Understanding Specific Gaming Experiences: The Case of Open World Games

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0.1 Abstract

Digital games offer players a variety of experiences. Open world games allow players to choose what to engage with, and subsequently choose what experiences they want to have. However, this means it is not always clear what players are doing or why, even within the same game. This lack of commonality questions what it means to have 'a' gaming experience if there is little overlap in player behaviour. This thesis explored what it means to experience an open world game, and how experiences are unique to specific games/type of games. The first two studies showed that despite differences in what players do, there is an overarching experience: self-pacing gameplay by choosing what to engage with. Studies three and four explored if motivation could explain what experiences players pursue, but current measurement tools were not statistically or conceptually dependable enough to provide robust findings. Study five conversely explored whether goals can explain player behaviour, and found players consider their actions goal-directed. Finally, study six explored how to overlay goals to actions taken in a specific gaming session. This revealed that the game also provides goals for players to consider, meaning gameplay is not only driven by player intent.

Overall, open world games are a series of contextually-situated experiences; players purposefully engage with in-game content, but remain flexible to what the game may offer in the moment. Whilst individual experiences vary greatly, players had the same unifying experience of navigating goal pursuit. Goals can be related to gameplay data to reveal what player-game interactions take place, and how players report them. Therefore, this thesis shows players can have little overlap in the specific experiences they have within games, yet still have the same overarching experience. Understanding such experiences requires data from a player's perspective, as gameplay data alone cannot reveal player intent.

0.2 Acknowledgements

Narns, Humans, Centauri, we all do what we do for the same reason: because it seemed like a good idea at the time — G'Kar, Babylon 5

I have always been a good traveller. Even before I was one-years old I was frequently on long-haul flights around the world, never causing a fuss at the unfamiliar space and expansive stretches of time. My mother tells me I would happily keep myself busy by playing with the tray latches and the window blinds, much to the amusement of the flight attendants. Finding joy in the simple things, and pursuing solo activities for long periods of time, have apparently always been traits I possess. On one occasion, as we stood up at the end of a particularly long flight between the UK and Australia, I supposedly patted the plane with all the confidence of a toddler and said, 'had enough now.'

In many ways, this thesis has been its own extraordinary journey, of which I have been its willing traveller. And like my flights of old, I have pursued my independent amusement under the watchful eye of my family. My mother and father have been unwavering in their support, and I would not be who I am today without them. Though, it is my husband Forty who has been treated to the full hands-on experience of pursuing a PhD, suffering through the lows and celebrating the highs, always with a smile. Without his steadfast belief in me, I could not have made it to the end. And of course, there has been my supervisor Paul; the person who saw a bright-eyed psychology student looking for a cause, and honed me into the research scalpel I am today. We have accomplished a lot together, but the greatest gift was finding the academic mentor I didn't know I needed. Someone who is equal parts kind and wise, yet firm and resolute. And perhaps, one day, I may call him my friend.

With everyone behind me, I feel like anything is achievable. And so I dedicate this work to those that did not give up on me. It's been a long journey, and I have thoroughly enjoyed every step of the way. But the plane has landed, and I must depart.

pats thesis had enough now.

0.3 Declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for a degree or other qualification at this University or elsewhere. Work from other authors is properly referenced and cited as such. This thesis contains material published in the following publications and preprint:

1. Opening the World of Contextually-Specific Player Experiences (Hughes & Cairns, 2021)
2. Growing Together: An Analysis of Measurement Transparency Across 15 Years of Player Motivation Questionnaires (Hughes, Flockton, & Cairns, 2023)
    - Josephine Flockton aided in citation collection for the empirical uses of questionnaires.
3. No Item Is an Island Entire of Itself: A Statistical Analysis of Individual Player Difference Questionnaires (Hughes & Cairns, n.d.) [preprint]

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Chapter 1

Introduction

"It is not because things are difficult that we do not dare;
it is because we do not dare that they are difficult."
— Lucius Annaeus Seneca

There are thousands of digital games with a similarly vast amount of experiences enabled by them. From somewhat simple puzzle games like *Tetris* (1984) to complicated, intricately social environments such as *World of Warcraft* (2004), the definition of what even is a 'game' has shifted to accommodate this evolution (Stenros, 2017). Similarly, the types of experiences players can have in games has also grown; games provide a plurality of experiences, where players can enjoy them in several ways (e.g., eudaemonic vs hedonic enjoyment, Oliver et al. (2016)). If a player seeks an in-depth narrative experience where their choices advance the plot, they could play *Detroit: Become Human* (2018). If they seek a vast world to explore, they could play *Minecraft* (2011). And if players seek connection with other players, they could play an online multiplayer game such as *Elder Scrolls: Online* (2014). In the case of *World of Warcraft* (2004), a player could even find all of these within just one game.

It is known that some types of games are distinct from others, and draw players into specific experiences. However, there has been little research on how game-specific gaming experiences differ from one another, preferring instead to consider games as an undifferentiated whole (where players 'play games' and 'have gaming experiences' such as immersion). Because of this, we do not know what different types of experiences there are to have, why some are more appealing to players over others, or even how and why experiences differ. For example, research has found *Wii Sports* (2006), a game involving physical movement of the body, is an immersive gaming experience (Pasch, Bianchi-Berthouze, van Dijk, & Nijholt, 2009). However, *World of Warcraft* (2004), an online multiplayer game, is also immersive (Christou, 2014). These two games offer entirely different experiences, both in how they are played and what activities players can do; how then can they differ, yet supposedly deliver the same experience?

Furthermore, it is possible to have multiple gaming experiences within the same game. What constitutes an 'experience' is linguistically expansive and can refer to a vast array of overlapping contexts that enable one another (Cairns & Power, 2018). The distinction here relates to the difference between what a game is, and what a player experiences — for example, a game narrative can both be immersive, and provide players the experience of immersion. In other words, experiences differ between what the sum total experience of the game is (the 'game experience'), and the set of contextually-situated events that happen within the game a player interacts with (the experience of playing the game 'in the moment'). Whilst the distinction may at first appear merely semantic, it is brought into sharp relief in so-called open world games. These games are known for allowing players to 'do what they want when they want,' by providing a multitude of activities to pursue whilst not pressuring the player to do any one of them. Consequently, the game is a place to choose what to do, and the player experiences making choices. However, the experience of choice will vary between each player, as they will have a unique collection of contextually-situated experiences depending on what they choose to engage

with, which are driven by the interactions they have with the game. Each player therefore engages with the same game, but simultaneously constructs an individually unique experience of the game (where there may be little to no overlap in content engaged with; Dale & Shawn Green (2017)).

This variation in experience between open world game players is also higher than most other types of game. For example, players of the strategy building game *Civilisation V* (2010) must always start with a settler and build their empire through a series of pre-defined technology progressions. The Match-3 game *Candy Crush* (2012) involves players progressing through a series of levels in the same order, meaning each players' trajectory is comparable. This is not the case in open world games. One player in *Breath of the Wild* (2017) could diligently work their way through the main story, completing every side objective they come across. Another player could simply run to the final boss straight after the tutorial. In fact, they may not even need to fight the final boss at all, instead spending their time enjoying the scenery (P. Atkinson & Parsayi, 2021). All players have 'experienced' the game, and perhaps may all rate the overall experience as immersive — but are these comparable when they share little overlap in contextually-situated experiences? How can we conclude anything about the experience of playing *Breath of the Wild* (2017) (or indeed any open world game) if each player has such a different collection of experiences? Can we be sure there are in fact any commonalities of experience to be found?

Because of the high level of choice and freedom to pursue game content allowed by open world games, there are few players who could claim to have experienced everything these games have to offer. Indeed, even finding two players that have played through the exact same content would be challenging, if each component can effectively be played at any time with little consequence. It is therefore unknown what sequences of interactions with the game a player will encounter, or what influences their action selection. Whilst assumptions could be made that players likely focus on the main quest, there is evidence to suggest otherwise. There is little empirical research investigating completion rates in open world games, but publicly available data on main quest achievements earned by players (accessible via *Steam* game pages) makes it possible to observe the general trend in gameplay — the higher the average main quest achievements earned, the further players get into the main quest[1]. As Figure 1.1 shows, there is a steady decline in main quest completion across multiple open world games. Whilst most players will start the main quest (an average of 84%), far fewer will complete the story (23%). This means less than a third of players complete the main quest.

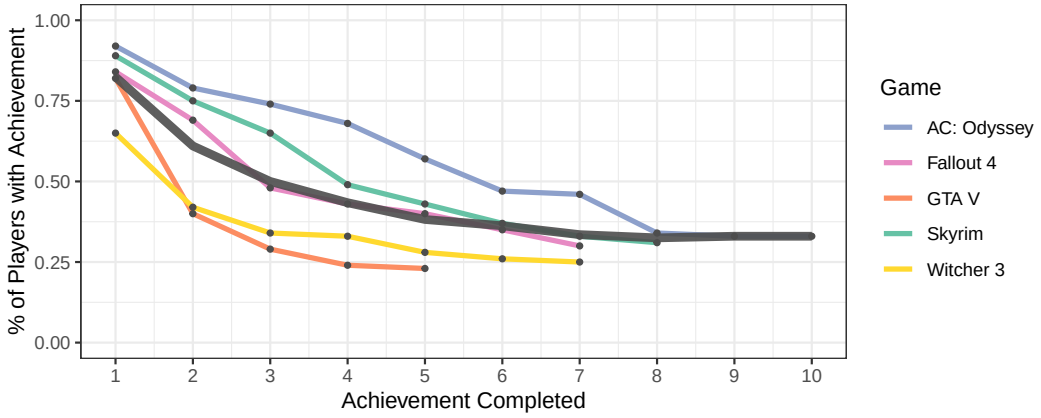


Figure 1.1: Main quest achievement completion for a selection of open world games. The black line represents average quest completion.

Further, this is unlikely due to the player choosing to stop playing the game entirely. Table 1.1 shows that players spend many hours in these games, far greater than how long it would generally take to complete the main quest (an estimate provided by the website *HowLongToBeat.com*). Whilst it takes on average 38 hours to complete the main quest in these games, players spent an average of 101

[1] see Appendix A for more information on how the data were collected.

hours playing. This means that, even if every player did complete the main quest (which as shown in Figure 1.1 is not the case), there is still 63 hours worth of playtime unaccounted for. Therefore, despite players putting in numerous hours into these games, they do not appear to be doing the main quest. Consequently, we cannot assume players are playing the main designer intent of the game, and as such have the same contextually-situated experiences. This leaves us unable to know both what the game is in terms of gameplay, and what the player is experiencing. It is therefore unknown what players are doing, why they are doing it, what experiences they are having, how these experiences combine together, and if their experiences are comparable to other players.

Table 1.1: The mean time spent in a selection of open world games versus how long the main quest should take to complete.

Game	Mean Play Time (hrs)	Mean Time to Complete (hrs)	Mean Play Time Difference (hrs)
Grand Theft Auto V	186	31.5	154.5
Skyrim	113	33.5	79.5
Witcher 3	68	51.0	17.0
Fallout 4	102	26.5	75.5
Assassin's Creed: Odyssey	65	40.0	25.0
OVERALL	**106.8**	**36.5**	**70.3**

In some sense, all aspects of the open world gaming experience are currently unknowable — it is unclear what (if any) overall experience players are having, because it is unclear what contextually-situated experiences they encounter, because their actions, reactions, interactions, and reasons for choosing actions, are unknown. To conclude what experiences players are having, there is a need to measure and explain what actions players are selecting. Therefore it is important to link what players are doing to why they are doing it, to observe how experiences are enabled.

It is possible that, due to the highly individualised nature of each player's experience, there is no observable commonality. Each player's experience may be so unique as to obscure any sense of overarching context. If true, this would question what is meant by a 'gaming experience' when it is observed at a specific experiential level. It is therefore important to study such specific gaming experiences, to understand the extent to which singular games can provide a stable 'experience' from a collection of contextually-situated experiences, and what such an overarching experience looks like.

To understand contextually-situated experiences, it must be known what open world players are doing (i.e., their actions), as no assumptions about their play trajectories can be made. Player reasons for choosing certain actions over others will inform on the types of experiences they are having. Not only the choices they make will be important, but also the experience of choosing they encounter. What players choose to do will consequently influence what they experience, and therefore their choices highlight both what experiences they are seeking and why.

This thesis aims to explore what gaming experiences are enabled in open world games, how the actions of players enables these experiences, and the extent to which experiences are comparable across individuals. In doing so, what it means 'to experience' an open world game is explored, and what is meant by the concept of a 'gaming experience' when it is contextual to a **specific** game/type of game. Overall then, the thesis addresses the following question: what does it mean to experience an open world game, and how do players enable it through the actions they choose?

1.1 Research Questions

Therefore the main thesis research question is as follows:

What is the experience of playing an open world game?

To answer this question, a variety of sub-questions must also be considered. For example, the boundaries of what constitute specific games has historically been unclear, as the concept of 'genre' can be

ill-defined (Deterding & Zagal, 2018). It is possible during this work to choose a game that appears to enable an open world experience, but is in fact not considered to be an open world by its players. Indeed, it is possible that an open world game is not a specific experience that players can identify at all. Therefore, it is important to first clarify what an open world is and how to identify it — in other words, what is the overarching experience of playing an open world game? By defining this, the contextually-situated experiences studied within them can then be accurately considered a result of the open world nature. To do so, the following sub-question of the thesis must be considered:

1. What defines the open world gaming experience?

Once it is established what the overall open world gaming experience is, the next step is to understand how this experience relates to what players do in the game — what actions do players take to enable experiences, both contextually-situated and overarching? There are a number of wider concepts of behaviour that may explain how players choose their actions, so it is unclear which is most appropriate for the study of open world games. Therefore, the following sub-question is relevant:

2. What framework works best for understanding action selection in open world games?

As an example, motivation is a common underlying concept theoretically expected to drive action selection, but it is unclear how applicable it is in open world games. Do players have measurable motivations whilst playing? Do they have multiple motivations? If so, how much do these influence behaviour? If motivation does not apply/cannot be accurately measured, it will be more difficult to relate experience-enabling action selection in open world games to previous research. To explore this, a further sub-question requires answering:

2.a) Can motivations be measured and related to the open world experience?

A similarly common explanation for choosing actions is goals. For example, players could be motivated to pursue a specific goal in an open world game, and this shapes the experience that they have and seek out. However, it is currently not clear what goals players have in open world games, and how best to access this information. Therefore, the following question must also be considered:

2.b) Do players consider their actions goal-directed in open world games?

Understanding both what defines the open world experience, and the applicability of motivation and goal-driven concepts makes it possible to explore action selection in open world games. The analysis in this thesis showed goals were more appropriate to understand action selection. However, observing goal and action choice is not straightforward, as most of the choice happens within the mind of a player. It is unclear what players believe to be 'choices,' such as what level of abstraction they consider their choices to be made at (e.g., goal selection vs action selection). Theoretically, pressing a button to move forward is selecting an action — similarly, deciding to complete the main story is also an action. These decisions are vastly different in scope and abstraction, which make them difficult to compare, and see how they relate to the gaming experience overall. Understanding what drives a player's action selection could reveal what choices are deemed as important to them, and by extension make up their gaming experience. Therefore, a further sub-question is as follows:

3. How do players relate goals to action selection in open world games?

Finally, how players perceive what drives their action selection should be applicable and observable in their gameplay, highlighting how behaviour relates to gaming experiences. Identifying which actions and goals make up contextually-situated experiences may explain why experiences differ between players, and in what ways. Therefore, the final sub-question is as follows:

4. What is the experience of selecting goals & actions during gameplay?

To answer the above research questions, a number of studies have been undertaken. The following section outlines the scope of the thesis and methodologies used.

1.2 Research Scope & Methodology

To answer the research questions, this thesis consists of six studies; studies one and two relate to the first question, studies three and four relate to question 2 a), study five addresses questions 2 b) and 3, and study six relates to questions three and four. An overview of these studies is provided in Table 1.2.

Question	Study	Chapter	Summary	Method Type
1	1	3	How players define the open world experience	Content Analysis
	2	3	How player-defined factors enable the open world experience	Thematic Analysis
2a	3	4	Identifying potential player motivation questionnaires	Scoping Review
	4	4	Factor analysis of player motivation questionnaires	Factor Analysis
2b	5	5	What goals players have in open world gaming experiences	Content Analysis
	5	5	How goals relate to one another in open world gaming experiences	Hierarchical Task Analysis
3	5	5	How players relate actions to goals in open world gaming experiences	UML State Diagram
	6	6	What goals exist in a specific open world gaming experience	Thematic Analysis
4	6	6	What players experience during a specific open world gaming experience	Mixed Methods

Table 1.2: A summary of the studies that make up the thesis.

In total, 6 analysis types are used, which are qualitative, quantitative, and mixed methods approaches, across 6 studies. Study 1 employed a Content Analysis (Krippendorff, 2018) to explore what descriptors players use when describing open world games. Players were found to describe open worlds as having a high volume of content in a large environment, where they could explore at their own pace. The findings were used to create the interview questions of Study 2, which employed a Thematic Analysis (Braun & Clarke, 2006) to understand what themes constitute the overarching open world experience. Players indicated 5 interlocking themes that enabled them to self-pace gameplay through engaging/disengaging with tasks at will, which was key to the experience.

After establishing how players define the overarching open world experience, the next 2 studies explored the feasibility of motivation to understand action selection and its relation to the experiences players have. Study 3 involved a Scoping Review (Munn et al., 2018) of the literature, to establish what player motivation questionnaires exist and are used by researchers. 18 were found that had been empirically used, which represented interdisciplinary approaches to understanding how players differ. Building on this, Study 4 performed Confirmatory and Exploratory Factor Analyses (Cairns, 2019) on 11 of the identified questionnaires, to explore their statistical validity, reliability, and overlap. Findings suggested no one questionnaire was well suited to capture the known extent of motivations possible in players, with high degrees of conceptual and statistical overlap present. As such, motivation was deemed inappropriate to understand the actions of open world players in this thesis.

The final 2 studies therefore explored the feasibility of goals to explain what actions players select to enable their experiences. Study 5 involved Content Analysis, a modified Hierarchical Task Analysis (French, Taylor, & Lemke, 2019), and the construction of a diagram inspired by Universal Modelling Language (UML) State diagrams (Samuel, Mall, & Bothra, 2008), to explore how players chose what actions to pursue in open world games, to understand how action sequences related to goals. Players naturally discussed their actions in terms of goals, where such goals could be linked to specific action sequences. Finally, Study 6 replicated the analysis of Study 5 but in a specific gaming experience, which also allowed a further analysis of how actions and goals changed over time. This analysis was exploratory in nature and used mixed methods, combining quantitative game data with qualitative recounts. Players again spontaneously discussed goals, which were related to their actions, and took place as a series of contextually-situated experiences. However, it was also found that players would prioritise discussion of certain actions and goals over others, indicating that some contextually-situated experiences are more salient and meaningful to share than others. The level of detail given by participants was also found to be dependent on how the questions were framed in the post interview. The overall contributions of these studies is discussed in the following section.

1.3 Contributions

Overall, this thesis contributes to knowledge surrounding what it means to experience a game, both at the overarching level and the experiences enabled by the interactions between the player and the game. The thesis therefore contributes theoretical, methodological, and practical insights into the area of understanding specific gaming experiences, described below.

1.3.1 Theoretical

Across the 6 studies, a number of theoretical contributions have been made. An empirically-grounded definition of the open world experience is provided, which indicates players consider the experience to be the ability to self-pace gameplay within an unrestrictive environment. In doing so, how to understand contextually-specific gaming experiences (such as open world games) is described, by understanding what aspects of the interaction between player and game enable it. This overarching experience is enabled by the collection of contextually-situated experiences unique to each player and play session. Therefore, this thesis also demonstrates why it is important to separate the concepts of experiences that happen within the context of a game in the moment, from the overarching experience of playing the game; focusing on one negates the influence of the other.

Finally, how goals relate to actions is explored, showing the complex interconnections both within such concepts and between them. It is concluded that it is too simplistic to consider action selection to be guided by 'a goal,' as multiple goals are typically active at any time, where the most salient may be highly abstract and only knowable by asking the participant directly. Instead, it is more accurate to say that action selection is guided by a variety of desires which fluctuate over time, which can themselves be influenced by the specific contextual situations the player finds themself in by interacting with the game in the moment. Put another way, the player brings a multitude of goals to a game, as does the game, which enables navigation of how best to act and react.

1.3.2 Methodological

Whilst exploring the open world player experience, a number of methodological contributions have been made. Firstly, a statistical analysis of player motivation questionnaires is provided, that highlights a high degree of conceptual overlap between instruments. Such overlap calls into question both their reliability and validity in measuring player motivation. As previous research has relied heavily on semantic similarities between items and scales, this thesis provides a new way to analyse how questionnaires relate to one another.

Secondly, how to extract action sequences from secondary data accounts of gameplay is explored, and how to relate these to the overarching goals of a player. Such analysis indicates how players make sense of their actions, and what drives them towards certain in-game content. Previous research has typically overlooked the time component of experiences recounted by players, and so this thesis highlights how reported action sequences can be extracted, abstracted, and connected to goals.

Thirdly, how to relate observational gameplay data to player accounts of their actions and experience is explored. This is done by mapping recall of events to the actual events that took place, to demonstrate points of interest. Players are goal driven, but frequently interrupted by the game, and so switch goals frequently throughout play. Whilst players are generally accurate in reporting their goals, actions are less recalled, especially if they are less central to their desired interest (such as movement). This thesis consequently shows how to combine qualitative and quantitative data in insightful ways to understand what players are working towards moment-to-moment, as well as what aspects of a gaming experience they prioritise for discussion. Finally, this thesis indicates recall can be influenced by the context of the question being asked — players who discuss their goals and actions before or during play report more actions and goals. Therefore, this thesis demonstrates the importance of the context of the questions asked of players when discussing experiences.

1.3.3 Practical

The findings from this thesis can benefit designers and developers of open world games. Firstly, understanding what open world players value about the open world experience has been explored, with specific insights gained into what players expect from an open world game. In turn, this can aid designers in creating games that align with the values of their players.

Secondly, a main finding from this thesis is the flexibility in what players choose to do in open world games. Rarely do players have only one goal in mind when playing, as they enjoy the freedom to explore options that arise from the contextually-situated experiences that occur. Understanding the desire of players for flexibility when changing between goals can help designers to ensure players do not feel trapped into any one type of content during play.

