create a platform for future research, to examine how much external information sources can impact a virtual team's communication.

Although this project examines this from a theoretical standpoint, practical testing with real users will only prove to further this area of research. With this project concluding, the appropriate following stage for this area of research would be to move into practical user testing, with an information model that reflects an up-to-date in-game meta. This should take place within a controlled virtual environment where a team's social and behavioural interactions are monitored and recorded. Studies should also be conducted into how players interact with these information models in real-time within in-game spaces. Furthermore, it would be important to look at the effects that real-time in-game information models have against information models that remove players from the in-game space. Due to the time constraints of this Master's research project, no user-testing was involved. Therefore, very little information is known on how the artefact practically works

within the competitive virtual space of a CSGO game. Although the theoretical framework behind the model is evident, there has been to this date, no user-testing to affirm the theories behind team behaviours and social dynamic shifts when these information models are implemented into a virtual team. With that being said, it would be important to reiterate that the next step forward within this research area should involve user-testing.

It is also important to distinguish that these information models do not only have to just be restricted to competitive multiplayer video games. The use of information models and external information sources can be used widely across virtual teams communicating for work. This can include digital businesses, digital media projects, and even research collaborators within an academic field. Due to the unexplored nature of this area, the possibilities are limitless for future research to consider. The primary significance that this research project adds within this field is the foundation for future research to continue from. It is never an easy task to explore an area in which academia has rarely ventured. Consequently, the tangential literature provided on top of the positive research question response, allows an important milestone and starting point for future researchers to continue ahead with. On this basis, future research will be able to assess the tangential literature and fill in the missing areas which support the continuation of research into external information models. In consideration of the above, although the model created affirms the proposed research question, the significance of the study lies heavily upon the platform that future researchers can continue from.

However, it is important to note that this research project did have its limitations. Most importantly, during the data acquisition phase it was decided that a limited scope towards monetary rewards would be chosen. Therefore, this model does not consider individual monetary rewards, such as bomb defusals and plants, or weapon kill, to be counted as rewards. Therefore, a player who exceedingly achieves the above (unlikely from a new player), would have more money than the model suggests they have. However, as a team can only buy when their poorest teammate can buy, this limitation, although significant, should not discredit the model entirely. The next big limitation is how frequently the CSGO meta changes with continuous updates and upgrades to certain weapons. This is done by the games developers in an effort to balance the game and create a more equal playing field between the two teams weapon choices. During the time that this project took place, CSGO went through numerous meta changes, and one economy rework which now means that the final artefact is not in line with what the current in-game economy for CSGO now is. Changes to the in-game meta is not uncommon and it would only take a small realignment of the data set to revalidate the information model. Regardless, while the data of this model may no longer correlate to the in-game meta of CSGO, the presentation of the information model and theoretical platform that it is based upon still stands. As long as the internet exists, there will be online virtual gaming teams, and with those online virtual gaming teams there will always be new users and a need to offer a way to support them in-game and in real-time. At this point it would be appropriate to address future researchers who wish to continue on from where the research project finishes. The future of this research should consider looking into user testing and design thinking. Glanceability for these information models is a great asset, as it reduces confusion, limits the time spent attaining the information, and makes the model easier for newer users to interact with. User testing will prove to be an important step in improving the glanceability of future information models.

The intention of this work was to prove the research question, but also aid new explorative thinking into this relatively unexplored area of academia. Virtual teams have begun to slowly rise in popularity, and with the continuous growth within the entertainment industry of eSports, they will only grow in popularity. With that in mind, research conducted into how these new virtual teams work, cohabitate virtual worlds and interact, will aid the future not only for academics, but also for the practical users of these services and teams. With the constant demand for instant connectivity and instant social gratification, these virtual teams, and the spaces that they exist in will only continue to grow. Therefore, society as a whole, needs to start assessing the jobs, impact, and scope in which virtual teams will exist in the future as our society grows more and more digitally dependant.

8.0 References

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9.0 Addendum

To allow for the review of the practice-based component of this Master's research project I have attached a link to a live drop box paper which contains two embedded prototype links, one screen recorded video and a PDF prototype document.

https://paper.dropbox.com/doc/AUT-Masters-CD-Jordan-Prototype-Portal--As8VD36CWWiKL9LI8KC~vZDCAQ-syh66803d8X27yVHR6DHM