Finally, the exploration of how to measure and understand what players pursue throughout a gaming session, in terms of their actions and their goals, may be useful for designers. Study 6 demonstrated a way to record gameplay data and player perspectives in a way that allows a granular analysis of what players engage with that also accounts for their reasons for pursuit (i.e., their goals). Designers could use this analysis technique when conducting play tests to gain more specific feedback.

1.4 Statement of Positionality

As the nature of this thesis involves qualitative methods of data analysis, it is important to acknowledge how the views and experiences of the researcher can influence the results. Doing so increases the transparency of the work conducted, as well as provides further information for how to interpret the results presented. Firstly, I have been playing games for the majority of my life, and open world games have been amongst my favourite type for over a decade. From my own experiences I observed a desire to explore more than just the main narrative presented by the game, and in fact spent a majority of my time actively avoiding it. The range of choices of activities outside of the main quest proved more engaging to me, which, guided by background in psychology, led me to consider what decision-making processes may underpin these choices. After initially taking this psychological focus, I began to consider the simpler underlying question of what do players actually do in these games, and how can we make sense of such choices.

Consequently, my experience with open world games naturally affects how I view them, especially in terms of what I view to be 'good' examples. For example, I have spent the majority of my gaming experience in single-player, role-playing open world games, and so have less experience with multiplayer games. There are likely players who have the opposite experience of mine, and so I have been mindful to separate my own opinion of what makes an open world game 'good' from the opinions of my participants when considering how to define the open world gaming experience. One such way I mitigated this impact was the use of secondary data sources to ground initial investigations into the opinions of players. In doing so, it was possible to generate interview questions for primary data collection using a bottom-up approach, less influenced by my own experiences.

Secondly, not only have I experienced first hand the breadth of experiences possible within open world games, I have heard from discussions with other players a like-minded appreciation of the level of freedom given by these games. This combined appreciation and knowledge of open world gameplay allows me to communicate with other open world game players in a more naturalistic way. Furthermore, I am familiar with common terminology and the types of contextually-situated experiences that can occur. Consequently, detailed conversations and interpretation of data are possible using my prior knowledge. However, it is important that my knowledge does not affect how I interpret what other players mention, as they are likely to have very different experiences than my own. Therefore, throughout the thesis I have made use of a variety of data sources alongside interviews, in order to triangulate findings. In doing so, this reduces the influence of how I communicate with players, whilst still maintaining the useful insights gathered from them.

1.5 Ethics Statement

Throughout this thesis, ethical management of participants and their data was considered. All empirical studies were approved by the University of York's Physical Sciences Ethics Committee before commencement, and all participants were over the age of 18. The following considerations were made:

- **Participant Wellbeing:** Studies were designed to not cause harm participants, such as using secondary data sources and asking non-intrusive questions during interviews/surveys.
- **Anonymity and Confidentiality:** All data was anonymised after collection, and no identifying data was stored. When quoted, participants are referred to by number (e.g., Participant 1).
- **Informed Consent:** Participants were given information sheets before taking part in a study, which explained the nature and goal of the work. Participants were also debriefed afterwards on the study and given time to ask questions. Participants were told they could withdraw at any time during the experiment or at debrief, and could do so without penalty.
- **Data Management:** All data are stored in password protected folders on the University of York Google Drive. After 10 years, the data will be deleted.

Chapter 2

Literature Review

"Writing is the process of asking the next logical question."
— J. Michael Straczynski

Understanding open world games and the experiences contained within them relies on understanding various aspects of player experience, and how to measure them. Accordingly, this literature review considers such aspects as the player experience, choice, motivation, and goals, as well as how the measurement of such concepts has been done in previous research. However, as the main domain of this thesis is open world games, the review begins by considering research explicitly focused on these games. To date, explicit open world games research has not provided a clear foundation to understand the gaming experience contained within them, and so the following section provides an overview of this research and its current limitations.

2.1 Open World Games

2.1.1 What Are They?

Before exploring the open world experience, it is first important to be clear on what the experience actually is. Games, whilst loosely sorted into genres, can be contentious in their labelling, with disagreements between players. This is especially true in open world games — players frequently disagree as to what does and does not count as an 'open world'. A notable example of this came with the release of *God of War* (2018), whereby the game director explicitly stated he did not intend to make the game an open world[1], but many players argued that to them the game felt like one (such as threads appearing on the *God of War* (2018) subreddit[2]).

Disagreements are reflected in the academic literature as well; Sullivan, Mateas, & Wardrip-Fruin (2012) defines open worlds as having a "multitude of options for the player," whereas Tanenbaum (2013) defines them as games that "present the player with a toolkit for creating emergent player authored narratives within a simulated world, by creating lots of small interlocking goals spread across a large virtual geography." Other definitions focus on the exploration component, such as Szymanezyk, Dickinson, & Duckett (2011) who defines them as involving "the use of large open worlds with a distinct gameplay focus on player exploration and discovery." A lack of clarity complicates the understanding of the experience, as there is no full agreement as to what it truly 'is'. By extension, it is even unclear whether there is indeed such a thing as an 'open world' to be easily identified.

Therefore, not only are open world games hard to define from current approaches used in the literature, they are also not clearly defined by players, designers, or researchers. Whilst definitions show similarities, they are not cohesive in distinguishing an open world game from similar types of experiences by themselves. A definition that could be created from past literature would be the

[1] Retrieved from www.polygon.com/e3/2017/6/23/15860796/ on 25/02/2020
[2] Such as www.reddit.com/r/GodofWar/comments/8f95iv/, retrieved 25/02/2020

following: open world games have multitude of options for players to choose between, allowing them to create their own narratives and explore across large spaces. However, this definition is synthesised from researchers' perspectives, and so it is unclear if this is how players themselves view the open world experience. To overcome this, a reexamination of the definition of the open world experience will need to be conducted, with a focus on the players' perspective.

Defining concepts on the surface may seem a trivial task. However, in many cases words do not inherently hold meaning. The phrase 'open world' will mean something different to players than it would to other groups of people. For example, in machine learning research the phrase 'open world' refers to an assumption that no one agent knows everything about a system, and so whether a specific statement is true is not always knowable (see Moore & Van Pham (2015) for an overview). For example, an agent can be told a husky is a type of dog. If asked if a labrador is a dog, it would say no, despite the objective truth of the fact; its pre-defined yes/no classification is specified so that only huskies are dogs. The open world assumption however allows the agent to say 'unknown' rather than forcing a yes/no response. Consequently, the meaning of an open world, and any concept, is dependent on the group in question and how they use words.

Relatedly, socially defined terms are highly flexible and subject to change. People make judgements of value when considering definitions, and these are based on what is important to that individual (Bateman, 2015). Therefore, it is common that any usage of a definition will highlight what the individual in question considers to be a 'good' example of the category as well. For example, Zagal & Deterding (2018) observed the usages of the term 'roleplaying games' (RPGs) and found these to be different depending on the social and gaming background of the individual. Those who grew up with tabletop RPGs did not consider MORPGs to fit the definition, and vice versa. This is because their use of the term was a way to divide the world based on what they personally found to be a good example of an RPG that they were used to.

Considering language in this way is known as Prototype Theory. Some elements of a concept, known as prototypes, are more important than others when defining a concept. This was theorised by Rosch (1973), where the use of categorical language is fluid and fuzzy but can still capture the important essence of words. In her seminal work in the area, Rosch provided evidence that this is how people learn to categorise concepts that contain continuous variables. The work mostly revolved around the classification of colour and object shapes, which must have something unique as people across the world in various cultures all roughly agree on the categorisation, such as where on the colour spectrum green exists. People also tend to give the same sort of greens as typical examples of the colour, meaning there must be something special about green that helps to identify it.

Rosch concludes that people compare against a prototype of what a member of the category *ought* to look like. When presented with a new stimulus people attempt to classify it by comparing it to what they already know about. If a new animal is found, a person may assess it against their 'prototypes' of multiple animal categories - does it have fur? Can it fly? How many legs? Using these the person can identify which most closely relates to the animal, thereby using the prototype as a guide. Some prototypes are more perceptually salient than others, explaining why some are more frequently used as examples. There are many different shades of purple, but not all of them are 'good' examples. Similarly, there are many examples of open world games, but not all will be useful to convey what a typical open world game looks like. When a person learns a new category they first associate with it the most salient aspect of the stimuli. Afterwards they begin to generalise this out to other instances by applying the prototype where appropriate. This explains why highly salient concepts are learnt first, as they become the central point to organise the category around. These are known as 'natural prototypes', and are characteristics that cannot be compromised on if the category is to be maintained. If flightless birds are still included in the bird category, it can be assumed that the ability to fly, whilst a feature, is not a central/natural prototype, but is present typically. On the other hand, there are no examples (except for disease e.g., Gill (2001)) where birds have no feathers. This means the presence of feathers is more central to the bird category than the ability to fly.

For open world games, some features may be more important than others, making them central to the concept, whilst other features may be typically present but not necessary for the category to be maintained. It is also likely that many of the features of an open world experience are continuous

in nature — 'open' is not a binary classification, and neither is 'size,' a commonly assigned feature discussed previously. Therefore, to understand what the open world experience is from the perspective of players requires an understanding of what aspects are considered central, and why. From this, prototypical examples of open world games can also be found, which can be used in this thesis to select games to use as stimuli.

Outside of defining the experience, past research on open world games falls into two general areas: those interested in player behaviour enabled in these games, and those interested in creating better gaming environments using open world games. As the latter is more to do with computational generation than player experience (i.e., making better game assets), it is outside the scope of the current thesis, and therefore not detailed here. However the former is of interest, and can be further split into researchers with Human-Computer Interaction (HCI) interests (e.g., player behaviour, narrative/philosophical explorations), and researchers with AI focused interests (e.g., player modelling, procedural environment generation). Both are overviewed in the following sections.

2.1.2 HCI Research in Open World Games

To date, there has been no HCI research that aims to understand the open world experience in its totality. Instead, the focus has been to understand aspects present within them/enabled by them, such as in-game purchase intentions (Zhao, Wu, Song, & Yao, 2022) and the experience of exploration (Wolf, 2021). Such behaviours can be present in many types of game, and so it is unclear whether there is anything specific to open world games that changes these findings. Other work has focused on the design of open world games and the intent of the designers who make them. For example, Tanenbaum (2013) described how game designers view the relationship between what they create and what players do with them. Open world games are specifically mentioned (referred to as sandbox) as a design choice that gives players more freedom at the expense of a tightly controlled experience laid out for them. The player is given the ability to create their own experience, referred to as emergent player-authored narratives, because they are given freedom to choose what to engage with. Whilst exploring the sometimes negatively viewed player behaviour that comes with defying what the designer 'intended' for the player to do, the authors argue that players are not typically doing this to be subversive. Instead, players wish to explore all aspects of the game to fully engage with it, leading them to having multiple goals to pursue at once. This also helps explains why players can have contradictory goals, as they can focus their attention accordingly to whatever goal is currently dominant for them. Emergent narratives may therefore explain why it is difficult to identify 'the' open world experience, as players are actively encouraged to make their own and make the meaning of the experience themselves. However, the focus on the design of the game in this work does not account for how players experience the game, as there was no empirical investigation into the topic.

The concept of emergent narratives within open world games discussed in Tanenbaum (2013) has been explored elsewhere, such as the thesis by Murnane (2018) on how *Skyrim* (2011) players construct stories around their characters, documented in forum posts. Interestingly, players incorporated random contextual game events into their character stories, illustrating how players co-create stories through interaction with the game. Therefore, it is possible that random contextually-situated experiences are both common and important to the overall gaming experience. However, the work here was based on secondary data (pre-existing data collected from online forum posts), and was reflective of entire gaming experiences across hundreds of hours. Consequently, it is unknown how much narrative reconstruction happens for a singular and specific gaming experience that has just occurred.

Other research has used open world games to explore the experience of playing them, but from a restricted analysis of the game space, rather than the totality of what players were doing and why. For example, previous work has sought to understand abstract concepts such as how wilderness is portrayed in media to understand the dichotomy of man vs nature (Bonner, 2018). Other work has considered how urban spaces are used as design features in open world games (Bonner, 2015), and how the killing of animals is portrayed (e.g., Van Ooijen (2019)), as a reflection on societies' views at large. Some work has gone beyond a theoretical analysis of game components like wilderness vs urban

spaces by conducting qualitative explorations with players, such as Denham & Spokes (2021). Players were given a specific location in *Red Dead Redemption II* (2018) and asked to play unstructured, before being interviewed about the experience. Answers were analysed via Lefebvre's theory of the use of space (Lefebvre, 2012), showing how players experienced the game space with specific attention given to the difference in rural and urban spaces. Therefore, such work reflects of the medium of games and how it affects players, which is a subset of experience, but not the main focus of this thesis.

Overall, HCI research interested in open world games has typically only studied sub-components of the experience, sometimes as a way to explore societal views through media portrayal. Therefore, it is unknown what the overall player experience of open world games is, or how players construct experiences from their play in specific gaming sessions (rather than reflections across an entire game).

2.1.3 AI Research in Open World Games

Open world games provide an interesting research area for Artificial Intelligence (AI), whose goals include creating better models and objects by harnessing the unpredictable and complex nature of these games (such as improving the believability of in-game agent movement (Tomai, Salazar, & Flores, 2013) and crowd behaviour (Szymanezyk, Dickinson, & Duckett, 2011). Other research considers how to track and understand noisy player data, and in turn relate this to individual player differences (e.g., Melhart, Azadvar, Canossa, Liapis, & Yannakakis (2019)). Whilst the former is outside the scope of this thesis, the latter relates to understanding the player experience of such games.

One such collection of player-oriented AI research investigates goal recognition. Due to the high flexibility in what players are able to do, research has used open world games to train algorithms to recognise player goals. Much of this research takes places in the educational game *Crystal Island*, and began with Ha, Rowe, Mott, & Lester (2011) who used Markov Logic Networks to identify player goals from sequences of player actions. Crystal Island is a gaming environment for students to learn about microbiology, via finding the source of a disease outbreak. As this involves exploring multiple sources of information to piece together the answer (and consequently having multiple goals to choose between), players can achieve them in any order, similarly to open world games. The authors found they could identify the current goal of the player better than baseline models by 82%, though its accuracy was low. Min, Ha, Rowe, Mott, & Lester (2014) extended the work of Ha, Rowe, Mott, & Lester (2011) with an improved model utilising deep learning, and Min et al. (2017) improved the model again by adding an additional data source in the form of player eye tracking. More recently, Gupta et al. (2022) extended the above work to both recognise and predict player goals based on probabilities of the goal being active. This was done by incorporating reflective statements from participants at 5-minute intervals, so the model could account for what the player was currently thinking about.

Overall, the work considering goal recognition and prediction in open world games is insightful if building AI models. However, there are limitations when seeking to understand the player experience of open world games, and indeed how players interact with goals. These mostly surround the game environment chosen, and the conception of goals. Firstly, all the above research takes place in *Crystal Island*, a modified educational game which aims to teach students in a gamified setting. It is therefore not reflective of commercial open world games and the further complexities they bring. Secondly, in all studies goals are extracted and defined from the game, typically by looking at what goals a player had achieved before, and the sequence of actions completed. For example, if a player is talking to the camp nurse after having completed a laboratory test on the food sample, this is interpreted as following the goal 'submitting a complete diagnosis'. As such, the goal of the player is defined by the game state and the interpretation of the researcher who assigns the goal class label. How the players view their goals is not considered, which may be vastly different. Therefore, the above work can only relate game-imposed goals to in-game actions, and cannot account for player-derived goals. As open world games are a two-way interaction between the player and the game, only considering game goals ignores many possible reasons for interaction. Thirdly, it is known that players can have more than one goal active at a time, and are known to interleave between them when necessary (e.g., Tanenbaum (2013)). The above work cannot account for this, as only single goals are created in the models (though

this is noted as a limitation in the work e.g., Gupta et al. (2022)).

Lastly, as the aim of the above work is to create AI models to recognise and predict player goals, results report model performances rather than what players did and experienced. Therefore it is unknown why certain goals were selected, or what they meant to the player and the experience they had. Even Gupta et al. (2022) which included player reflections did not elaborate on the content players mentioned in detail, as it was only a parameter to add to the model. Overall, goal recognition in open world games has yet to be studied for the purpose of understanding what players experience, or how they define their own behaviours.

Other research using AI to understand players comes from player tracking data, typically by clustering players and attempting to relate this to individual differences. M. Aung et al. (2019) was the first paper to attempt to model and cluster player behaviour in open world games, using *Just Cause 2* (2010) as a case study. The authors inputted a variety of game data (such as location, deaths, kills) into a model to cluster behaviours and create player profiles based on the activities found within them. Not only could the model accurately cluster players based on their behaviour, it could also distinguish playstyles at different time points (i.e., players with lower play time showed different behaviour than those who played longer). Melhart, Azadvar, Canossa, Liapis, & Yannakakis (2019) similarly related in-game values (e.g., playtime, completion of side missions) and player clusters (based on k-means and researcher interpretation) found in *Tom Clancy's The Division* (2016) to reported motivation scores on the Ubisoft Player Experience Questionnaire (UPEQ; Azadvar & Canossa (2018)). Clusters of players and their differing motivation scores could be accurately predicted, especially when the identified player clusters and in-game values were inputted together.

However, both studies share the limitation that player clusters are based on researcher interpretation, rather than how players view their own behaviour. In both studies the researchers ascribed meaning to the clusters to identify the type of player they reflected, but it is unknown how this aligns with how players think of themselves. Similarly, it is also unknown what the in-game values provided from the game mean to players; do players view their number of deaths and number of completed side missions as important metrics for what they do in open world games? Consequently, there may be no meaningful relationship between these variables to the player or their experiences, and clusters may not be based on anything substantial. Finally, work on clustering open world game players based on their game data is done without considering what the player experienced *during* the game, as there is only access to a final motivation score and aggregated player data. It is therefore unknown what specific experiences occurred within the gaming session, and why players responded in the ways they did. Overall then, AI approaches are not currently able to address the questions of this thesis.

2.1.4 Summary

Whilst there is previous research in open world games, it is unclear both what the open world experience 'is', and what players are capable of doing within it. Some concepts enabled by the experience have been identified (such as exploration), and player movement can be tracked in certain games, but how to understand and explain what players do is still unknown. Therefore, the following section broadens the examination of player experience to consider experiences players have with other games to explore their relevance to open worlds.

2.2 Gaming Experiences

2.2.1 Clarifying the Concept of 'Experience'

Gaming experiences, as explained in the Introduction, are commonly discussed at a multitude of levels. Typically this is broken into two categories; the sum feeling of a gaming experience (summative experiences such as immersion), and the experiences players have in the moment of gameplay enabled by their interactions with the game (the contextually-situated experiences). An example of this distinction can be seen in Calleja (2007) who distinguished between macro and micro levels of

immersion. Types of gaming experience can therefore vary widely in scale and duration, indicating a vast breadth in what is considered to be 'an experience.' However, all gameplay experiences are enabled by the actions a player can take when interacting with the game system. Such actions may also relate to a variety of factors a player uses when selecting them, such as their motivations to play, and game-specific goals. The link between the varying levels of experiences, and the actions a player take that enables such experiences, is highlighted in Figure 2.1.

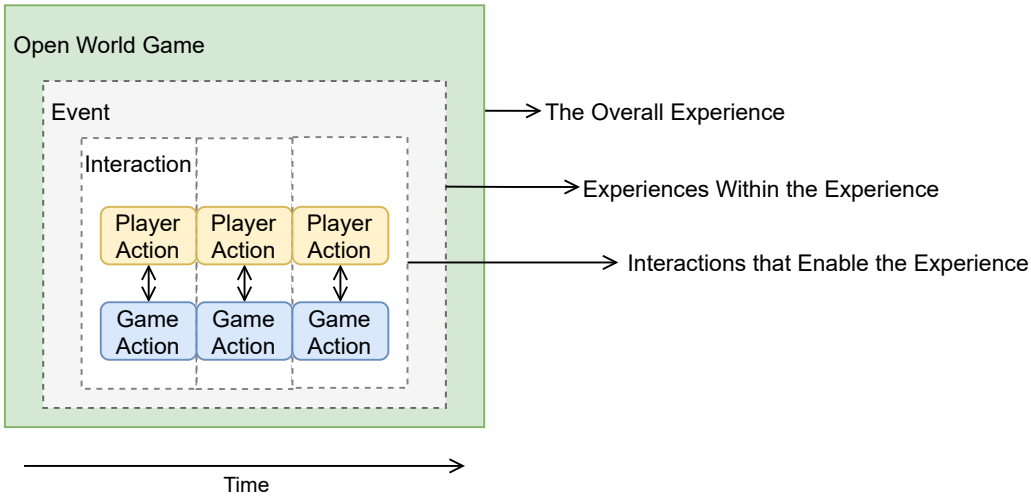


Figure 2.1: The relationship between the overarching gaming experience, the contextually-situated experiences, and the interactions a player has with the game.

To understand Figure 2.1, consider the following worked example. A player is engaged with a narratively-intense open world game (the green outer box). At one point during their gameplay, they may experience surprise at an unexpected narrative twist (a contextually-situated event, contained in the grey box). This twist is a singular event made up of a series of interactions between the player and the game system (highlighted in the white box), such as clicking the character, reading the dialogue, responding to the conversation etc. The player may have initiated this interaction, or the game may have presented the event on its own, indicated by the bi-directional arrows where player and game act and react to one another. After playing the game for an extended period of time, the player may decide to end the session. At this point they reflect on their gameplay, and conclude they found the experience of the narrative immersive, as they learnt about the narrative of the characters. Therefore, the former experience relates to what a player experiences in the moment of a specific in-game event, whilst the latter relates to the sum outcome of having a series of contextually-situated experiences. Both types are experiences a player has, but the first is markedly shorter in duration.

Therefore, whilst distinct, the two experience types are not wholly disconnected; the immersive narrative experience encompasses the momentary experience of surprise at the narrative (in that being surprised at a particular event likely leads into the overall felt experience). There is however no guarantee a particular player will experience the same moment of surprise, and may have other experiences that led to the experience of another emotion (e.g., an emotional connection to a character's backstory). Whilst many players may report the experience of the narrative as immersive, how the low-level, contextual experiences combine together to enable this outcome experience is unclear.

This issue is even further complicated in open world games, as there is no way to know what contextually-situated experiences a player will have until they are having them. The player has agency to interact with a vast range of content at any time and in any order — they may never even interact with the main narrative element of the game. What contextually-situated experiences occur, and how these enable the overall gaming experience, are therefore difficult to predict and understand. Further, if each player can have a highly varied set of contextually-situated experiences, how then can they

lead to the same cumulative gaming experience?

For this thesis, the 'open world experience' is considered the sum total of a collection of contextually-situated experiences a player has, enabled by the interactions between the player and the game. Such player-game interactions are known to influence the engagement and enjoyment of players (Caroux, Isbister, Le Bigot, & Vibert, 2015), and enable co-authorship of events in open world games, where players are not passive agents but create emergent narratives (Murnane, 2018). This also acknowledges that it cannot be assumed players of the same open world game will come across or experience the same content (Dale & Shawn Green, 2017).

Therefore, there are two levels of experience to explore to understand the open world experience; the summative, and the contextually-situated. In the literature, there has been a strong focus on summative experiences (experiences that happen after reflecting on the whole gaming session e.g., immersion, challenge), with some attempts at understanding specific aspects of games such as their mechanics (what specific aspects of games players like/how they use them e.g., social functions), and explorations into similar experiences within the same genre (e.g., Massively Multiplayer Online games; MMOs). These lenses reflect different levels of research focus, from broad experiences across games to how specific games differ from others. Consequently, overarching experiences relate to summative and genre-focused approaches, whilst mechanics map closer to the contextually-situated experiences. An overview of each lens is explored in the subsequent sections, and show that whilst these lenses can be applied to open world games, they are not helpful in distinguishing why open worlds are a distinct gaming experience, why a player would seek out this experience over another, or account for the contextually-situated experiences present within them.

2.2.2 Summative

Player experience research has considered various types of game experiences, across a wide range of topics. Research here looks at understanding how playing games leads to the feeling of a certain experience. The most common application is to understand how games are similar, and what the overall summative experience of playing games feels like to players. In this section, three examples of such experiences are outlined — Immersion, Challenge, and Uncertainty — followed by an explanation as to why such experiences fail to account for specific gameplay experiences found in open world games.

Immersion, defined as "the engagement or involvement a person feels as a result of playing a digital game" (Cairns, Cox, & Nordin, 2014), is a widely studied summative experience. It has been liked to multiple game features, such as the effect of music on game immersion (such as Sanders & Cairns (2010) and Zhang & Fu (2015)), the effect of first vs third person perspectives (Denisova & Cairns, 2015), and how immersion relates to the appeal of video games (Christou, 2014). Such studies highlight that the experience of immersion is an important factor for games, and one that is typically enjoyed by players (E. Brown & Cairns, 2004). Therefore, open world players may seek out an immersive experience, and this is why they play. There may also be specific factors about the game that make it particularly immersive, such as the types of quests available, and the sound design.

Another frequently studied experience is Challenge, a factor considered important for games and a key to their enjoyment (Vorderer, Hartmann, & Klimmt, 2003). For example, players enjoy/find satisfaction in resolving tension within challenging emotional aspects of a game (e.g., T. Cole, Cairns, & Gillies (2015), Bopp, Opwis, & Mekler (2018)). Players need an optimal level of challenge to feel competent at the game (Abuhamdeh & Csikszentmihalyi, 2012), which is also related to Immersion — players feel more immersed when the challenges they face match their current skill level (e.g., Cox, Cairns, Shah, & Carroll (2012)). Overall, players enjoy experiencing challenge in games, as without challenge games become boring (Czikszentmihalyi, 1990). Therefore, open world experiences may offer a specific challenge that players enjoy, where it can easily match their current skill level.

A third summative experience studied is that of Uncertainty (Power, Cairns, Denisova, Papaioannou, & Gultrom, 2018). Kumari, Deterding, & Freeman (2019) sought to provide a taxonomy of types of uncertainty, as whilst it is commonly mentioned as important for games (e.g., outcome uncertainty leads to higher suspense and in turn higher enjoyment; Abuhamdeh, Csikszentmihalyi, & Jalal (2015)), there was little agreement as to *when* uncertainty leads to these outcomes and why. A notable

finding is that choices experienced as 'free' (where players have high levels of agency to choose their actions) create feelings of competence, as players believe they are making meaningful differences. Therefore, open world experiences may offer players a place to feel competent in making choices, making the uncertainty they feel both manageable and enjoyable.

Whilst these approaches capture overarching commonalities in player experiences, and may explain why certain aspects of open world games are appealing to players, they share the same limitation. Summative experiences treat games as an undifferentiated whole; the interest is in how playing games leads to an experience. Consequently, it is difficult to understand how specific games/types of games differ from one another, both in leading to the same summative experiences and the distinct experiences particular to a game. Why are open world games chosen by some players over others, if numerous games offer high immersion, challenge, and uncertainty? Research may understand that players enjoy feeling immersed in games, but it is harder to understand what about the game led to this enjoyment. This is true of many summative experiences; reading a book is an immersive experience (e.g., Nell (1988)), but we cannot point to any one line or sentence that led to this feeling.

Further, understanding that games are immersive may help explain why people play games, but not why players play *specific* games. Summative experiences cannot explain why the experience of playing one game is different to another; playing a driving game can be immersive/challenging (e.g., *Forza* (2005)), and so can playing a Match-3 (e.g., *Candy Crush* (2012)), but these games are distinctly different in terms of gameplay and style. Games may show similarly high levels of immersion/challenge, meaning this approach cannot distinguish between the experience offered to players, as there is no indication of what caused the summative feeling being described. The feeling of immersion/challenge is the *outcome* of having an experience, rather than the in-the-moment experience.

Overall, summative gaming experience research cannot tell us why players differ within the *same* game, as in the case of open worlds. Players can partake in vastly different content whilst still experiencing immersion, with no indication as to what contextually-situated experiences led to this feeling. To understand such player differences, there is a need to study games within their own contexts, to avoid overlooking distinct features that enable such summative experiences.

2.2.3 Individual Games

One way to remain contextually-specific when studying gaming experience is to consider individual games, to assess what about them is distinctive. This section outlines examples of specific games that have been studied in the past, before explaining why this approach is too specific to explain experiences across games (and by extension open world games).

The games chosen to study from a feature-level approach (i.e., considering specific aspects of a single game such as its mechanics) are typically those that became rapidly popular, and so there is interest in understanding what makes them uniquely appealing. Games such as *World of Warcraft* (2004) and *League of Legends* (2009) are two such examples, where their uniqueness and immense popularity inspired an influx of research surrounding them. Though it is difficult to know the exact number of subscribed players in *World of Warcraft* (2004) (those who own accounts), at its peak there were over 12 million players[3]. *League of Legends* (2009) had 8 million daily concurrent players as of September 2019[4]. This massive player base has motivated researchers to understand what about these games draws players to them over other types of experiences. In turn, such individual approaches may help explain why open world games are unique at the feature level, potentially explaining the experiences players have within them.

For example, researchers have been interested in why *World of Warcraft* (2004) became such a successful Massively Multiplayer Online game (MMO), and what factors contributed to this (e.g., Ducheneaut, Yee, Nickell, & Moore (2006)). A variety of factors specific to *World of Warcraft* (2004) have been studied, such as how players perceive and value intimacy (Pace, Bardzell, & Bardzell, 2010),

[3]Retrieved from web.archive.org/web/20130809153328/http://us.blizzard.com/en-us/company/press/pressreleases.html?id=2847881 on 15/11/2022

[4]Retrieved from www.eurogamer.net/articles/2019-09-18-league-of-legends-hits-8m-concurrent-players-every-day on 15/11/2022

the specific appeal of the game (Christou, 2012), and how players view their in-game characters (Yee, Ducheneaut, Yao, & Nelson, 2011). All these studies consider *World of Warcraft* (2004) to be a unique gaming experience, and so worthy of study at this detailed level. Similarly, to understand the unique player experience found in *League of Legends* (2009), Mora-Cantallops & Sicilia (2018) explored how players scored on the Player Experience of Need Satisfaction questionnaire (PENS; Rigby & Ryan (2007)). This was motivated by the fact that most online games research looked at games such as *World of Warcraft* (2004), but games in the Multiplayer Online Battle Arena genre (MOBAs) provide noticeably different experiences — players of such games have less desire to socialise than those who play MMOs (e.g., Tyack, Wyeth, & Johnson (2016)). The work by Mora-Cantallops & Sicilia (2018) found that *League of Legends* (2009) players felt more competent about their play performance the higher rank they were in the game, and players did not feel differently towards their team members regardless of their rank. By focusing on this one game, the authors were able to show how the feeling of competence is valued more by *League of Legends* (2009) players than the social aspects of the game, highlighting that the game provides a unique experience (or alternatively, attracts a unique subset of players that are different to those who play MMOs).

The research on individual games has therefore gained insight into the specific features that may otherwise have been missed by taking a summative approach, such as the focus on intimacy in *World of Warcraft* (2004). In turn, understanding what unique features are present in open world games may help explain the unique experience they can provide. However, work that focuses at this level is typically so specific that it cannot infer anything about other games, even ones that are similar. It may be possible to understand how specific gameplay elements influence the gaming experience, but we cannot be sure that a specific game mechanic is experienced the same way across different types of games. The Role-Playing Game (RPG) element of 'levelling up' is present in many games, and players enjoy this feature in some games (e.g., Bostan & Berkman (2017)). But do players feel the same about this mechanic in all games? Is it an inherently different experience to level up in a fantasy MMO from levelling up in a puzzle game? Furthermore, in the case of open world games, there is no guarantee that all players will even engage with a specific gaming element. Research for example could focus on the narrative elements, but it is known players typically do not spend a lot of time on the main quest (as discussed in the Introduction). How then can researchers know which element to pick to study, if it is unknown how much players engage with it at all?

Overall, studying at the feature-level is so specific that it cannot infer how they are experienced in different contexts, or even across players within the same open world game. If the summative experience is too focused on the outcome of the experience, and the individual level is too specific to explain experiences within the same game, there is a need to consider games differently. One way is to focus on what experiences connect a collection of games together, typically referred to as a genre.

2.2.4 Game Genre

Genres of games offer a way to talk about player experiences that is both connected to game features and allows comparison across games (though genre is itself a contentious classification system e.g., Clearwater (2011)). Games considered part of the same genre may hang together due to a similarity in the experience offered to players. If true, considering how open world games are similar to one another may indicate what about the experience is unique. In this section, the genre-focused approach is described, with examples of its usage in MMO games. This is followed by highlighting how this approach still requires refining to truly understand what about game experiences players seek.

The MMO genre is considered a distinct cluster of games, with specific variances to account for. A typical research focus is on their ability to foster social interactions. Indeed, this social interaction is usually key to the experience (H. Cole & Griffiths, 2007). Because of this, research has focused on why players enjoy this experience and what draws them to it, such as Chang et al. (2008) who explored why players stay loyal to certain MMO games. Similarly, Suárez, Thio, & Singh (2013) found MMO players enjoy the ability to immerse themselves in a fantasy world, whilst other researchers such as V. H.-h. Chen & Duh (2007) sought to understand what influences players to seek out this socialising experience. Therefore, understanding what is unique to this type of game is important to

understanding what players enjoy about them, and so has fostered research interest. Similarly, there may be unique interactions present in open world games that create the experience of playing.

The genre-focused approach therefore helps explain how game features combine to enable experiences that players reflect on. In *World of Warcraft* (2004), there are features that enable social interaction (e.g., chat) that allow players who enjoy social interactions to use these features to feel this gaming experience. However, the genre approach still focuses heavily on the summative experience of games treated as a whole, rather than what are the constituents of play leading to the experience. It is typically deployed to link the above approaches together (i.e., how game features lead to summative experiences), rather than explain what the experience is and what it means to players (referred to as the contextually-situated experiences in this thesis). The socialisation elements in the MMO genre are linked to enjoyment and other summative experiences, and therefore it is unknown what experiences occur when interacting with such elements. Just as Costikyan (2013) recognises uncertainty as central to playing games, he also recognises the distinct sources of uncertainty that a game may offer, which lead to the felt experience of uncertainty (Kumari, Power, & Cairns, 2017). Therefore, to truly understand games and their impact on players, the contextually-situated experiences they offer must be understood, and how these link both to the unique game features and the summative experience.

2.2.5 Summary

The approaches discussed above cannot explain all the behaviours possible in open world games. The summative experiences such as Immersion could tell us how, overall, players felt about the open world games they play. But players completing entirely separate aspects of the same game could all be immersed — one could be immersed in the main story, another immersed in the world setting, yet another immersed in the fighting elements. The feature-analysis approach is similarly difficult to apply because each player can come across different content; if some players never complete past a certain point in the main storyline (though still play for many hours), what is there to learn from analysing these features of the plot, the mechanics, or the player's reaction? Even attempting to tie game features to summative experiences misses out on understanding what players are experiencing in the moment of gameplay, which constitutes the overall gaming experience.

The crux of the problem lies in the fact that, although players can be playing the same open world game, there is no guarantee they will come across the same content, and therefore have the same contextually-situated experiences. Because of this, it is unclear what the experience of playing an open world game actually *is*, as discussed in Section 1. Therefore, the current thesis aims to move beyond these three lenses when considering the open world gaming experience, and apply a more specific approach which acknowledges the contextually-situated experiences players have. Such an approach would need to be able to relate the actions a player engages in to their experience of selecting these actions, as there is no guarantee the actions they partake in will be the same across players. To do so, it is important to understand how players select the actions that make up their individual experiences.

2.3 Choice

As discussed in the previous section, due to the high degree of freedom over the choices players can make in open world games, assumptions cannot be made about what actions make up an open world experience. Therefore, there is a need to understand how players choose what actions they engage with, to understand how these create experiences (both summatively and contextually). Decision-making has been extensively studied in a variety of fields, most notably in psychology, though it has also been studied in games and general HCI. This section provides an overview of these theories, and shows that whilst these theories can relate to some aspects of action selection in open world games, none cover the sheer vastness of the available choice-space, or explains how the ability to choose affects the gaming experience.

2.3.1 Psychology Research

When discussing action selection and the surrounding topic of decision-making, what people are doing and why is a focal topic. Consequently, outlining the psychological literature on decision-making is required for this thesis. Of particular interest to open world games is research involving risk/economics, consumer/marketing, and task switching, discussed in the following sections. However, despite the extensive and active nature of psychological decision-making research, they are not as cleanly applicable to open world games as may be assumed. This is for two overarching reasons: psychological research has a focus on 'A vs B' paradigms, and a focus on outcomes over what is experienced. Therefore, before discussing the common research frameworks deployed in psychological research, an outline of these two overarching limitations is provided to contextualise the work.

2.3.1.1 A vs B vs False Dichotomies

Psychology as a discipline is concerned with producing reliable and replicable results from typically tightly controlled study designs. Indeed, psychologists frequently discuss the replication crisis underway, where established studies are failing to hold up when retested (Wiggins & Christopherson, 2019). Decision-making research is no different, and is commonly studied in controlled laboratory settings. For example, when considering how people navigate economic decisions, the prisoner's dilemma is commonly used (Flood, 1958). Two players (who cannot communicate with each other) are told they are being interviewed by the police, and will serve 2 years in prison unless they take a plea deal. They must decide whether to sellout their partner or stay silent, resulting in differing rewards/punishments — if both betray, they both serve 5 years, if both stay silent, they both serve 2. If person A remains silent but B betrays, A serves 10 years and B goes free, and vice versa. The prisoner's dilemma has been used to understand decision-making and its relation to many other factors, such as the effect of culture (Wong & Hong, 2005) and gender (Molina et al., 2013).

Here decision-making is reduced to a binary choice between two options, referred to an A vs B paradigm. Results are easy to interpret as it is clear what the outcome of a decision is, making it easier to infer what influenced the choice (e.g., the player chose to be silent, which is related to their gender). However, action selection in open world games (and indeed many real-world choices) are more complex. Players can choose from multiple tasks at any time, they can choose to abandon a task for another, and players can even bring in their own self-made goals (e.g., not dictated by the game, such as wishing to roleplay and so guiding their actions towards specific in-character events). Consequently, decision-making research that only considers choice between two options cannot account for the experience players have in open world games. Players are not forced into a binary choice when they create their individuated open world experience — indeed, open world games often give strong indications of the 'next step' in the main story, and so players need not even make a choice at all if they don't want to. Therefore, when referencing psychological research on choice it is important to acknowledge the complexities in choices available to players.

To address the limitations inherent to A vs B paradigms, there has been a recent call for decisions to be studied in more complex settings, such as continuous choices. Continuous choices are those that happen in sequence, where the entire choice sequence is analysed to understand how decisions evolve over time. In some research, this also accounts for the subjective experience of the person making choices (e.g., Schreiner, Yalcinbas, & Gremel (2021)). This reflects that the decision to pursue a choice is not always a fixed binary point, but something continually reflected on (e.g., walking down a road, and choosing to continue walking). In doing so, it is possible to account for how multiple choices combine together, and how a single choice is maintained over time. Such choices are more reflective of open world gameplay, where players are presented with many actions and activities to do, where they are likely pursuing one when a new one appears. Indeed, in the call to research continuous choices, the concept of open world games is even referenced (Yoo, Hayden, & Pearson (2021)). For example, a player may be pursuing a side quest when they come across an event relating to the main quest. In this moment, whilst it may appear to be a binary choice, the full scenario must take account of what the player was doing *before* it was presented — will they choose the main quest, or *continue* their original task? Over the course of play, multiple scenarios such as this will be presented, which

may over time influence the choices players make. However, the current call to research continuous choices is still simplistic in its analysis, calling for research into the pathway of choices for singular actions, thereby not equipped for when there is also a breadth of choice available. To understand the interactions a player has with an open world game, and how these lead to the experiences a player has, it will be important to understand both the sequence of choices as well as the breadth of choice.

2.3.1.2 Outcomes over Substance

Psychology, being concerned with human behaviour, has a general focus on the outcome of a decision. This is unsurprising, as understanding what a person chooses can be related to variables that may influence it (such as how personality traits like neuroticism relate to the likelihood of risk taking (Lauriola & Levin, 2001)), and to potentially understand how to change people's behaviour (such as to make healthier choices (Hansen, Skov, & Skov, 2016)). What players choose to do in open world games is of course relevant to understanding their experience. However, it is equally important to understand *how* players make choices, as the *experience* of choosing may be what players are actually seeking. Such inferences can be seen in the informal way players describe what the open world experience is; do what *I* want when *I* want. If we don't understand what the player experiences whilst choosing, what it means to players to play may be missed. Therefore, psychological research focused on outcomes will likely not inform on what the experience of choice is like for players, but it may help to understand why they choose the outcomes they do.

With the above two limitations in psychological research covered, the following sections address the common frameworks deployed for studying decision-making. How these may be relevant to the open world experience is discussed, as well as what their specific limitations are.

2.3.1.3 Risk/Economics

A common framework to understand decision-making in psychology is the factor of risk, frequently in terms of monetary loss. Larrick (1993) discussed a variety of models that explain how decision-making occurs when there is an element of risk, building on the observation that people tend to avoid taking risks where possible (though not always). Such risk models are grouped in to two types of explanation; universal and individual differences, reflecting the aim of the theory. Risk models either attempt to explain similarities across human decision-making (universal), or explain why people differ in their decision processes (individual). The models Larrick (1993) reviewed that show the strongest relation to open world gameplay are discussed below.

Cardinal Utility Theory (Bernoulli, 2011) was the basis for Prospect Theory (Kahneman & Tversky, 2013), which both constitute universal explanations. The former theory explains that safe small gains are generally chosen over large risky gains, as the larger a value gets the smaller the return is overall. In other words, gaining £100 from £0 is more appealing than going from £500 to £600, even though they are the same monetary increase. Prospect Theory expanded this by adding that people are less focused on the *absolute* value of an outcome and more in the *perceived change* in value from a defined reference point. Because of this, they argue that whilst people avoid risks when gaining value, they are more likely to take risks when there is a chance of losing value. Although both theories are general, they can be applied to open world experiences. For example, players may attempt to gain value from doing an action/series of actions instead of others, where 'value' could refer to a variety of elements both concrete and abstract; a rare item, unlocking new content, a higher expectancy of enjoyment etc. Players may also reflect on their current game state to decide what they need to increase their chosen 'value,' rather than any absolute measure of gain.

For those in the individual difference explanation, Larrick (1993) firstly introduces Expected Utility Theory (Friedman & Savage, 1948), that seeks to understand and predict what outcomes are preferred for different people. People do not always avoid risks or seek them, as risk can be context dependent; not buying insurance when travelling on holiday could be perceived as too risky by some people, but those same people may engage in high-stakes gambling. Consequently, people make choices by evaluating what they expect the risk to be to *themselves*, which is unlikely to be the same across people. People therefore have individual ideas about what constitutes 'risk', which universal

theories cannot account for. In the same way, individual differences in open world players would be hard to understand from looking only at what actions have been carried out — players will individually decide whether their actions involve a perceived risk.

Although Expected Utility Theory does not go as far as to suggest *why* people differ in their attitudes towards risk, other theories have. Larrick (1993) goes on to explain the theory proposed by J. W. Atkinson (1957) which relates to the motivation of people making decisions. Generally, people wish to experience a sense of achievement from their choice, and the harder a choice is the more achievement it can provide. This explains why people making choices that have a high level of certainty are not as enjoyable as those with more risk — they are less challenging to make, and it is this challenge that is satisfying to achieve. The best choice to make therefore is the one that provides the highest sense of achievement but still with some chance of success. The theory argues the inverse is also true; people will avoid choices that are perceived to bring failure, to avoid the negative associated feelings. Differences between decision-making here is consequently dependent on how the person feels about achievement. If they highly seek it, they will seek choices that maximise success, whereas those who prefer to avoid failing will choose options that minimise failure. For actions selected in open world games, the individual approaches could explain behaviour. Open world games provide multitudes of ways to experience achievement as well as challenge (as discussed in the previous Section 2.2), and so players may be attempting to maximise their sense of achievement whilst minimising the risk of failure. What constitutes achievement and failure may differ between players, explaining what draws them towards certain interactions with the game, and consequently the experiences they have.

However, risk theories to explain action selection in open world games have the same limitation: what is there to risk? Players have already purchased the game, and so there is no further monetary loss. Further, players can complete any task at any time meaning their selection is not zero-sum, as almost all tasks can be completed afterwards with little consequence. Consequently, players do not risk missing out on content, or making the 'wrong' decision (and even if they do, they can always reload an earlier save, or restart the game). The potential aspect that players may risk is that they are wasting their time pursuing activities that do not provide a sense of value. Action selection may consequently be optimised to enable an efficient rate of satisfying contextually-situated experiences. However, it is unclear if the risk discussed in the literature (such as monetary loss) is the same as the risk of wasting time. Indeed, as playing a game is a leisure activity, one could argue players are already committed to 'wasting time' when they play. Overall then, risk is not an easily applied theory to explain action selection in open world games. This is further true as many risk theories rely on some form of forced binary choice (i.e., high vs low risk monetary choice) which is not present in open world games, and on understanding the chosen outcome rather than the process of choosing.

2.3.1.4 Consumer/Marketing

Unlike many psychological theories, the research on consumer choice takes a step away from the A vs B paradigm. This is because consumer choice is concerned with understanding the buying preferences and processes of customers, where there may be multiple options available for the same product. Following is an overview of relevant findings which may map to the open world experience (for a more in-depth review see the working paper by Babutsidze (2007)). These mainly surround the concept of choice overload, where people are presented with a large array of options.

For example, J. W. Payne (1976) argued the number of choices can impact the types of decision-making processes people employ. People are typically incapable of making informed choices when there are too many options (for example, 6 different brands of soup), so will quickly look for ways to reduce the number to be more cognitively manageable. This process of elimination eventually leaves one product, which is then chosen. The work criticised previous research for typically only studying scenarios involving choosing between two options, as demonstrated in the psychological research covered in this literature review so far. The initial model for choice overload has undergone a few additions since its first publication. Work by Lussier & Olshavsky (1979) tested the model empirically and found that choosing between multiple brands (which they define as more than three) often involves a two-stage process. The first step involves removing as many options as possible using a

conjunctive strategy (where consumers evaluate desired information about each product to eliminate any that don't meet their desired 'threshold'), and once the number was more cognitively manageable the process switched to a compensatory strategy (where consumers weigh desired traits against each other) to decide on the final choice. This was further extended by Bettman & Park (1980) who showed that the difference between the two stages was related to how consumers used information to make their decision. When there were many choices available, consumers typically used the attributes of the items to distinguish between them (similarly to Lussier & Olshavsky (1979) in that consumers assess a specific trait the product needs to have for them to wish to buy it). Consumers tend to use brand-processing for the final selection choice, most likely because the choice presented to them is overall a choice between brands.

In the case of open world games, it is also true there are usually a vast range of tasks and actions to choose at any time. It is possible that players are susceptible to choice overload, and to avoid it will find ways to reduce the options available. Players may first reduce the choice by assessing what they wish to complete at the time, perhaps by setting artificial restrictions such as a desire to only seek out contextually-situated experiences that involve combat. When the only options left are perceived to bring about a desired outcome, they can then assess which one most meets their current desires.

The concept of 'brand' however does not transfer to the open world experience, as selecting actions that provide a specific experience are not always similar to one another; there could be two different quests of the same style (e.g., monster hunts), but quests could also be completely different (e.g., monster hunt vs boss battle), that would equally fulfil a desire for combat. Furthermore, action selection in open world games is not zero sum in the way buying a product is; choosing one activity does not negate the ability to choose another to be pursued later. If players are seeking specific experiences, they can choose a sequence of actions that are likely to trigger such events, where there is no expenditure of resource to do so other than time (which they have already committed to spending by playing the game). Consequently, players may not experience choice overload at all, as their choices do not carry the same weight of consequence as purchasing a product. Finally, consumer research by definition is interested in what people buy, and consequently the outcome of a decision. Therefore, the experience of making a selection is less studied, which in open world games is likely to be of significance — players are not only interested in the outcome of their actions, but in experiencing the process of making these choices. Put another way, the journey can be as important as the destination.

2.3.1.5 Task Switching

Finally, a potentially relevant area of psychology to the open world experience is task switching, where a person voluntarily stops pursuing one task to pick up another unrelated task, before returning to the original task (S. J. Payne, Duggan, & Neth, 2007). This is sometimes more commonly known as multitasking, where people attempt to complete more than one task in a given time period, so divide their attention and time accordingly (e.g., office environments (González & Mark, 2005)). As open world gameplay is known to allow players to switch actions at any point with limited restriction, it is worth exploring how people navigate such activities.

A frequent line of research into task switching is based on foraging theory, a model built on animal studies of how organisms decide when to leave the current patch of food searching to pursue another, typically considered 'exploitation vs exploration' (Charnov, 1976). This task switching has then been applied out of food searching to that of 'cognitive foraging' in humans, where people instead search for solutions within tasks, such as whether to read a specific article found during a online search for information, and decide when to move on from this task to another they are pursuing, such as searching for other articles or using a new search term (Pirolli & Card, 1995). Psychologists here are interested in factors that influence task switching, as well as its effect on task performance. For example, many studies have focused on task switching between tasks of differing levels of difficulty (Adler & Benbunan-Fich, 2015), reward (Duggan, Johnson, & Sørli, 2013), and cognitive load (Chan & DeSouza, 2013). Hardy & Gillan (2012) showed that task switching may be motivated by how frustrating a task is, so people switch to alleviate this affect. When given the ability to switch between tasks voluntarily, participants were more likely to switch to a task that was less frustrating than a task that was more interesting. In terms of task performance, S. J. Payne, Duggan, & Neth (2007) found

from a series of experiments asking participants to make words from two different sets of Scrabble letters (one easy and one hard) that people frequently switched between the tasks, even though doing so negatively impacted their task performance. That is, it would have been more efficient to switch tasks less frequently and focus more time on one task, and yet participants spent more time on the easier task to the detriment of their overall performance. The authors argue that participants were following a heuristic (a belief or way of thinking that helps to guide people in making decisions (Tversky & Kahneman, 1974)) that biased them towards spending more time on the easy task, named Green's rule — people had a predefined time limit they were willing to give to either task, and would increase this time for each successfully found word.

For open worlds, these behaviours may also be true. Players have a set amount of time they can play for, and so must decide how much time they give to any task. They may choose to focus on easy tasks so to increase their rate of returns (such as in-game rewards), or focus on actions they have strong confidence will lead them to a desired experience (e.g., wanting a narrative so pursuing the main quest). It may also be true that players switch tasks due to frustration with the current experience, suggesting players may choose a 'path of least resistance' approach to constructing their desired open world experience, by purposefully navigating towards contextually-situated experiences that would enable this.

However, in open world experiences, it is unknown the extent to which there are distinct differences between chosen tasks/actions in terms of difficulty and reward, or if players are constantly 'foraging' for reward when following a quest. It is possible for a multitude of quests/activities to be similar in levels of difficulty and reward given — how do players choose between activities that offer similar outcomes? Furthermore, in such task switching experiments participants are aware of all tasks they must achieve in a given time frame. When a player begins an open world gaming session, it is unlikely they are aware of all the options available to them to begin with, as activities may emerge over time. For example, a player may make an initial choice to pursue a quest that requires them to walk across the map. During this travel, another option is presented to them (e.g., a new side quest). Do they decide to pause their original task to complete this new one, or to ignore it and come back later? Players would not know the extra option was available until they come across it, as they do not know all the contextually-situated experiences they will encounter when starting. Further, players do not in fact *need* to complete anything, and may find high degrees of enjoyment even if no task is completed. Indeed, it is possible players do not even view their activities as 'tasks' that require completion. Therefore, the task switching literature is too reductive in terms of what options people choose between, and too focused on the outcome of switching. Open world experiences are continuous task switching spaces that evolve over time, where the switching may itself be the intended experience (rather than only the outcome).

2.3.1.6 Summary

Overall, there are numerous psychological research frames looking at decision-making, and how people prioritise certain tasks over others. However, most is difficult to apply to the actions players select in open world games, or how they relate to the contextually-situated experiences players have. There is a lack of A vs B decision points encountered in these games, and the experience of choosing is itself important to what makes the experience unique, rather than only the outcome of choosing. Further, many of the frameworks discussed above rely on factors simply not present/common in open world games, such as risk and the need to complete tasks. Therefore, whilst the psychological literature is interesting to note, it has several drawbacks for application to the work of this thesis.

There are however other fields that have studied choice and the actions people select, which may be easier to apply. One such fields is Human Computer Interaction (HCI), the area in which games research typically falls under. For this reason, work here tends to be more applied to the settings encountered in open world games, and so may be more useful for understanding actions selected within them. Therefore, the next section explores research on action selection from the HCI field.

2.3.2 HCI Research

Human Computer Interaction (HCI) research has explored how people select actions when using technology in a variety of ways. As the focus is on an interaction with a technology (typically a computer), work here may be more readily applicable to open world games than research from a pure psychology focus. Two such relevant theories of action selection are described in this section; engagement, and situated actions.

2.3.2.1 Engagement

Though there are many definitions for what constitutes engagement, O'Brien (2016) defines it as the quality of a user's experience with technology, which includes features such as novelty, felt involvement, endurability, aesthetic appeal, and perceived usability. These features are divided into three categories (affective, cognitive, and behavioural) that relate to different aspects of engagement, such as attributes that affect reasons to engage and reasons to continue engagement. Within a games context, players are continuously engaging with the game in order to play, and so how this process works may help explain the experience players enable in open world games. Indeed, higher engagement has been shown to relate to increased enjoyment and presence (see Boyle, Connolly, Hainey, & Boyle (2012) for an overview).

O'Brien & Toms (2008) proposed engagement is a process of 4 steps repeated multiple times and can be identified at multiple levels of granularity: the point of engagement, engagement, disengagement, and reengagement. Each step can be influenced by a number of features of the process. For example, a person becomes engaged when a task is novel and catches their attention, which may be influenced by their motivations to find a task to engage with. The person then remains engaged with this task when it is both interesting and gives positive emotive feedback for doing so. The person may disengage with the task because of an outside distraction, or because the task became too difficult and so is frustrating. Following this, the person may reengage with this task after a pause (due to a distraction) and become engaged once more.

For open world games, a similar engagement process may occur. A player may become interested by a new task (a quest or a place to explore), and stay engaged with it as long as it is adequately challenging/involving. They may then disengage when the task is completed or it did not meet their expectations, or if they are temporarily distracted by something else (e.g., another quest to consider). However, the last step of re-engagement is potentially more flexible in open world games, in that players can disengage from a task without needing to leave the entire game. For example, a player may engage with a quest to save a Non-Player Character (NPC), disengage to pursue hunting an animal, and then disengage from this to explore a new map area, before returning to the original quest. Such a series of actions would not inherently compromise engagement with the game, although a series of disengagements due to frustration may lead to the player leaving the game completely (e.g., each new selected task/quest proves to be uninteresting). Therefore, re-engagement may not solely need to be with the original task, but could refer to re-engaging with any task within the game.

However, whilst engagement models in HCI show overlaps with open world gameplay, such models are built for technology use rather than gaming. Consequently, the idea of a person completing tasks to remain engaged is less well defined, as it is unclear what level of 'task' to consider (i.e., the game itself? a quest? an action?), or if players consider their play to be a series of tasks at all. Furthermore, players do not 'need' to complete any task in order to remain engaged with the game, as simply walking around in a game world could be considered engaging by players.

2.3.2.2 Situated Actions

In contrast to many psychological theories of action selection highlighted in previous sections, some work questions the extent to which actions can be considered truly planned. Suchman (1987) introduced the concept of situated actions, where behaviours cannot be fully pre-planned before the activity commences; actions are chosen in the moment and the specific context that led to them arising, as until the activity begins it is unknown what will happen. A common example of situated action

with technology is using a printer; a person has a goal when they approach the printer (i.e., to print a document), but the specific steps they take cannot be known until the process of using the printer begins (e.g., it is unknown the sequence of buttons to be pressed and what information the printer will show during the process). After the interaction has completed, people then construct narratives around their actions, to make a coherent explanation of their behaviour (commonly referred to as their plan of actions). Consequently, plans of actions stated after actions are a result of reflection, rather than the cause of action (such as stating the intention was always to select the specific buttons in that order, even though this was not known beforehand).

The theory of situated action has been applied to games in various ways, such as creating more interesting computer game agents (Wavish, 1996), and understanding why toxic behaviour occurs in games (Kou, 2020). For open world experiences, it is possible a similar process occurs. Players may have an intended goal of play, but until they enter into an interaction with the game, they do not know what contextually-situated experiences they will encounter. The game has agency to respond to players, which cannot be totally predictable. Therefore, navigation of such events and experiences can only be done in the moment, and from there the experience of them reconstructed afterwards. It will therefore not be enough to only know the desires of players going into the gaming experience, as the interactions they come across will shape how they respond in the moment. Furthermore, it may be difficult for players to discuss their action selection behaviours accurately, as recounts may be entirely post-experience construction of events. Combining what players intend to do, what they recount experiencing, and relating this to their gameplay would therefore highlight if playing open world games does indeed involve a series of situated actions.

Overall, aspects of HCI research may apply to open world games, as they take into account the process of action selection to a higher degree than psychological theories. How actions are selected in the moment is also considered here, and indicates players may not know how they will respond to the game until they find themselves in a contextually-situated experience. However, such theories tend to be made for technology use generally, making the research outcome-focused and unable to explain engagement for engagement's sake. The applicability of this work therefore may need revision when applied to the open world experience context. Because of this, there is also research that specifically discusses games and the choices made within them. These should be more readily applicable to open world games, and consequently are explored in the next section.

2.3.3 Games Research

As games are an interactive medium, multiple researchers have explored the choices available to players in games. This involves understanding what players choose given a set of options and why, for a variety of reasons, such as wanting to make more interesting games for players, or using games to understand how they relate to aspects of the players themselves. Whilst little of this has taken place in open worlds, there has been work in other types of games. This section covers the most notable types of choices studied, which covers narrative/moral choices, game engagement, exploration/navigation, and how choices relate to individual characteristics such as personality. In sum, whilst the choices explored in this section take place in games, there is little relation to the types of choices that are available in open world games. Even models that show promise would require refinement to this specific context, calling into question their generalisability.

2.3.3.1 Narrative/Moral Choice

Unlike the previous psychological literature on choice discussed in Section 2.3, the domain of moral decision-making has received attention specifically within games. This is typically to understand if moral choices in games reflect those made in real life (e.g., Weaver & Lewis (2012)), and whether games can influence player's morals outside of the game (e.g., Khoo (2012)). The former relates to what values a player brings into a game, and is therefore relevant to the thesis topic. The latter relates to how games affect real-life behaviours outside of the game, and so is outside the scope of the current work. As much of this work involves moral choices made specifically within game narratives,

the two topics are combined here.

Researchers interested in the relationship between in-game and real-life moral choices have typically done so by observing player in-game behaviours and comparing them to morality questionnaire data to identify correlations. A commonly used questionnaire is the Moral Foundations Questionnaire (MFQ) developed by Haidt & Joseph (2007), which describes 5 pillars of morality people use to assess behaviours against; Care/Harm, Fairness/Cheating, Loyalty/Betrayal, Authority/Subversion, and Sanctity/Degradation. Pillars that people most strongly connect to will guide their behaviours and judgements of others, which accounts for why morals are not identical across individuals.

To investigate such a relationship between real life and in-game moral behaviour, Weaver & Lewis (2012) found that the majority of their sample (75 in total) made moral decisions within the game *Fallout 3* (2008), reflecting research that most people in real life act ethically. After 30 minutes of gameplay, 51 players agreed they made choices like those they would in real life. Scores on the MFQ also predicted in-game choices, as those who indicated higher on the foundation of Care were more likely to exhibit kindness in their gameplay. Such an effect is nuanced however, as Joeckel, Bowman, & Dogruel (2012) showed that only the moral foundations that players considered most important (salient) were used to make decisions with. If the choice did not involve these salient morals, players did not have a clear way to respond, and so choices became effectively random. This shows that players may not disengage from their morals when playing (as suggested by Hartmann & Vorderer (2010)), but rather they only care about certain morals to begin with. Consequently, players in open world games may be guided by their internal values, of which some will naturally be more more salient than others.

However, morality is not always only a fixed concept, as some situations can make moral foundations more salient in a specific context. Tamborini et al. (2018) argues the game itself can increase the salience of some moral foundations, which in turn increases their impact on in-game decisions. Because of this, some moral foundations can become 'temporarily accessible', in that they can be increased and so more readily available for players to use in decisions. By manipulating the temporary accessibility of moral foundations to participants, Tamborini et al. (2018) found the Care foundation can be made more salient, which in turn makes players more likely to uphold this foundation in gameplay choices involving care decisions. Whilst the foundations of Authority and Loyalty were more likely predicted by their trait scores (i.e., traditional methods of measuring the foundations of players), this highlights the need to consider the differences between state and trait features of players and their effect on choices. Overall, this work indicates there may be differences in the values a player has depending on how active it is in the current context. It is therefore important to understand both the general values of a player and their current, contextually-situated values.

Another way the context of moral decision-making can be influenced is the game itself. Consalvo, Busch, & Jong (2019) conducted 28 semi-structured interviews with players of games which feature moral choices, and concluded game structures such as the narrative can encourage players to behave in ways that both align and misalign with the player's own beliefs. This is because the nature of the effect is contextual — whether a game can encourage a person to override their own moral beliefs for the sake of the game varies between the scenarios presented.

Some work has criticised the aims of the previous work, such as Krcmar & Cingel (2016) who argues they only considered the end decision rather than the process of how a player made the moral decision. These authors instead considered whether players were likely to make moral or strategic choices when playing games, and to what extent players relied on their moral foundations to do so. Rather than recording the decision points from the game, they instead asked the players to state when they made a choice in a 'think aloud' task whilst playing. Using *Fallout 3* (2008) as a stimulus, they found that on average players made 16.43 decisions, and gave 19.12 reasons for doing so (slightly higher as players sometimes gave more than one reason for the same choice). There was no significant difference between the amount of decisions made that were moral or strategic; 54% and 46% respectively. This implies players used a roughly equal amount of moral and strategic choices, which brings into question how much of moral decision-making in games actually uses a moral reasoning pathway. Similarly to the study by Weaver & Lewis (2012), the authors found a relationship between the Care foundation and behaviour, as 37.6% of all decisions were related to it. However, the Care

foundation was not used in gameplay to a level of statistical significance. This highlights that, whilst players may discuss the reasoning for care, they may not actually use it in their gameplay decisions. It is therefore important to study both the process of moral choices as well as the end decision, as they are not always the same. For open world games, it is similarly possible that the vales players discuss after a decision is made may not be the same as those that are active during the moment.

In summary, narrative-heavy games can elicit a range of moral decision-making processes and choices, some of which share similarities to the beliefs of players in real life. The mechanics of the game can influence choices made, depending on the specific contexts of the game and the values of the player. Whilst choices do not always match to the reasoning given by participants, it highlights the need to understand both the process and the outcome of behaviour. In the case of open worlds, understanding *how* players choose between actions may be just as important as knowing *what* choice was made. Further, it is possible the factors affecting the decision-making process in the moment may not align to what players report afterwards, indicating a need to assess players in the moment thought processes.

However, moral choices made in narratives are only one such type of choice afforded in open world games. As discussed in the Introduction, most players do not engage with the Main Quest in open world games, so little can be learnt about their other choices from this literature. For example, it is unlikely players utilise a moral reasoning process to choose between quests that both hold strategic value (e.g., gaining gold or gaining a new horse). Therefore, such literature could only explain the behaviour of a small subset of players, and within them only a selection of their in-game actions.

2.3.3.2 Engagement

Section 2.3.2.1 discussed HCI models of engagement, however models have been created specifically for games research. For example, the engagement theory put forward by Schoenau-Fog (2011) shares many similarities to the model proposed by O'Brien & Toms (2008), but was designed to specifically explain gaming behaviours instead of general technology use. The engagement process consists of 4 components: players are first motivated to pursue an objective, which to do so they must perform activities (ranging from socialising to exploring), and when accomplished leads to an emotional affect, that influences whether they will take part in the objective again. This is known as the OA3 model (referring to Objectives, Activities, Accomplishments and Affect) and, similarly to O'Brien's process model, argues engagement exists as a process loop. This may be the case in open world gaming experiences, where players are in a constant loop of pursuing objectives and evaluating how they felt upon completion of it. For example, objectives could range from single tasks to pursuing a questline, and the affective feedback given to the player may influence the likelihood they will both continue with the current action, switch to a different one[5], or disengage from the game entirely.

However, in open world games the objective may not always be successfully completed, yet still lead to an affect which influences engagement. If a researcher wishes to view playing an open world game as a singular objective (for example, to have fun) then the model is sufficient. It would not however explain the actions that are undertaken within this process; not only does a player choose to engage with an open world game, they also can choose to engage with specific objectives (e.g., a particular quest line), which in turn allows selection of specific actions. This is due to the hierarchical nature of open world games — actions (e.g., fishing) feed into quests (e.g., collect 10 fish), quests feed into quest chains (e.g., help fix the village's food shortage), and quest chains can feed into larger narratives (e.g., saving the village from starvation). Therefore, it is possible a player can engage differently with each of these 'levels', whilst disengaging/reengaging within levels below it. Furthermore, it is possible for players to consider more than one objective at once in open world games, with little consequence for what they eventually choose to pursue. In summary, the high degree of flexibility over objectives players can pursue, which lead to the contextually-situated experiences they have, would therefore require current models of engagement to be extended.

[5]Such behaviour is a slight extension to the OA3 model, in that objectives engaged with in open world games can differ from one another without the need to leave the game in order to change.

2.3.3.3 Autonomy

Autonomy has been considered in games from the lens of Self Determination Theory (SDT), and is defined as the ability to pursue actions freely for interest or personal value, usually enabled by having access to a variety of choices and rewards (Ryan, Rigby, & Przybylski, 2006). Players can fulfil their need for autonomy through their actions in games, by feeling in control of the narrative (Przybylski, Rigby, & Ryan, 2010) and what their character looks like (Kim et al., 2015). When the need for autonomy is met, players experience enjoyment and higher levels of other overall experiences such as immersion (Ryan, Rigby, & Przybylski, 2006). Autonomy also differs between games, as open world games are known to provide high degrees of autonomy moreso than other games (Azadvar & Canossa, 2018), due to the control players have over what they wish to pursue. In doing so, exercising autonomy may lead players to the contextually-situated experiences they have, explaining differences both within and between players. For example, different players will have different perceived needs of autonomy, and players can vary in their needs between play sessions.

However, it is unclear how players would select specific actions once they have a desire to enact their autonomy. Multiple actions could lead to this feeling (such as exploring an area, or choosing one quest over another), which could be scored equally highly for autonomy. Therefore, it is not known why players select certain actions over others if only considering the perceived autonomy of players.

2.3.3.4 Exploration/Navigation

Open world games, by typically containing large spaces for players to explore across, require players to effectively navigate through them. Navigation does not always relate to physically moving through a space (as Sloan (2016) showed how the presence of nostalgia in game design can encourage players to navigate through plot and seek out narrative information), though it is the most common conceptualisation.

One area of player navigation research potentially related to open world games is on the use of 'wayfinding' game cues. Wayfinding is a large field addressing how people navigate through environments by referencing objects, which can take a variety of forms (e.g., maps, signposts, roads; for an overview see Arthur & Passini (1992)). This can also include navigating through any environment, such as 'wayfindng' through a website design (e.g., West & Leskovec (2012)) or finding a book in a library (Eaton, 1991). In video games, cues can help to guide players in spaces they could otherwise get lost in.

Darken & Sibert (1996) showed how players need wayfinding cues to navigate within virtual worlds (in their case the use of maps and gridlines), otherwise they become disorientated and cannot effectively search within the space. For open world games, how the game world is presented to players may influence where they go, and by extension what they find to interact with and experience. If players are more likely to come across certain content over others, it is possible this will influence what they experience. Further, it is not only just the presence of wayfinding cues that help players, but also how they are presented to players. M.-X. Chen & Chen (2019) focused specifically on improving map designs in 3D virtual worlds to improve navigation, and found in certain tasks using a semi-transparent map improved navigational time rather than using an opaque map. Interestingly, participants did not rate the maps significantly differently in terms of preference, showing that an improvement in efficiency does not always relate to a more enjoyable experience. Related to how players rate the experience of games, Moura & Bartram (2014) focused specifically on how wayfinding cues could affect the player experience. Though the focus was only on maze and puzzle-style games, the authors found players expected there to be wayfinding cues available and recognisable to aid them in navigating the world. If this expectation was not met (because there were little cues or none they could recognise, especially newer players) then they became frustrated and disorientated. This highlights the need for games to meet the expectations of their players, as a disconnect here can increase frustration. In open world games, if players expect certain types of action selection opportunities to be available/readily signposted, and this is not met, this could result in a negative playing experience.

Other game features that can influence player navigation include the presence of paths to follow (e.g., Liszio & Masuch (2016), Ruddle (2005)), and the explicit visualisation of other character's move-

ment paths (Kay & Powley, 2018). Smith & Du'Mont (2009) noted that having more experience and perceived skill with First Person Shooters (FPS) was related to increased performance in search and navigation tasks, showing how players can be influenced by the games they play, which in turn can change how they perform within games. This bidirectional effect is noteworthy, as it is sometimes not clear what came first — did players with naturally high navigational skills gravitate towards FPS games, or did playing the FPS games increase their skills? For open world games, are experienced players better at navigating the game, which changes their approach to action selection?

Other research has focused on the experience of exploration within games, such as the theoretical discussion by Wolf (2021) on how the ability to explore leads to enjoyment. Such exploration activities described include entering the game world for the first time, engaging with NPCs, and the feeling when exploration has been exhausted. However, this lens is a reflection on games rather than an empirical understanding of how players experience exploration. Such empirical work has been undertaken in relation to how player differences may influence their exploration behaviour. Si, Pisan, Tan, & Shen (2017) analysed 25 players in 3 different exploration games created in *StarCraft: Brood-War* (1998), an expansion to a Real Time Strategy (RTS) game. This was done to investigate whether game style could influence how players explore game spaces, as the authors did not want to assume a player's tendency to explore was a fixed trait. The results indicated 4 exploration archetypes, briefly explained below:

- **'Wanderers'** were players who did not seem to have any specified goal of where to go or what to do. They only find objects immediately within their sights, and rely on landmarks within the terrain to navigate. Because of this, they have little strategy and behave with mostly random movements.
- **'Seers'** mostly focused on viewing all the available space, doing so as quickly as possible and by collecting helpful information. This allows them to behave in direction-orientated ways when planning gameplay activities, relying on being able to see as far as possible and having a mental map of the region to reference against.
- **'Pathers'** were focused on creating mental maps of the environment, by taking note of different types of terrain encountered to make reference of later. Similarly to Seers they prefer to see all of an area before moving on, as this helps build the mental map of what terrain features are present, allowing them to formulate sequences of movements to plan out strategic gameplay.
- **'Targeters'** considered the environment features in terms of how they can be used to their advantage. They seek out landmarks and predict where undiscovered terrain features will be, before attempting to confirm if their prediction is true. This allows them to plan in advance but remain flexible if their predictions are wrong.

These archetypes were not typically static within players, as they are applied differently depending on the type of game played. Only 3 participants had a consistent exploration style for each game, and all 3 used the Seer approach. The majority of players changed styles between games, and some showed multiple archetypes within the same game. For example, in the game designed solely for exploration, no players showed the Targeter archetype, but in the game designed to encourage searching behaviours, 59% of players were Targeters. There was also evidence that how familiar participants were with playing games affected their likelihood of showing certain types of archetype. Of those who only played for less than 1 hour a week, 91% were Wanderers, whereas those who played more than 5 hours were 63% Targeters. This implies that some exploratory behaviour can be learnt through repeated gameplay, highlighting interaction effects between what players bring to games versus how games influence players.

Whilst the work of Si, Pisan, Tan, & Shen (2017) is useful in understanding how exploratory behaviour can vary between players, it was not conducted in a commercial game (as the stimuli were modified for experimental purposes) and did not take place in an open world environment. Because of this, it is difficult to know if these archetypes exist only in RTS games. It is also possible that the scale of exploratory behaviour enabled in open world games changes these archetypes in some way.

Overall, player exploration research has looked at how the game can influence where players navigate to, and what differences players bring to the game. Research has also shown how to improve navigation by adding in wayfinding clues, and the player experience of exploration generally. However, this work is not typically applied to open world games, where navigation is only one aspect of actions a player could take. Further, in open world games players have the ability to modulate how much exploration is required of them, through mechanics such as fast travel. Therefore, player navigation research only applies to one behaviour present in open world games, and may not be useful in explaining how exploration is used to achieve other types of action selection.

2.3.3.5 Individual Differences

Whilst some work has looked at what types of players are drawn towards certain games (such as the motivational profiles of *Minecraft* (2011) players (Canossa, Martinez, & Togelius, 2013)), others are concerned with how different types of players act in games. For example, Pirker, Griesmayr, Drachen, & Sifa (2016) found play style and amount of progression through *Just Cause 2* (2010) were related variables, but also that they were highly variable within players. Whilst there were clusters observed and used to group players depending on their behaviour (e.g., Explorers, Rushers, Elite Players), the analysis also showed players frequently moved between them depending on the mission they were currently pursuing. All players changed styles at least once, and the average number of clusters a player would be in during the game was 2.91. Therefore, it is likely that play styles within open world game experiences will vary both within and between players over time. It will be difficult to conclude any observed cluster is an apt summary of a given player, as the cluster is likely only relevant for that specific time period and contextually-situated experiences they have. The work did not however seek to understand why players varied in play style, or why they pursued certain parts of the main story (the metric used to measure progression). This is because the focus was to show it was possible to cluster players in a meaningful way based on their in-game behaviours. Consequently, it is unknown why open world game players change their play style, and by extension the actions they select.

Other notable individual difference that has been related to in-game behaviours include personality traits, such as a relationship found between extroversion and enjoying challenging games (Johnson, Wyeth, Sweetser, & Gardner, 2012), and a negative relationship between Honesty/Humility and engaging in aggressive in-game actions such as killing opponents (Worth & Book, 2015). Other work has shown Conscientiousness is higher in certain player types, notably those that enjoy overcoming challenges or are strategy focused (McMahon, Wyeth, & Johnson, 2012). Outside of personality traits, research has shown links between gender and preference for certain games (Phan, Jardina, Hoyle, & Chaparro, 2012), as well as how age influences motivation (such as younger players being more motivated for fantasy in games (Greenberg, Sherry, Lachlan, Lucas, & Holmstrom, 2010)).

Overall, the above work considers variables within players that may affect how they approach games. Such variables may affect the actions players select in open world games, and how they respond during contextually-situated experiences. Therefore, how players differ from one another is important to consider for this thesis.

2.3.4 Summary

This section has outlined how choices are understood and researched in three domains; psychology, HCI, and applied into games. Whilst the findings are various and cover a number of aspects of choice, few are apt to help explain the choices available and made by players of open world games. The notable exceptions are that of engagement and exploration, however even these require redesigning to fit the open world game setting. Therefore, these lenses to understand choice do not appear well suited for the current work.

However, there are two further lenses of choice that have not yet been covered. These are motivations (i.e., what supposedly drives players to seek out certain experiences) and goals (i.e., what players wish to achieve from a gaming session), two concepts that are both well studied and have been applied to games in the past. Consequently, both may help to explain the choices made by open world

players, which create the experience they have; motivation may lead people to choose options over others, whereas what goals players have for play may influence what they do. It is however unclear which is most appropriate. For this reason, both are now reviewed in their own sections in this literature review, where the strengths and limitations of applying these lenses to the open world experience are highlighted.

2.4 Player Motivation

Motivation, the concept that people are drawn to make certain decisions because of some internal drive, has been both frequently theorised on and applied to games. If players are drawn towards certain decisions because of differences in their motivations, this may explain what players choose to do and therefore experience in open world games. Consequently, theories of motivation and their application to games may help explain what open world players choose to do. However, the measurement of motivation typically relies on the use of questionnaires, of which they are numerous available and it is not clear the extent to which they overlap. Therefore, this section also draws focus to the measurement of motivation itself to situate the applicability of the concept to open world games.

2.4.1 The Reification of Motivation

When looking at work concerned with why players differ from one another, there are many theories used to motivate the work, with distinct framings to be considered. This has been highlighted in the past, such as Hamari & Tuunanen (2014) who found many different perspectives to player attitudes when considering player typologies. Overall, the dominant types of framing for such work are player traits, player preferences, and player motivations (including needs satisfaction).

Player Traits are aspects of people generally considered stable over time, which influence behaviours (usually built from psychological trait theory). This implies they can be useful in predicting whether certain people will like/dislike a given game or aspect of a game. For example, players who identify as having a 'Narrative Orientation' show significant positive correlations to enjoying role-playing elements in games (Tondello, Arrambide, Ribeiro, Cen, & Nacke, 2019). Building on this, Player Preferences refer to a person's attitude to a given stimulus, usually when asked to make a decision about it (Slovic, 1995). These may be less stable than traits, as several factors could influence preference for a game. For example, whilst personality traits may influence game genre preference (Peever, Johnson, & Gardner, 2012), so too could gender (Hartmann & Klimmt, 2006). Therefore, preferences are more flexible and build upon a number of factors, rather than a singular 'trait'. Finally, Player Motivations refer to players seeking out or avoiding specific experiences in a game. A common motivation theory in games research is Self Determination Theory (SDT; Ryan, Rigby, & Przybylski (2006)), that posits players pursue games/aspects of games that can satisfy a basic human need (autonomy, competence, and relatedness). Players are motivated to fulfil these needs, which in turn will drive their gaming choices. Therefore, this perspective argues whilst the underlying motivations may be the same between players, the level of satisfaction within each need will vary.

Despite these quite different terms, which serve to emphasise different ways of conceptualising differences between players, the practical measurement of the concepts shows a high degree of convergence. Each theory typically employs the use of questionnaires to assess the thoughts of players, meaning whilst the underlying stance of the work may differ, the methodology used is the same. By reducing abstract concepts into concrete items on a scale, a process of reification has occurred. Because of this, the distinct differences found when considering these concepts at the abstract level have been removed, and the questionnaires become what is actually being measured.

For example, preferring games that give a sense of freedom is one theoretical explanation for behaviour (such as Autonomy/Exploration in the GAMES questionnaire (Hilgard, Engelhardt, & Bartholow, 2013)), and being motivated to fulfil a need for freedom is another (such as the Autonomy sub-scale from the PENS questionnaire (Ryan, Rigby, & Przybylski, 2006)). If players are asked a question in a questionnaire about this, the items appear similar. 'I like games that offer you a lot of op-

tions and choices' is semantically comparable to 'The game provides me with interesting options and choices,' despite the former being derived from preferences, and the latter from a motivation/needs satisfaction perspective. Because of this, researchers using any questionnaire across theoretical domains could do so interchangeably, as the items have become comparable. They may even do so with little consideration for the theory, and care only for what the questionnaire claims to measure. There is evidence of this from recent work by Tyack & Mekler (2020) that found many researchers using SDT in HCI games research gave little consideration or explanation to the theory that led to its construction. Of 110 papers referencing SDT, only 27.72% explained how the theory motivated the work. This suggests it is commonplace to only lightly consider the theory behind the construction of a questionnaire, and so these differences in theory may not always be considered by researchers.

Therefore, this thesis considers the terms preference, trait, and motivation interchangeable, where all are referred to as motivations for brevity. The following section outlines common theories that explain how such motivations may influence what players do in games, and how it could apply to the open world experience.

2.4.2 Theories

Motivation, similar to open worlds, is a term that does not have a universally accepted definition. In the simplest sense, and for the purposes of this thesis, motivation can be defined as desiring a (subjective or otherwise) change in one's self or the environment (Baumeister, 2016). The desire to change can be influenced by several factors, such as the needs of a person (such as biological needs like hunger or psychological like safety), the emotions of a person (such as sadness or excitement), and the cognitions of a person (such as their goals or values; Reeve (2016)). Within motivation there is the distinction between trait and state motivation; the former refers to recurring patterns in behaviour motivated by desires such as food, whilst the latter refers to a contextualised desire to perform an action in a specific setting (Baumeister, 2016). Consequently there is overlap between the two, as a person can have a pattern of recurring motivation for an activity (such as a desire to explore), but also a highly specific urge within a given setting (such as to explore a cave in a game). Due to this overlap, and associated lack of consensus in the field for the true difference between the two (e.g., Reeve (2016)), this thesis considers motivation to be any desire to enact specific change within a game, including both recurring patterns (which are more trait-like) and those brought about by the specific context of the game (which are more state-like).

As the definition for motivation is broad and generalist, it is perhaps unsurprising it has been applied in many contexts to understand a variety of behaviours. For example, students highly motivated to learn are more likely to watch lecture videos (de Barba, Kennedy, & Ainley, 2016), and online gamers with a motivation to achieve use games to show their skills to other players (Merhi, 2016). Whilst many motivation theories from psychology are generalist and not specific to games, there is one notable exception. Self Determination Theory (Deci & Ryan, 2000) has been widely used to understand gaming behaviours (Ryan, Rigby, & Przybylski, 2006). The aim is to understand what factors underlie motivations — how do people satisfy their underlying psychological needs through the activities they pursue. Typically in games these are intrinsic (internally motivated), with 5 main components: autonomy (having freedom and choice), competence (feeling capable of achievement), relatedness (feeling connected to others), presence (feeling engaged with the game) and intuitive controls (how well the player feels they can translate their desires into game actions; though Johnson, Gardner, & Perry (2018) argues this overlaps too strongly with Competence and should be collapsed). Ryan, Rigby, & Przybylski (2006) argue these can be applied to players choosing to play a game, choosing between games to play, and in-game choices. Through a series of 4 validating studies the authors show games that satisfy these needs give rise to more enjoyment, and predict whether players wish to continue playing in the future. In doing so, the Player Experience of Need Satisfaction (PENS) questionnaire was created in order to assess the felt experience of these needs. The PENS questionnaire has been used in numerous studies, discussed in the following section.

When considering open world games, they should satisfy needs of autonomy, presence and competence, and perhaps relatedness if in a multiplayer setting. SDT may also theorise that, as players are

motivated to pursue tasks that fulfil their psychological needs, the variation in player behaviour may arise from differing levels of needs. However, SDT is designed as a general theory to explain player motivation, intended to remove individual variances of games and genres to explain 'fundamental' psychological needs that exist across contexts (Ryan, Rigby, & Przybylski, 2006). Whilst this is useful to understand general motivational factors, it cannot explain specific behaviours, and by extension what about the open world experience is unique. SDT for example could not explain why players choose some actions more often than others. Consider the following scenario: an open world player has the ability to collect herbs for medicine crafting, and the ability to defeat an enemy defending a unique piece of armour. Both are equally accessible to the player, and the act of doing one would not exclude the player from (at a later date) pursuing the other. Both would satisfy the need for autonomy and competence, perhaps to equally high levels, as the player can choose which task to pursue and there is an explicit goal from performing either action. How does the player choose between them?

Therefore, even within motivation theories specific to games, it is possible these are not specific enough to explain the open world experience in terms of what players are motivated to do in them. SDT and other motivational factors have however been applied to games in the past, and so are discussed in the following section.

2.4.3 Application to Games

Numerous studies have considered what motivates players towards certain types of games and in-game activities. Following the seminal work of Bartle (1996) that theoretically outlined how players are not a monolith but instead a diverse range of people with differing reasons for play, understanding how to measure these differences has been a focus of many researchers. Questionnaires designed to capture player differences began to populate in 2006, with the introduction of three popular scales from three separate disciplines; Games (Yee, 2006b), Psychology (Ryan, Rigby, & Przybylski, 2006), and Media (Sherry, Lucas, Greenberg, & Lachlan, 2006). Whilst questionnaires are an obvious way to measure differences due to their ease of administration, that does not mean they are easy to design or interpret. Because of this, multiple questionnaires have been designed. These either capture new dimensions of motivation, such as 'Continuance Intention' by Wu, Wang, & Tsai (2010), or improve existing questionnaires, such as the trait scale proposed by Tondello, Arrambide, Ribeiro, Cen, & Nacke (2019) which improved on BrainHex (Nacke, Bateman, & Mandryk, 2014)). This iterative process reflects the organic growth of the field, where the aim is for measurement of player differences to improve with new studies and new designs.

Hamari & Tuunanen (2014) provided a meta-synthesis of the most notable motivation theories, comparing each to observe similarities between them. They conclude there is significant overlap in the field, despite a variety of names used to describe each concept. These are grouped into 5 areas which explain why players choose to engage with a game, dependent on what they want from the experience: Achievement, Exploration, Sociability, Domination, and Immersion. However, Hamari & Tuunanen (2014) stress the limitation of statically categorising players in such a way, highlighting it is potentially too restrictive and does not capture the variability of players over time and place. For this reason, it is more common to consider players to have a multitude of motivations for play, some more active than others, which explain their general trends in behaviour.

Such measurement tools have been used in previous work. For example, Billieux et al. (2013) found a weak positive correlation (r = 0.34) between exploratory behaviour in *World of Warcraft* (2004) and the motivation for discovery, a subscale of the Motivation to Play in Online Games Questionnaire (MPOGQ; Yee (2006b)). Schaekermann et al. (2017) looked at curiosity motivation in *Destiny* (2014), and how this related to the types of in-game behaviour players engage with. Four clusters of curiosity-driven motivation were found (social, sensory/cognitive, exploratory, and novelty), created from answers given by participants on a range of questionnaires (including the Seeker sub-scale from the BrainHex motivation scale (Nacke, Bateman, & Mandryk, 2014)). Their model could predict which of these clusters a player would fall under from their gameplay data.

Of particular widespread use is the PENS questionnaire, described previously. Brühlmann & Schmid (2015) profiled the motivation of players in *League of Legends* (2009) into 4 clusters based

on answers to the PENS scale, to observe how this affected their in-game behaviour. Interestingly, whilst there were notable differences between clusters in terms of the sub-scales present, they were not mutually exclusive; most clusters contained a blend of sub-scales. Further, despite such differences in motivation, the clusters displayed similar in-game behaviour overall, indicating motivation did not influence their behaviours in significant ways.

Other uses of PENS include evaluating how games enable certain experiences, such as Inchamnan & Wyeth (2013) who compared scores on the PENS to cognitive actions a player can take in games, with data across 3 games (*Portal 2* (2011), *I-Fluid* (2008), and *Braid* (2008)). Cognitive actions were evaluated by 3 experts, and these scores showed that *Portal 2* (2011) scored highest in player experience (in terms of competence, autonomy, intuitive controls, and immersion), the ability to provide mechanisms for achieving goals and challenges, and the ability to provide actions for players to engage with including physical control. *Braid* (2008) however was shown to provide the highest scores for achieving goals and for providing opportunities for evaluation. Consequently, games can lead to different player experiences depending on their design. This may explain why open world games provide unique experiences to players; there are specific game design components that enable feelings such as autonomy more strongly than other games.

The above work considers motivation as a static number in time, where players are measured once. It is unclear how stable motivation is over time, and there are few studies that consider how motivation may change. An exception is Schultheiss (2007), who measured the motivational traits of players of *Space Merchant Realms* (2003), an online multiplayer game, to assess whether these were likely to change over time. From a factor analysis they identified 10 motivation factors (67.18% of the variance), which across two time periods (10 weeks apart) was found to remain constant. The author concludes 4 factors increased over time, but 3 did not reach a level of significance. The one that did (Anger/Taunt) is labelled as significant at the $p > 0.1$ level, which is not conventionally considered significant. This implies motivations which lead players to continue engaging with a game may remain constant over time, though more research is needed to support this claim.

For open world experiences, it is highly likely that players will vary in their motivations to play and engage with certain in-game content. Being able to measure motivation and compare it to their behaviour would therefore provide useful insight into why and how certain contextually-situated experiences are navigated. However, current ways of applying motivation to explain in-game behaviours have several limitations. For example, the existence of multiple questionnaires with overlap in subscales makes it difficult to choose the most appropriate tool, as it is unclear which is 'the best.'

Further, there is little discussion in the literature on what happens if a player has high scores in two or more of these motivations. Whilst previous literature has shown motivations are not mutually exclusive, in that being high in one does not decrease another (Yee, 2006b), this is rarely followed to its conclusion for what it means for players. The concept of conflicting motivations and desires is arguably built into the very design of open worlds. The game acknowledges players want to engage with different things and accommodates accordingly. Whilst it could be argued this is done to meet differing needs across players, it could also be found within players as well. An individual player may have both the desire for narrative and the desire for freedom in a single gaming session, putting these in direct conflict. By pursuing one the player cannot by extension pursue another simultaneously (e.g., if they want to find all of the special hidden items in the world space, they cannot at the same time progress the narrative). How then, does a player navigate this conflict?

To date these questions have not been accounted for in player motivation theories, potentially because open world games are unique in their ability to provide players with conflicting motivations. If a player wants to both socialise and achieve, but cannot pursue these simultaneously, how do they choose which to satisfy? Are high scoring motivations equally valued by the player? If the player switches between behaviours to accommodate different motivations, how and when does this occur, and how does the game influence this? Examining conflict between motivations is difficult to measure with current questionnaires, but is likely common in open world gameplay. Players can pursue almost any activity at any time, so must constantly navigate their competing desires. Therefore, before it is possible to understand the influence of motivation on the open world experience, there is first a need to decide how is best to measure it.

2.4.4 Summary

Overall, the theories of motivation show promise in applying to the open world experience, however there are a number of practical issues that require attention before they can be used. This mostly revolves around the presence of multiple questionnaires available to measure motivation, with little indication of which is best or how much true overlap there is. Therefore this thesis investigates how best to measure motivation in the gaming context.

2.5 Goals

Another potential explanation for choices made in open world games is that of goals (e.g., things players want to achieve and work towards). Unlike motivation, goals are not typically measured via questionnaires, but instead of asked directly to people before or after an experience. Goals have also been studied in gaming contexts before, meaning they may easily transfer to open world gaming experiences. Therefore, this section covers theories of goals and how they relate to behaviour, as well as their application in games.

2.5.1 Theories

As players can 'do what they want' in open world games, it is likely they will need to choose between activities to do and experiences to have. Players are unlikely to be pursuing the main quest (as discussed in the Introduction), and so the goal of the game (i.e., to win) is similarly unlikely to guide players. Instead, players may choose what to do by using goals they bring to the game. Therefore, it is important to understand how goals influence player behaviour, and so the following section outlines current theories of goals.

Goals, though a commonly explored topic in the literature, have not always had a clear definition. Broadly, goals are defined as a mental representation of a desired future state, which a person believes (consciously or not) they know how to achieve (Hassin, Bargh, & Zimerman, 2009). Elliot & Fryer (2008) provides a historical overview of the definition of goals, and offers the following definition: 'a cognitive representation of a future object that the organism is committed to approach or avoid' (Page 244). For the purposes of this thesis, goals are considered cognitive representations of future states, where a person generally knows how and is committed to achieving the desired outcome. In many ways, goals have been linked to motivation (discussed in the previous section), as to have a goal typically means to move in a motivated way towards/away from something (e.g., Mitchell (1982); see Elliot & Fryer (2008) for an overview). To pursue a goal requires selecting actions to follow, where actions are considered goal-directed if a person is attempting to achieve a specific outcome, and the actions taken as part of this can influence said outcome (Dickinson & Balleine, 1994).

The link between actions and goals has been widely studied, both in terms of neuroscience and behavioural psychology. For example, previous research suggests goal selection is optimised in the orbito-frontal cortex of the brain, via a process utilising actions that have been abstracted (Fine & Hayden, 2022). Consequently, action selection is inherently tied to goal selection, and so what people do in open world games is likely related to what goals they set for themselves. In terms of behavioural psychology, many studies have focused on how people achieve long term change via goals, such as the effect of apathy on weight loss (Volicer, Frijters, & van der Steen, 2013) and the effect of social support on addiction recovery (Johansen, Brendryen, Darnell, & Wennesland, 2013). However, such studies focusing on long term change lose many of the day to day actions that lead to the outcome of the goals set (i.e., time between testing is so long that most of the day-to-day behaviour is lost). For example, in the case of Johansen, Brendryen, Darnell, & Wennesland (2013) measurements were taken at the beginning of the study, 9 months later, and 2 years after. Consequently, it is unknown what actions occurred between these points that influenced participants' behaviour. It is therefore important to understand how actions relate to goals on a more granular level, in smaller settings more similar to that of playing open world games.

One such approach designed to apply in a variety of settings, whilst still linking goals to the actions people take, is the Theory of Goal Systems proposed by Kruglanski et al. (2002). Goals and the Means to achieve them are described as hierarchically connected in ways that enable Actions (referred to as the Goals-Means-Actions framework in this thesis). Goal Systems are networks that describe how Goals (either conscious/focal or subconscious/background, that naturally vary in commitment a person has to completing/investing time in them), any relevant Subordinate Goals, and Means relate to one another, typically shown with arrows that can be facilitative or inhibitory. Relations between Goals and Means are influenced both by how the network is structured in terms of connections, and the attentional resources available to complete specified Goals and Means. It is therefore possible to apply the framework at different levels of abstraction — a Goal could be to complete the main quest, with associated Means involving talking to NPCs and travelling to specific locations. A Goal could also be to kill an enemy by using the Means of magic or physical weapon attacks. In other words, the Goals-Means-Action framework may apply both to the contextually-situated experiences, and the wider, summative experiences players are aiming to have.

Depending on the context, it is possible to have a Goal connected to multiple Means, and a Means connected to multiple Goals. For example, an open world player may have the Goal of convincing an NPC to help them, which involves choosing what type of answer to give such as peaceful or aggressive (i.e., the Means of completion). Conversely, the Means of killing an enemy could be done for many Goals, such as to collect treasure or to fulfil a quest to kill the enemy. When a Goal is connected to a Means they become associated together, allowing for transfer of properties between them (such as activating the memory of the other, and activating the commitment to complete). The lower the number of connections per Goal or Means, the stronger the association is between the two. For example, it is possible that players may more strongly associate the Means of opening a chest with the Goal of looting, than the Means of moving around a dungeon, as the latter could relate to numerous Goals. Because of this, they may be more likely to report opening a chest and looting together, as the association is stronger.

Furthermore, as the structure of the network is not static/fixed, the context of a situation can alter the connections between Goals and Means — some Means may be more desirable than others depending on what is available, and Means may be associated to the same Goal in some contexts but not others. For example, talking to an NPC (Means) to obtain a specific rare item (Goal) may be more appropriate if the NPC is nearby and the player has the money to buy it. If this is not true, the best Means may instead be to explore a specific dungeon where the item is known to sometimes be found. It is also possible for people to change Means if the current one does not seem to be working, and for people to change Goals if they come into conflict with one another. Because goal pursuit is a cognitive task, players with more than one active Goal may struggle to complete them, as attentional resources must be shared. Therefore, how Goals and Means change over time is important to consider, as well as how much cognitive effort a player must exert to follow one or more of them, to understand what the player experiences.

Figure 2.2 combines the above description of the Theory of Goal Systems into an imagined open world player's goals. In this example, the player is completing a side quest given by an NPC, which involves clearing a dungeon of enemies and taking any loot. The Goals and Means highlighted in blue indicate what the player has chosen to do at a given point in time (in this case, the observable action is fighting an enemy with a sword), as opposed to the grey Goals and Means that are inactive. Chosen Means and Goals will be more contextually relevant depending on the situation; a player can only kill an enemy if there is an enemy to kill, and the player can only return to the NPC for a reward once the dungeon is cleared. Orange arrows indicate inhibitory associations, as to pursue a specific Goal and Means, other options must be suppressed — a player cannot loot a table at the same time as killing an enemy. Below the dotted grey line indicates how actions a player takes relate to the Means chosen, which are likely to also have inhibitory affects on one another. Unlike the aspects above the dotted lines, Actions are more readily observable by looking at what the player is doing, as actions are how players interact with the game.

The complexity of how Goals relate to Means and Actions can be seen in this relatively simple example. Goals can have numerous Means, Means can attach to more than one Goal (as in the case

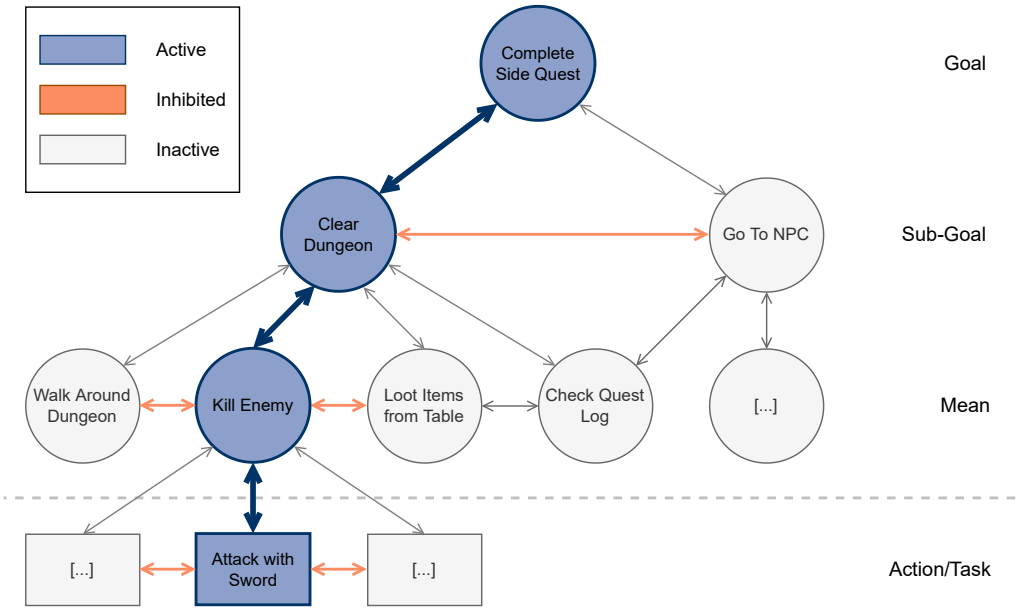


Figure 2.2: An example of how the Theory of Goal Systems could apply to the goals of an open world player.

of checking the quest log), and what aspect of the network is active will change frequently throughout gameplay. Therefore, the Goals-Means-Actions framework provided by Kruglanski et al. (2002) is useful for understanding and describing complex open world experiences, as players may have many goals active at any one time (such as to explore the world, and to find treasure, and to finish a set number of side quests). However, only some can be executed in a given contextually-situated experience — for example, players could only find treasure if there was an event in the game allowing this to happen. In the Goals-Means-Actions framework, only goals that can be pursued are 'active', and so it is important to understand what specific interactions are occurring in the game to enable the pursuit of specific goals. Therefore, using this framework may help explain how specific actions relate to specific goals of players in open world games.

However, the framework relies on the implicit assumption that the person is attempting to complete their goal and their evaluation is contingent on this completion, as it is usually a requirement of them (e.g., to finish a work task). In games however, especially open world games, it is possible to not complete a goal but still have a positive experience. As it can take hundreds of hours to 'complete' an open world game, it is likely that players have goals that cannot be finished in one session. It is possible for players to enjoy gaming without a 'successful' goal completion in this scenario, and so whether a goal is completed or not may not reflect the entire experience. Consequently, the enjoyment of the *pursuit* of their goals may be more telling of their experience. Indeed, research has shown that if the means of goal pursuit are enjoyable, people rate the goal more favourably (e.g., playing *Tetris* (1984) to aid in psychological research led to higher interest in taking part in further studies than circling the letter 'e' in a biology paper; Milton Adams & Hart (2015)). Therefore, if open world players enjoy the process of pursuing their goals (i.e., their chosen Means), they may place more value and enjoyment on their goals.

Furthermore, during gameplay new goals may appear that are more interesting and so become active, meaning the first goal must be paused. This switching of goal may not necessarily be viewed negatively by players, and so it is important to understand how players report the experience of goal pursuit in open world games, not just the goals themselves.

Overall, goal theories are useful but need less focus on achieving a goal and rather how the goal is pursued in the moment. This is similar to the above section discussing situated actions; actions may not be meaningfully tied to goals until *after* the experience has taken place. Therefore, understanding

both goals and the actions taken to pursue them likely influence what players experience in open world games.

2.5.2 Application to Games

Similarly to the theoretical definition of goals, there has also been wide discrepancy in what constitutes a game goal. Typically the definition relates to what the aim of the game is for players to complete (e.g., Zagal, Mateas, Fernández-Vara, Hochhalter, & Lichti (2007)). Debus, Zagal, & Cardona-Rivera (2020) builds on previous definitions to provide a typology for game goals, where goals are considered hierarchical and ordered into superordinate and subordinate goals, where the latter explains how the former is achieved. This shows overlap to the Goals-Means-Actions framework Kruglanski et al. (2002) described in the above section, where Means explain how Goals are implemented.

However, this definition of goal only considers to come from the game, and not the player. This definition of goal is similar to the work discussed in Section 2.1.3 focusing on goal recognition in open world games. Such goals are usually derived from the game and labelled by the researcher, which could be inaccurate and not align with how players view them. Video game experiences are known to be highly goal-directed, but it is the player's goals that provide the meaning of the experience (Oswald, Prorock, & Murphy, 2014). Player goals can align with the game as suggested by Debus, Zagal, & Cardona-Rivera (2020) (referred to as progression goals in Oswald, Prorock, & Murphy (2014)), but they can also be unique to the player, known as personal goals. Therefore, this thesis focuses on what players define their goals as and what meaning is provided from doing so. The goals set by the game are considered secondary, as open world experiences allow for players to ignore the 'main' objective entirely, and so are unlikely to explain what players are trying to achieve.

Goals have been looked at in games in previous research, typically through the lens of achievement (i.e., progression goals). For example, it is known that players frequently describe achieving in-game goals as a reason to play games (e.g., Hoffman & Nadelson (2010)). Players who perform well in games — and by extension achieve game goals — also report higher levels of enjoyment (Trepte & Reinecke, 2010). In these scenarios, the goals of the game align with the goals of the player; the player wishes to achieve the goals set by the game (e.g., defeat the final boss). However, it is known that players also have personal goals for variety of reasons, such as to create a more unique challenge (Park, Song, & Teng, 2011). A common example is speedrunning, where players attempt to beat a game in the quickest time possible, and commonly performed live in front of viewers (Sjöblom, Törhönen, Hamari, & Macey, 2017). Other self-imposed goals can be formed within a community of players, such as what activities guilds in *World of Warcraft* (2004) want to work towards (Schrader & McCreery, 2008). Therefore, there is not a total overlap between player and game goals. This is likely to be true in open world games, as players are typically not completing the main quest, as shown in the Introduction. What goals players bring to the open world experience is therefore unknown.

In summary, work applying goals to games is uncommon, potentially because for many games, the goal of the player is the same as the goal of the game; beat challenges to win. However, in open world games, players have far greater flexibility to have goals outside of those set by the game. Work that has considered player goals is either done to create AI models of goal recognition, or to acknowledge that players sometimes create their own goals to provide extra challenge. Therefore, whether player goals is an apt way to understand action selection in open world games is unclear, though shows promise in explaining why players have unique contextually-situated experiences.

2.5.3 Summary

Overall, goals provide an alternative approach to understanding how choices made in open world games enable the experience. Goals are potentially easier to use as they do not rely on questionnaires, but it is not always clear how specific actions relate to the goals of a player. Therefore it is worth investigating if players themselves talk in terms of goals and their relation to actions, and if so, how to map this onto gameplay data. This is therefore an aim of the current thesis.

Now that the theoretical literature relating to understanding the open world experience has been explored, the final section of this literature review discusses how to measure the aspects that make up an experience. This helps to frame which methodologies should be used, and what factors should be accounted for when using them.

2.6 Measuring Experience

The previous sections have covered topics that relate to the research questions, but there is yet an exploration of which methods would answer them. To answer the research questions, it will be important to measure the experiences players have in open world games. It can be difficult to access experiences, both because it is an internal process happening in the mind of the player, and as any investigation will naturally interrupt the experience taking place. Further, there are three aspects of experience that must be measured; what the player is doing, why they are doing it, and how these processes make them feel. Therefore, this section outlines ways to measure player experiences that could provide useful insights, utilising both qualitative and quantitative techniques.

2.6.1 Gameplay Metrics

To understand what players are doing in open world experiences, it is important to collect in-game actions and gameplay metrics (such as the location of players, or what they are currently interacting with). Some games log player actions, which are easy to extract and analyse. For example, Canossa, Martinez, & Togelius (2013) correlated in-game values collected from game logs in *Minecraft* (2011) with the Reiss Motivation Profiler, such as the number of fish caught, number of times the game was loaded, and the number of times an item has been mined. Melhart, Azadvar, Canossa, Liapis, & Yannakakis (2019) analysed game data in *Tom Clancy's The Division* (2016) compared to a player experience questionnaire data. Game data included the number of missions completed, playtime, and player's level.

Such game logs however are high level statistics of gameplay, and summative in nature. Ideally, in-game actions should be granular and collected moment to moment, as summative descriptions obscure what players experienced in the moment. For example, M. Aung et al. (2019) looked at how player behaviour in *Just Cause 2* (2010) differed between players who dropped out early and those more committed to the game. Collected data included number of enemies killed, number of items picked up, and location of the player with a time stamp. From this data it was possible to show the trajectory of players through the game world, and how these differed between player clusters. Other examples utilise video streams of players, to extract features such as location and number of kills in *Fortnite* (2017) to compare to subjective ratings of the experience (Moll, Frick, Rauscher, & Lux, 2020). Further moment to moment game data collection exists in work building AI models to detect player goals (e.g., Ha, Rowe, Mott, & Lester (2011), Gupta et al. (2022)). Such data reflects where the player is in *Crystal Island*, what actions they have previously completed, and what NPCs they have interacted with.

Therefore, collecting such gameplay data, especially if it is moment to moment, would benefit understanding the open world experience. Knowing where players are and what they are interacting with would help to define what contextually-situated experiences are occurring. However, current gameplay data collected by previous studies has a number of flaws. Mainly, the data is somewhat basic and difficult to link to the player experience. For example, what does knowing the number of fish collected tell us about the player experience? Is this a meaningful metric of play? Knowing how many side missions a player has completed is interesting, and this could be modelled over time if collected at multiple time points, as a measure of progression. However, what side missions have they encountered? Did players find the experience of them different? Other data such as location is useful, but again is lacking in depth — when a player is in a specific location, what can they see? What can they interact with? More specific data is needed that can identify exactly what players are doing on a moment-by-moment basis, in a more human-centric approach. This is because it is currently

unknown what behaviour is important to collect and analyse, rather than simply noise. Put another way, in-game actions should reflect how players themselves describe their actions, as these are the actions players deem to be meaningful.

Overall, in-game data is useful to collect to understand contextually-situated experiences in open world games, and how these enable the overall experience. To fully utilise it however, more granular and player-driven data will need collecting for analysis, based on what players believe is important.

2.6.2 Player-Perspective Measures

In contrast to gameplay metrics, data collected from players can tell us the why and how of players within a gaming experience. Typically, such data is collected by asking players to recount an experience they have had, and ask them to explain it. This section outlines how to utilise a variety of qualitative data sources to access the open world gaming experience, from the perspective of players.

2.6.2.1 Primary Data

To understand how players view their experience, it is common to ask them about it afterwards, to allow them a space to explain their actions. This is known as primary data, where there are active participants in a sample. Questionnaires are a frequently used way to collect player experience data, with at least 48 instruments currently available, and Immersion being the most common type of experience measured (Borges, Juy, de Andrade Matos, Silveira, & Darin, 2020). Such questionnaires include the Player Experience of Needs Satisfaction scale (Ryan, Rigby, & Przybylski, 2006), and the Player Experience Inventory (Abeele, Spiel, Nacke, Johnson, & Gerling, 2020), which allow player experience to be quantified and compared across players, as well as look at specific sub-components of player experience (such as Competence and Challenge). They have consequently been used in a number of ways, such as understanding how games differ in their design to create different experiences (e.g., Inchamnan & Wyeth (2013), Singhal & Schneider (2021)), and how aspects such as background audio can affect the player experience (e.g., Rogers, Jörg, & Weber (2019)). Questionnaires are therefore useful to collect easily analysable data on the player experience, for a large volume of participants (due to the ease of distribution). To understand what experiences players have had in open world games, collecting survey scores may provide valuable insight. However, players cannot go into depth about their experience or why they felt and scored the way they did. Further, it is possible for players to experience a different aspect of the experience than is measured — if a player experiences challenge, but the questionnaire does not include this sub-component, this would be missed.

To overcome this, players can also be interviewed about their experiences, allowing them the space to explain their thoughts freely. For example, to understand how autonomy is experienced by players in games, Tyack & Wyeth (2021) conducted post-gaming experience interviews with players. The findings helped to contextualise why in-game choices are viewed as essential for autonomy in games. Johnson, Nacke, & Wyeth (2015) interviewed players of the Massive Online Battle Arena (MOBA) genre to understand what about it was particularly appealing, to contextualise why MOBAs were seen to be less encouraging of autonomy, more frustrating, and more challenging than other gaming experiences. Such data therefore provides more in-depth responses into the experiences players have, which may be particularly helpful for understanding the open world gaming experience. As it is currently unclear what is unique about the experience, and what players experience within it, conducting interviews with players may provide insights. It is however more time consuming to conduct than questionnaires, and sample sizes are typically smaller.

Overall, using primary qualitative data such as questionnaires and interviews may provide insights into what players experience in open world games. However, care must be taken when sampling players, as biases in responses are likely. Most notably, players may not be entirely honest in their responses to questions given by a researcher, due to social pressures like wishing to appear competent at games. Further, players opt-in to studies using questionnaires and interviews, and so answers are naturally biased towards those given by people interested in participating in games research. To overcome these concerns, it is possible to take advantage of pre-existing data (known as secondary

data), where players naturally discuss their gaming habits and experiences without the presence of a researcher. Secondary data is therefore explored in the following section.

2.6.2.2 Secondary Data

As players who take part in research are biased to self-select, it is important to consider data from a wider range of players. One way to do so it to use secondary data, specifically ones where players are playing or discussing play in more naturalistic environments. This can reveal what experiences players like to share and discuss amongst themselves, highlighting their priorities for events that occur. For example, Kosa & Spronck (2018) studied forum posts on the topic of augmented board games (where technology such as smart phones are used as part of play), to reveal if players felt positively or negatively towards them. Thominet (2017) looked at what types of feedback players reported in the game *Subnautica* (2018), using an existing in-game feature that sent feedback to the developers. For the open world gaming experience, utilising data of players discussing games they play may yield insights. Players may discuss themes and concepts that would not have otherwise been known about before seeking primary data, and so may reveal more ecologically valid areas to explore.

Overall, using such sources avoids the bias created by a researcher asking specific questions of players, and may yield more naturalistic findings. However, the data used may not always fully align with the research questions, as it is being repurposed and relies only on what players want to say, which may not be very detailed. Secondary data should therefore be carefully used when exploring the open world experience, to properly situate results and how they fit into the research aims.

2.6.2.3 During-Experience Data

Both primary and secondary data are typically collected after an experience has taken place. However, it is also possible to collect data whilst an experience is happening, revealing how an experience evolves over time. Sometimes this data is physiological in nature, such as skin conductance (e.g., Ravaja, Saari, Salminen, Laarni, & Kallinen (2006)) and heart rate (e.g., Drachen, Nacke, Yannakakis, & Pedersen (2010)). Other times, qualitative measures can be recorded in the moment, such as via the use of a concurrent think aloud (Eccles & Arsal, 2017). For example, Krcmar & Cingel (2016) used a think aloud method to understand when players made moral versus strategic choices in *Fallout 3* (2008). For the open world experience, a concurrent think aloud may reveal what players are thinking about when selecting their actions and goals. However, it is possible that performing a concurrent think aloud is demanding of participants, meaning they may be unlikely to play as they typically would.

Because of this, it can be easier to collect in the moment information retrospectively, by replaying videogame footage to a player and asking their thoughts. For example, Tan, Leong, & Shen (2014) used a retrospective think aloud to understand gaming experiences in *Portal* (2007), by using this data to create codes for analysing what players were thinking during game moments. Other instances include asking players to rate their arousal after playing a game, by replaying the footage and assigning a score to each second (Melhart, Liapis, & Yannakakis, 2022). Such annotation methods allows an understanding of what occurs in contextually-situated experiences, without disrupting the experience itself.

In some cases, it is also possible to combine physiological data with qualitative interpretations, such as McAllister, Mirza-Babaei, & Avent (2013) who recorded the Galvanic Skin Response of players during a driving game. At specific points players were shown a recording of their gameplay and asked about what they had experienced. This was compared to the peaks and troughs in their skin conductance, to make inferences on what they had experienced both physiologically and qualitatively. Other examples include Tan, Leong, & Shen (2014) who combined a concurrent think aloud with physiological measures of players in *Portal 2* (2011) to explore how they could be used together. Together it was shown that both measures would miss important experiential insights, but together provided the most in-depth understanding of what a player had experienced across a collection of in-game events.

Overall, collecting experiential data in the moment can be difficult, as the nature of having an experience means a player's attention is divided. Using a concurrent think aloud method can reveal what players are attending to in the moment, though it may be cognitively challenging to perform whilst playing. To overcome this, it is possible to collect data that does not require an explicit response (such as physiological data), or ask players to reflect on their experiences retrospectively. However, post-experiential recall suffers the same limitations as any post-experience measure; players rely on their memory, and may reconstruct what has taken place rather than describe what happened in the moment. Therefore, collecting during-experiential data can provide important insights into gaming experiences, however care must be taken in how such data is gathered to avoid biases.

2.7 Summary

There are several theories and concepts that may help explain what the open world experience is, and how to measure it. However, many theories and concepts are not specific enough to explain a gaming experience with such a high level of freedom over action selection and consequent contextually-situated experiences. To summarise the literature review, the following models and concepts seem most relevant for the current thesis, or could be reasonably modified and expanded on:

- **Engagement**: players may seek to stay engaged with the game through selecting actions that bring them enjoyment
- **Exploration**: players may have a style of exploring the game, which can change between and within sessions
- **Motivation**: players may have specific desires to fulfil in a gaming session that drives their action selection
- **Goals-Means-Actions Framework**: players may guide their actions through goals and the means to complete them
- **Situated Actions**: players are likely to experience events not accounted for in their plans, and will reconstruct the process afterwards
- **Moral Foundation Theory**: players may be guided by underlying values that influence their decisions

The following gaps have been identified from the literature, which align with the thesis aims:

1. a need to clearly define the open world experience
2. a need to investigate how motivation is measured
3. a need to assess if players discuss their behaviour in terms of goals and actions
4. a need to understand how to link actions and motivation/goals to gameplay data

Consequently, the first step required in this thesis is to better define what the open world experience is from the perspective of players. The following chapter outlines this process.

Chapter 3

What is an 'Open World Game'?

"You keep using that word. I do not think it means what you think it means."
— Inigo Montoya, The Princess Bride

As discussed in Literature Review Section 2.1.1, there is currently no consensus on what the open world experience 'is.' The concept of an open world is currently variable amongst both players and researchers. It is possible that, due to the highly individualised nature of each player's experience, there is no observable commonality; each player's experience may be so unique as to obscure any sense of overarching context. Therefore, to understand what it means to experience an open world game, it is first important to understand what the overarching open world experience *is*, from the perspective of players. It is important to define open worlds from how players describe the experience, because how they use language offers insights into what is important to them, and by extension, the definition they deploy (as discussed in Literature Review Section 7.1.3).

To achieve this, a **contextually-specific approach** is used that asks players to describe and explain the specific open world gaming experience. The term 'contextually-specific' denotes that experiences found in games are typically grounded in their unique set of characteristics (e.g., the type of gameplay, mechanics, what the designers intend the player to do in the game). For example, the experience of playing a game such as *Elder Scrolls: Online* (2014) is specific to its context; the multiplayer aspects, the world design, the different classes players can choose — all elements combine together to make the game unique. Therefore, the approach for understanding experiences in *Elder Scrolls: Online* (2014), and by extension all open world games, should also be specific to its context. This is unlike many current approaches to studying gaming experiences, discussed in Literature Review Section 2.2. To briefly summarise, summative experiences can apply to multiple games, so they struggle to explain why a specific game/collection of games is chosen over others. Individual game experiences approaches overcome this, but are difficult to generalise as they are so specific to one game. Genre-focused approaches can be contextually-specific as they identify similarities across a collection of games, but this approach usually relies on describing summative experiences.

The contextually-specific approach used here overcomes these limitations, as it identifies the unique characteristics of open world games to explain why they are unique and what is their specific appeal. By doing so, it is possible to understand what players expect from the experience, and what about it is important to them. Therefore, this chapter answers the following aims:

1. What is the 'open world experience' according to players?
2. How is this experience enabled?

This chapter describes two studies that explored how to understand what an open world experience is from the perspective of players. Before asking participants directly about the open world experience, there was first a need to understand what players talk about amongst themselves. This is important for two reasons. Firstly, gathering naturalistic secondary data of players talking about open world games can identify appropriate questions to ask in primary data collection (in this case, Study

2). Consequently, this helps reduce researcher bias in interview question creation, as the interviewee may have preconceived ideas of what an open world is. By structuring questions around the concepts observed in secondary data, answers will more likely capture aspects of open worlds not predefined by the researcher. Therefore, Study 1 uses a Content Analysis (Krippendorff, 2018) of online game review data to guide the creation of interview questions for Study 2, a Thematic Analysis (Braun & Clarke, 2006) of interviews with open world game players. The concepts and works discussed in these studies have been repurposed in the journal paper *"Opening the World of Contextually-Specific Player Experiences"* (Hughes & Cairns, 2021).

Overall, Study 1 indicated players most strongly associated open world games to concepts of content, size, and the ability to explore at will. These results help understand what players relate to the open world experience, but not why they are important. Further, how far these concepts can be manipulated whilst retaining the core features of an 'open world' is is also not possible to know from this data. Therefore, the concepts identified in Study 1 were used to create questions for Study 2. Five themes that explain the key features of an open world experience were found, as well as how these interlock to enable it. These themes lead to the sense that, despite the diverse experiences players have, there are common expectations of what an open world game is, highlighting it is indeed a unified context that shapes the specific gaming experience. Because of this, there is a consensus on what the experience of open world games, in some overarching sense, 'should' be.

3.1 Study 1: Content Analysis

Previous studies have relied on a top-down approach to defining what an open world game is, where the researcher devises a definition based on what can be observed (e.g., Tanenbaum (2013)). Such an approach does not allow players to describe the experience from their own perspectives, and so there is a need for a ground-up approach. One way to collect ground-up data is by assessing user reviews of open world games. In game reviews, players comment on open world aspects with the intent of sharing their opinions with other players, by using concepts they themselves see as important to mention in positive or negative ways. If the game met/did not meet their expectations of what makes a game an open world, they are likely to mention it here with an explanation as to why. Therefore, Study 1 uses player reviews discussing aspects of the open world experience, with the following aims:

1. What aspects of open worlds do players mention in user reviews?
2. The creation of interview questions for a follow-up interview study

3.1.1 Method

A Content Analysis was performed to assess what concepts players associated with the term "open world". Content analysis assesses the frequency of categories found in qualitative data to indicate the most commonly mentioned concepts in a dataset (Krippendorff, 2018). Therefore, both a selection of open world games that players discuss, and comments made about these games, were identified.

3.1.1.1 Data Collection

Naturalistic observations of players discussing the open world experience were collected from the review site *Metacritic*, using the in-built tagging system to find 10 games labelled 'open world'. *Metacritic* was chosen as it is one of the largest review sites, and is known especially for game reviews. Indeed, more positive scores have been correlated with stronger sales for some games (Stuart, 2008). Ten open world 'base' games were selected to produce a set of games with a range of publishers, game settings (e.g., fantasy, historical, urban), and *Metacritic* user ratings (an indication of popularity). Downloadable Content review (DLCs) were excluded to keep game comparisons even. This process created a collection of user comments not biased towards one game or the way one publisher designs open world games. By sampling a range of user ratings, this would more likely produce data that

mentioned both positive and negative aspects of open world games, increasing comment diversity. The games selected are shown in Table 3.1, subsequently referred to by their abbreviations. Whilst the publisher Ubisoft appears twice (WD and AC BF), the setting of both games is markedly different (city vs naval Caribbean), as well as user ratings (4.8 vs 7.7), and so both were included.

User reviews from *Metacritic* were collected across the 10 open world games sorted by "most useful." Exclusion criteria were defined as no non-English comments, and comments with no explanation for their opinion (e.g., stating "a good open world" was not included). Twenty-five comments for each game that mentioned the phrase "open world" were collected, to allow each game to produce a sizeable dataset and for comments to yield useful content. This led to a total of 250 comments sampled. Comments were copied and pasted into an Excel spreadsheet by hand, as the dataset was small enough to avoid the need for code/text scraping software. To reduce the risk of human error during this process, the copied reviews were double-checked against the original webpage. Each game was assigned a tab within the spreadsheet so that reviews could be easily stored and analysed.

Game & Abbreviation	Publisher	Metacritic Rating	Release Year
Assassin's Creed: Black Flag (AC BF)	Ubisoft	7.7	2013
Dragon Age: Inquisition (DA I)	Bioware	5.9	2014
Grand Theft Auto V (GTA V)	Rockstar	7.7	2013
Horizon: Zero Dawn (H ZD)	Sony	8.3	2017
Kingdom Come: Deliverance (KC D)	Warhorse	8.0	2018
Legend of Zelda: Breath of the Wild (LoZ)	Nintendo	8.5	2017
Metal Gear Solid V: Phantom Pain (MGS)	Konami	7.8	2015
Elder Scrolls V: Skyrim (ES S)	Bethesda	8.2	2011
Watch Dogs (WD)	Ubisoft	4.8	2014
The Witcher 3: Wild Hunt (W3)	CD Projekt Red	9.3	2015

Table 3.1: Publisher and user Metacritic ratings for each game analysed, with the associated abbreviation for each game used in the text.

3.1.1.2 Procedure

The 250 comments collected were analysed for keywords associated with the phrase "open world." These units (or utterances) were compiled into a list, yielding 505 utterances relating to open world games. Whilst only 25 comments per game were sampled, players could mention various aspects of the open world, and so were counted as separate utterances. For example, AC BF Comment 4 (C4) mentioned "[...] the huge open world and ship combat is just beautiful" — this both references the size of the world ("huge") and the beauty of it ("beautiful"), so are considered as 2 separate units. If the player later commented on the same aspect (e.g., mentioning the size of the world again), this was not counted as a separate utterance. On average, each game produced an average of 50.5 utterances (SD = 10.09), with an average utterance per comment of 2.04 (SD = 1.08). This suggests no heavy bias towards any one game, where players made more utterances than another.

The initial content analysis iteration produced over 50 separate concepts, but on inspection these related to 3 loose groups: world environment, story elements, and wider game variables. From this, 10 concepts were established: 5 environment concepts (World Content, World Size, World Beauty, World Interactivity/Consequences, Freedom to Explore), 2 story concepts (Between Quest Factors, Within Quest Factors), and 3 game variables (Game Time, Game Difficulty, and Bugs). However, when reapplying concepts to utterances, one category was further split; World Content produced World Activities, as the presence of things in an environment was different than doing things in the world. Therefore 11 concepts were established, which were then counted to assess their frequency. Study 1 aimed to identify naturalistic concepts players associate with open world games to use as foundations for interview questions in Study 2, rather than identify the total concept types possible. Therefore, inter-rater reliability was not calculated. The study materials can be found in Appendix B.

3.1.2 Results

Figure 3.1 shows the distribution of concept frequencies. Detailed explanations are now provided, in order of count magnitude. The largest category (21.78% of utterances) was **World Content (WC)**, in other words, 'what is in the world?' This included the attention to detail designers' placed on the world design, the variety in scenery, whether players felt the world was 'handmade' as opposed to 'copy/pasted', how 'alive' the world felt, and how immersed they felt during play. For example, games mentioned positively had rich, diverse worlds with varied scenes and interesting landmarks: "it's surely an amazing world, it feels like it's breathing...living and way less like an simple scenery you have to complete your quest in" (LoZ, C4). Conversely, games negatively mentioned had bland, empty, uninteresting worlds: "I mean, what is the point of making an open world game if it's not interesting to traverse?" (MGS, C8). Bland worlds could still have detailed texturing and graphics, indicating players differentiate between the overall beauty of the world versus the attention to detail placed in making the world unique: "Beautiful game but very empty open world [...] there was no side things to see" (H ZD, C24). However, not all players rated the same game in the same way. Whilst some players would call a game uninteresting, others would call it unique and diverse. For example, reviewers of *Grand Theft Auto V* (2013) argued both for the game's rich and engaging content — "The open world feels incredibly alive and diverse" (GTA V, C4) — and against it: "[...] most generic open world game i've ever played in my live [...] with pretty much nothing to do on it" (GTA V, C15). Therefore, the content of the world is important to the open world experience, but its design can affect player enjoyment.

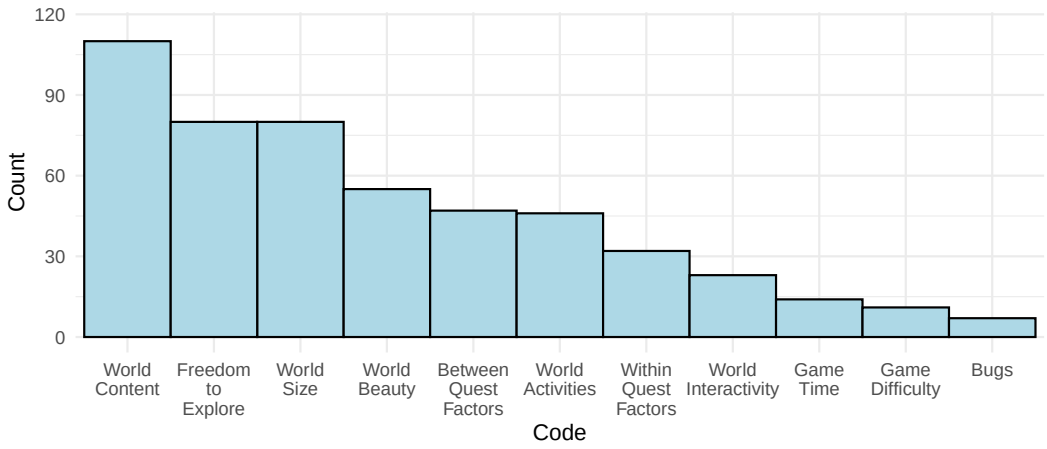


Figure 3.1: A histogram of the frequency of the 11 categories that related to open worlds made across 10 games.

The second largest category (15.84%) was **World Size (WS)**, with players either commenting on how large the world felt — "it's a Vast Open World Game With Over 16 Square-kilometers map size" (KC D, C8) — or if the size felt 'fake' due to the use of invisible walls/guided paths: "Not actually an Open world game (alot of invisible walls)" (DA I, C2). Whilst a game could appear expansive, artificial restrictions made the playable area smaller, which was viewed negatively: "Open world" is the term they use for "running through very large corridors" (DA I, C18). Relatedly, some players commented on the use of loading screens/transitions between areas, which affected how open the world was: "the game offers an almost completely open world with very few loading times and transitions" (AC BF, C25). The more loading screens, the less open it felt: "the loading that takes place after most of things you do and feels really disconnecting for an open world game"; KC D, C15. Therefore, size is important to the open world player experience, as players do not appreciate restrictions in the playable space.

The third category, tied with World Size (15.84%), is the **Freedom to Explore (FE)** — in other words, 'can I look around at my own pace?' This category referenced exploring the environment to discover new locations/points of interest, whenever the player wanted and without punishment: "Open world exploration is possible and you can swim, dive, jump, and climb most of the environ-

ments you see. I haven't explored that much yet, but so far it feels a lot like Skyrim with the ability to find cool loot, monsters, quests, etc." (W3, C15). Reviewers commonly related Freedom to Explore to World Content, as worlds with numerous interesting places were also enjoyable to explore and discover: "open world that is finally not just an empty shell, but a rich and complex place full of [...] things to discover. It's a joy just to run around the map and look around" (H ZD, C3). Therefore, players value exploring the world, especially when there are interesting things to discover.

The fourth category (10.89%) was **World Beauty (WB)**. Players mentioned the quality of the graphics and textures used — "The graphics are simply stupendous and a cut above what you're used to with open world RPGs, running at full 1080p" (W3, C15) — and responded negatively if the game had low quality graphics or was unrealistic: "open world is not attractive and actually too unnatural" (WD, C2). As mentioned in World Content, this is separate to the detail in the world design, as 'beautiful' worlds could also be 'sparse': "It is pretty, but it is empty" (DA I, C8). Therefore, players expect open world games to be aesthetically pleasing in ways that fit the setting of the game.

The fifth category relates to **Between Quest Factors (BQ)**; differences between quests available (9.31%). These could take many forms, such as the number of quests available — "The open world has numerous side quests" (KC D, C22) — quest diversity — "good open world games normally have a tonn [sic] of varied quests" (LoZ, C20) — the extent of player choice — "including the ability to really help or hurt anyone you want" (KC D, C22) — and how side quests relate/diverge from the main story: "If your going to do open world, populate it with deep interesting quest chains that diverge from the main plot" (DA I, C4). Players enjoyed a wide variety of quests to choose from that were not repetitive or seen as pointless 'filler', especially for side quests: "If you make an open world, please don't fill it with pointless quests or collectibles" (H ZD, C11). Sometimes however this was overdone, and players felt overloaded with the number of options available: "The volume of quests is somewhat overwhelming and some of the real gems can be difficult to pull out of the masses" (ES S, C3). Therefore, there is a balance in content where quests are varied but not overwhelming in number.

The sixth category, **World Activities (WA)**, featured players discussing activities they could take part in within the game world (9.11%). Comments included enjoying a range of activities unrelated to the main story — "there is always something to do, being it enemy's, something you can hunt, NPC and so on" (LoZ, C4) — and being able to forget there was a main plot at all: "I don't ever recall a game where I was trying to avoid to the main story, just so I can soak in the lore, the quests, the Witcher's Path and the amazing Slavic story-telling" (W3, C3). Therefore, players appreciate activities that are not related to the main story, and in some cases actively prefer them.

Similarly to Between Quest Factors, **Within Quest Factors (WQ)** refers to players who discussed aspects within quests they pursued (6.34%). This included the main story and its structure — "this game nails the way a open world with a great story should be [...] the story will keep you hooked" (H ZD, C13) — the freedom given to choose within quests — "Quest lines are linear, offer absolutely no choices and involve mostly talking to NPC A, going to dungeon B, killing everything inside, retrieving item C and then going back to NPC A" (ES S, C13) — and the ability to play their character as they saw fit: "there are so many ways to play your character, so many chances to be a thief, an assassin, a valorous knight or even a common cutthroat" (KG D, C8). Overall, players enjoyed varied and original storylines, that gave them flexibility in choosing options to make the playthrough their own.

World Interactivity/Consequences (WI/C) referred to comments on how well integrated player actions were into the game world (4.55%). This was assessed via how well they could interact with objects — "For an open world RPG you barely have any interactions with any objects whatsoever. You can't sit on chairs, you can't ask for a drink in the tavern, unable to climb up on rocks (I felt like I was participating in a Slip N Slide pool party), you can't sleep in your bed" (DA I, C5). Players also considered if their choices impacted the world. They negatively responded to choices with little impact — "Your actions have no real outcome, no matter if good or bad" (ES S, C6) — but responded positively to actions that did; "It's a fantastic detailing reveals the consequences of your actions" (W3, C10). They also commented on whether missions unrelated to the main story were still meaningful: "but you later find out most of the missions relevant nor worth the time" (DA I, C3). Overall, players liked games that showed their actions influenced the world, and did not like doing meaningless tasks: "Every side quest is meaningful — there are no pointless fetch quests that plague so many open world

RPGs" (W3, C25). Their influence over the world state is therefore related to the gaming experience.

Game Time (GT) (2.77%) related both to how long the game takes to play — "even after 100 hours of gameplay I still haven't grown tired" (MGS, C20) — and the games' replayability: "not many games have "endless" replay-a-bility after completing it. Skyrim provides at least a few hundred hours worth of gameplay and missions, enough to keep you engaged for a really long time" (ES S, C7). Players favoured lengthy games with multiple playthrough options, which related to how responsive the world was to their actions. The more responsive the world, the more options there are, and the more they can replay the same game; "I will play it again to see all the possibilities" (W3, C24). Therefore, the open world experience is expected to have a high play time, and can be played more than once.

The second smallest category (2.18%) was **Game Difficulty (GD)**, in that players found them challenging: "The day of hand holding and easy experiences are over" (LoZ, C12). Difficulty was not viewed negatively, as some players commented on games overall becoming too easy: "And this game is not easy, which is a great thing, considering how easy a lot of games are nowadays" (LoZ, C23). Easy games were not viewed positively: "the game babysits you through until you have enough bad-ass equipment to bore yourself to death" (ES S, C6). Therefore, challenge is an expectation players have of open world games, where players do not wish for the experience to be 'easy.'

The smallest category (1.39% of utterances) was the mention of **Bugs (B)**, in which the game would break frequently: "there are flaws, such as bugs. and there is many of them" (AC BF, C3). Interestingly, this was not always viewed negatively, and sometimes accepted as part of what makes open worlds: "I know, you can find a few bugs, but this normal in open world games with bigger budget too" (KC D, C10). Therefore, whilst bugs may be common in open world games, their presence is accepted as normal, meaning their influence on the experience may potentially be limited.

3.1.3 Summary

The analysis indicated 11 concepts, where the three largest accounted for more than 50% of utterances. These were: World Content (what is in the world), World Size (how large the world space felt), and Freedom to Explore (how free players were to explore the environment). Players were sensitive to differences between similar concepts, such that games could simultaneously be interesting to look at but empty and lifeless. If the environment is lifeless, players did not feel encouraged to explore, which negatively affected their opinion of the experience. Overall, the fact that three concepts captured more than half of utterances indicates they are important to the open world experience, and could be considered central to it. Together they suggest players most associate open worlds as (1) having high attention to detail with many objects, (2) a large environment size, and (3) allowing them to explore at their own pace (to "do what I want when I want").

There are however limitations to this approach. Analysing player reviews of open world games is not a direct measure of what players consider to be the open world experience. Some utterances analysed may be comments about the overall game being reviewed, and not specifically about the open world aspect. For example, separating open world from role-playing elements proved difficult during analysis, as role-playing involves questing and story structure, which was commonly present within open worlds. Whether these are integral parts of an open world, or an added feature, could not be determined from this analysis. Furthermore, comments were inherently biased towards giving opinions about open worlds, rather than merely describing them. This means reviewers may be biased to what they mention, and could overstate concepts not widely considered important to the open world, whilst failing to mention others.

Therefore, whilst the categories identified provide a useful start to understanding the open world experience, the findings must now be taken forwards to understand how and why they are important.

3.2 Study 2: Thematic Analysis

With the identification of 11 categories for what players mention in relation to the open world games, Study 2 aimed to explore these aspects further. This is because on their own it is not possible

to know why they are important, or how they relate to one another, a limitation to using Content Analysis. The aim of this study is therefore to understand what players believe the open world experience is, and why it is unique. Players of open world games were asked what defined the open world experience for them, and why. If the 'open world' experience is an identifiable concept, players should be able to discuss what makes it different from other gaming experiences. From this it may be possible to see how open world games are similar to one another, via their shared experience.

3.2.1 Method

Collecting an adequate sample size was an important consideration. 'Saturation' is a common approach (Blandford, 2013), described as a state where data no longer contributes towards the theoretical themes/categories of the study (Charmaz, 2006). Data collection continues until responses become repetitive, and categories are 'saturated'. In the context of digital games, saturation can be achieved quicker than real world settings, potentially due to their constrained and artificial nature. For example, E. Brown & Cairns (2004) investigated Immersion in games by interviewing seven participants. This sample, whilst small, elicited rich insights on what players meant by the term 'Immersion', and helped build the foundation of how to measure game immersion (Jennett et al., 2008).

Therefore, Study 2 collected a sample large enough to reach saturation, resulting in eleven participants collected via opportunity sampling from the University of York. Participants were asked to take part if they play/had played open world games in the past, and invited to talk about their experiences in a face-to-face interview with audio recorded for analysis. To begin the interview, players were asked to reflect on what open world games they had played, and what they enjoyed/didn't enjoy about them. This helped participants open up about their experiences and to think about why these features were important to them. Afterwards, players were asked what features they believed were essential for an open world experience. These questions were derived from the 11 categories identified in Study 1, which allowed players to expand on them and add any further nuances. For example, world size became the question, "how important to you is world size in open world games?" Using the categories in this way gave a natural structure to the interview, by providing question prompts. Once these features had been discussed, a thought experiment question of "what's a closed world?" was asked, to get participants to think more closely about what they meant by 'open world'. The interview schedule can be found in Appendix B. At the end of the interview they were debriefed on the purpose of the study, and given chocolate for their time. Interviews lasted approximately 50 minutes on average, with an average of 5544 words per interview.

To assess how players describe the open world experience a thematic analysis was conducted (Braun & Clarke, 2006), by transcribing voice recordings and analysing them for themes. This involved looking through the transcripts and assessing each comment, and coding them based on what players said about open worlds. Due to the high volume of complex data, the analysis was done as a series of iterative tagging stages. The first pass involved tagging all comments with a summary statement of what the participant said. Once this had been done for all of the data, it was possible to home in on comments talking specifically about the open world experience. These summary sentences were then analysed and grouped together based on similar meanings.

On inspection, these sentences typically described how concepts linked together; this was useful to understand the structure of the data, but not useful to describe the themes. Therefore, sentences were broken back down into codes and a mind map was created of how codes linked together. If a code only contained one link it was removed from the graph, until only a small group of concepts remained that were highly connected to other concepts. This produced five themes that explained what the open world experience is. The themes were then used to go back through the data to make sure they still captured the essence of what players were saying, to ensure no key features were missed.

3.2.2 Results

The five themes identified from the data are as follows:

1. Players are situated to scale within the world
2. The world is large, connected and accessible
3. The main goal does not restrict players from engaging with other activities
4. Content density is more important than world size
5. Players can self-pace gameplay through engaging/disengaging with tasks at will

How themes interconnect is shown in Figure 3.2. To fully understand this figure, detailed descriptions of themes are explained below, as well as how they create the experience of an open world game.

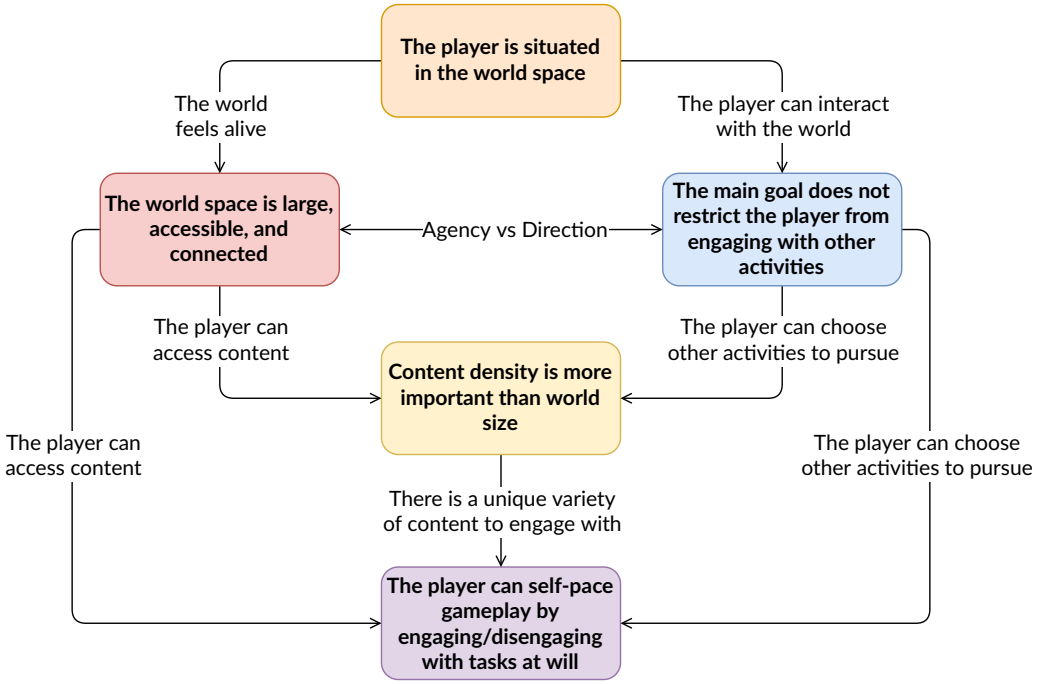


Figure 3.2: A diagram illustrating how themes relate to each other. Arrows show direction of influence.

3.2.2.1 Players are Situated to Scale within the World

The first theme of an open world experience is being situated within the world. That is, the player exists in the world as a character/entity where they exist to scale with the rest of the world. The player considers the game a world because they exist within it — "when I started playing them I'm like I could play this for hours, I'm having so much fun, I'm in another world right now it's amazing" (P6). In this regard, the focus is on the 'world' aspect of 'open world'. This does not have to refer to a physical world, as game settings can be in a variety of places (such as space).

By being situated, the player feels as though the world is alive and they are part of it — "you believe that it's a world if you believe that it exists even when you as a player's not there? There's stuff going on. It has to be really dynamic" (P9). Players typically related this concept to immersion; "and just the freedom as well to just get lost and immersed in a world like that" (P4). This immersion could vary in intensity, but the important factor is that the player believes they exist *within* a space; they are situated within a controllable entity and use it to interact with the world. The intensity of this situated feeling can be influenced by how the player is represented in the world. Some players enjoy having a character they can see and role-play with, as it makes the feeling of presence stronger:

> "Maybe it's more immersive if you are a character? Does that make sense? Versus if you are just a pair of hands, because you're thinking 'oh this is me playing the game, I need to dig this I need to do that', you're never gunna think, that you're really in there you know. Whereas you know in that game where you're playing a character you take the role." (P2)

Other players elaborated that they prefer a character because they can use them as a vessel: "I wasn't playing it thinking I'm a female policeman I was playing it thinking I'm me, and I'm just playing this game having a great time [...] if your character doesn't speak your character is just you" (P3). Players situating themselves into the body of a character is also important as it can enable them to envisage themselves within the world: "I think because it gives you that freedom to play the game how I guess maybe how you would play the game? Like how you would be in real life" (P4). The ability to play as themselves through a character gave them control over their actions, as players valued how unique each character is to them: "with an open world game no two characters are the same. That is like your character you chosen your race you've chosen the weapon system they're gunna choose to use, everything about it is completely your own" (P10).

Overall, an open world experience involves players taking the form of characters, which allows them to be situated within the world and enact their will through them. Players considered themselves situated either by controlling a character or pretending to be themselves. There were little preferential differences between these states; the importance was on having a vessel as their viewpoint. Consequently, being situated allowed the game world to truly become a world, where players exist within its rules. Being situated enables the next two themes; the world space is large and accessible, and the main goal does not restrict the player. Unless the player is situated in the world, they cannot interact with the world (the right arrow from the situated theme on Figure 3.2). Further, the player believes the world is alive only if they can access the space as though they are a part of the world (the left arrow from the situated theme). These themes are elaborated below.

3.2.2.2 The World Space is Large, Connected, and Accessible

The structure of the world is important to the player, and can infer the type of experience the player expects to have. World size for example was mentioned frequently — "I'm playing *Assassins Creed: Odyssey* (2018), which I believe is open world? It's huge" (P11) — though was usually related to the experience the player was expecting to have because of the size; "big world means that there's loads to explore, there's loads of new shiny stuff" (P5).

Whilst a large world was considered important ("if it's so small that you can explore for all of about 5 minutes and then you're done, then I wouldn't say that's open world I'd say that's just like, loosely level-based," P10) there was a limit to this. A vastly large world was overwhelming; "I've been put off by quite a few games where cause the marketing is all around oh this world is 10 times bigger than any previous ones and it's just like I don't need a world that's 10 times bigger" (P3). Succinctly explained: "size isn't everything. I think I wouldn't want to play a game bigger than *Red Dead Redemption II* (2018)" (P4). Instead, players commented on how they expected the world space to not contain 'artificial barriers'; "I like quite big, so I'm not going to bump into an invisible wall any time soon" (P7). Barriers are generally viewed negatively, as the player wants the space to be accessible: "there's times in the past where you've been playing an open world game and then you've gone to go to somewhere and there's been like an invisible wall. And you're like oh you've cheated me." (P3)

Overall, the above concepts explain the importance of the world space being large and connected. How the world is divided should not be due to a restriction that feels out of place in the context of the world; "if there's an invisible wall or if there's a pile of debris that you just can't climb" (P3). Whilst it may be segmented due to computational costs/design choice, this does not necessarily affect the world feeling 'open' as opposed to 'level-based'. The difference here is that the connectivity between areas does not encroach on the player's ability to access them. In contrast to level-based games where the player cannot go to level 3 until they have completed 1 and 2, in an open world the player can access each segment at will and in any order:

> "if you could choose which area you're going to, although they had to do it in smaller, basically chunks, if you could [...] direct the storyline in whatever direction you want to

> go in, I'd say that's still open world. But if you put in a small area and said okay until you finish the storyline in this area you can't leave to the next one or you can't go back to the previous ones, then I'd say that's probably no longer open world." (P10)

That is not to say the game cannot be designed to encourage players to go to sections in a specific order. Designers can set the difficulty to be higher in certain areas to guide players through an expected path. Players did not usually view coming across content higher than their level negatively, as they appreciated the ability to decide their level of difficulty:

> "I feel like that's something that gets done too much and something that I think in *Fallout 3* (2008) worked really well. You go somewhere and there's a level 20 super mutant and he just bashes your head in and you think okay, I'll go north instead and I'll come back when I have a bigger gun" (P9).

Players are happy to come across restrictions in this regard, as they still had the ability to try if they wanted to; "there were definite encounters in *[Mutant Year Zero: Road to Eden (2019)]* where I'd spent a long amount of time perfecting how to tackle an encounter that was slightly out of my reach instead of going oh I'll go and do that easy bit instead" (P3). The choice to tackle such challenges is fundamental to the open world experience (discussed further in Section 3.2.2.5), which can only be facilitated if the world space is freely connected.

Overall, an open world experience contains a space large enough to be explored, connected accessibly, and where the player is not kept from areas (including those higher than their current skill level) by artificial barriers. This leads into the idea that the game enables the player to do what they want within the game space, Theme 3.

3.2.2.3 The Main Goal does not Restrict Players from Engaging with Other Activities

A large factor influencing whether a game was considered too restrictive to be an open world experience was the structure of the main goal. If the game's narrative encompasses most, if not all, of the gameplay, it is not an open world; "Closed world? One thing would definitely be I think having a direct storyline which you play start to finish and that's it, there's nothing else to it" (P10). The player expects the open world to offer content outside of the main goal — "There was not much to do outside of sort of the corridor that's created for you" (P9, Knights of the Old Republic) — which enables them to pursue other activities; "I couldn't just in that [game] open a door and go outside, you have to do what the game's telling you to do" (P11, Resident Evil 2). Participant 5 raised the comparison between a game with a main narrative and one that does not:

> "Cause in Minecraft obviously you make all your own goals, there's no pre-defined thing of what you should do, I mean there's kind of achievements but you don't have to do them you can just build stuff. Breath of the Wild kind of similar you can just explore but there's a quest line you can advance if you want."

This highlights that open worlds do not necessarily need a story, but very commonly contain one. Therefore, this theme considers narrative a sub-part of a main goal, which cannot be too restrictive. For example, the main goal of *Minecraft* (2011) could be to survive, or to build, or to get to 'The End', but none of these dictates what the player can and cannot do to enjoy the game.

Overall, an open world experience should offer a main goal, but it should not be all-encompassing of the gameplay, but instead integrated within it. This integration should be done in a way that works with the main gameplay, otherwise the overall experience suffers; "And it felt like there's a story they're trying to tell, and their gameplay is getting in the way of that story" (P3, Red Dead Redemption 2). A lack of integration limits the player's ability to choose their tasks, as the experience feels disjointed and leads to increased frustration with the game overall:

> "The story elements themselves are extremely linear, so you have an open world that is very dynamic and things going on there's random encounters and such. But as soon as you're involved in a story mission all that stuff gets locked out and you get led down this narrow storytelling corridor. And I didn't enjoy that." (P9, Red Dead Redemption 2)

Notably, the above issues were flagged by participants for *Red Dead Redemption II* (2018), as it violated their assumptions of how linear the main goal should be: "one thing that I've noticed with Rockstar is like their main missions are very much do this, speak to this person, very like linear [...] and I would agree with that criticism that *Red Dead Redemption II* (2018) got was that the main story was just too A B C D E" (P4). Players found it too restrictive, which limited their ability to engage/disengage with tasks at will (discussed later in Section 3.2.2.5). The same was not true for *The Witcher 3* (2015). Whilst it has a similar game design of a main narrative to follow, this was not viewed as restrictive on the player's ability to choose tasks, and so was better integrated into gameplay: "But the *The Witcher 3* (2015) always felt like you would, you'd go somewhere have a cutscene and that cutscene would be like right off you pop go hunt this monster" (P3). In this example the player, after being given a task, was then free to pursue it or not. In contrast, when talking about the given tasks in *Red Dead Redemption II* (2018): "They're all sitting there, you can go to one of them but then you have to follow it to the end, you can't stop halfway through" (P9). As this restricts the player's ability to do what they like, it violates the player's expectation of the open world experience, highlighting its importance.

Overall, an open world experience has a main goal that, whilst engaging, does not restrict players from pursuing other activities; "I think with kind of more linear games you're clearly funnelled down a path, so when I think of Call of Duty it's like, mission mission mission, you're doing the same thing every time. But with open world games you've got all that freedom" (P3). The choice between these two modes of gameplay should be equally engaging to the player: "It's either playability or story, but I wouldn't, I couldn't say which is more important. Both" (P2). Referring back to Figure 3.2, the double-headed arrow between this theme and 'The World Space is Large, Accessible, and Connected' implies equal combinations of both is needed to enable the further themes. The open world exists in a state of tension between these two aspects, where if they became unequally present the game is no longer an open world. For example, a main goal that encompasses everything a player can do would restrict them from engaging with anything else, whereas a world space disconnected and small would not allow players the ability to move freely in a direction of their choosing. A lack of goals risks devoiding the game of meaning and purpose, whilst a too large world space risks feeling sparse and tedious to travel across. Put another way, if either theme is out of balance, the freedom of the player is restricted and the game can lose meaning, resulting in the experience no longer being classed as an open world.

3.2.2.4 Content Density is More Important than World Size

For the open world experience, it is important to offer interactable content. Without interactivity, the content is nothing more than scenery; "a computer game is interactive entertainment at the end of the day [...] as much as you want the bells and the whistles of you know smooth textures and no loading times I think the interactive elements are the most important. Those things that you can do and control" (P2). Interaction in open worlds can take many forms, for example interacting with objects (P7 contrasted interactivity in *Dark Souls* (2011) vs *Red Dead Redemption II* (2018): "there's lots of things in the world that you can see but you can't interact with them, so you can't like ride a horse or whatever you can kill it, you can't like row a boat and smack it"). Another example is the range of activities available to the player; "you encounter loads of different things then you get loads of new techniques so recently I just learnt how to do fishing so now I have to do this twirly thing and then there's like oh now I can do climbing and now I can swim and can row boats" (P6).

Consequently, players enjoy the ability to take content and use it in creative ways: "the cool thing was like I say the systems and all the different toys that you got to play with, and all the mechanics of how that interacted with the guards" (P1, Metal Gear Solid 5). Players want to engage with content in an open world, which requires a high volume of content to do so. If there is too little content, the

player feels as if their gameplay (notably their ability to explore) is meaningless; "I mean you can have a very very large map but what's the point in a really large map if there's nothing to do?" (P4). On the other hand, a game with too much content restricts the freedom of the player to move and choose between tasks; "equally don't want it to be cramped really, if it's sort of big and cramped then it feels like they're trying to force too much onto you, you can't have your own space" (P7).

The variation within content on offer is also important. Whilst content should provide enjoyment, the tasks pursued do not always have to be part of a main goal: "when I think of open world games I think of GTA V, you can literally just get in a car and ride in a circle, or drive, and not even be aware of the story. And it doesn't impact you at all, where you go, you know what you do. So, you know you completely free from any structure or, if you choose to be" (P2). However, pursued tasks should be meaningful within the world setting, otherwise the player feels like their time is wasted, typically referred to as 'filler content'. This highlights that more content is not always better for the gameplay experience: "I think nowadays a lot of them are filled with filler content? So kind of stuff to pick up or all the missions are spread out just so it can artificially lengthen the game. So you feel like you're almost doing busywork? And you're ticking off a list of chores rather than playing a game" (P3). Consequently, extra content can be devoid of meaning: "It's just padding. Like some of these games would have been better off being a lot more tight, because the stuff you're free to do is irrelevant in the sense that they're like challenges, go kill 10 bears or whatever so you can prove that you're a good hunter, but that doesn't tell a story you don't learn anything about the world or the universe or the characters" (P9). Players want to be able to deviate from the main goal to achieve other tasks, but these tasks cannot be pointless in a narrative sense.

Furthermore, players expect not only activities to do, but ones sufficiently variable in form and goal. Repetitive activities are viewed negatively as they are meaningless: "One of the things that put me off like Assassin's Creed and the Fallout series is there were just all the same. The side quests, it was go speak to this person and then go kill this monster or go assassinate this person" (P4). Without meaning, tasks are boring and likely to be abandoned: "And it was just kind of tedious just like now I have to go over to this place and have to go to this place and find the portal and close it and it's just like well, I just wanna finish the end of the story now" (P1, Oblivion). When the tasks outside the main goal are not repetitive and are grounded in narrative meaning, they bring enjoyment: "all of that felt like you were achieving stuff, and it felt like you were actually exploring something real and you were finding stuff out that was useful rather than just repeating the same stuff over and over again" (P11, God of War). Therefore, filler content is typically not appreciated by players because it lacks meaning, in both narrative and gameplay value, and so they do not engage with it. They do not find it fun, which is their goal from playing in the first place: "There's a real element of no fun, and I think that's a big problem with any of these games where you're going from A to B and collecting feathers that if that action of collecting the feathers isn't fun you're not gunna want to collect them" (P3).

The above concepts highlight the importance of content density. A high volume of variable, unique content within the world is more important than just the size, though both are needed for an open world experience to be meaningful; "If it's too sparse then you spend all of your time running around, it becomes walking simulator. But if it's too dense then you'd never get around to actually exploring it" (P5). When both are present this is also seen as more enjoyable:

> "If you've got a map that is full of stuff it feels way better than a giant map where the stuff is, or even if it has the same map stuff but it's spread out. So I don't know big Far Cry 5 is in comparison to Far Cry 4, but Far Cry 5 felt better it felt like the map was richer there was more going on, there was a lot less kind of open spaces and pointless travelling around" (P3).

Players would therefore prefer the space to be used efficiently, in that smaller but highly dense spaces are more engaging: "I think making the map physically bigger is either gunna spread out the stuff so it takes longer for you to get there or they're gunna have to spend a lot more time designing new stuff" (P11). This is because, as Participant 9 sums up: "the journey is as important as the goal, if not more important."

In summary, if there is no content between goals and tasks, the world is seen as pointlessly large, which negatively affects enjoyment. The game does not necessarily need this theme to be an open

world experience, but if it is lacking players are more likely to consider the game 'empty' and less enjoyable. This is why Figure 3.2 has a pathway through this theme, but can also go around it to access the final theme. Content density as a theme is enabled because the player can access content freely outside of the main goal, which is only achieved by an equal balance of themes 2 and 3. If the world offers a high volume of unique content in a relatively dense area, and the player is able to move without restriction across the space, the player is then able to select for themselves what to engage with. This relates to the final theme, explained below.

3.2.2.5 Players Self-Pace Gameplay by Engaging/Disengaging with Tasks at Will

In an open world experience, the player expects to engage and disengage with any current task at will and without restriction; "you can choose which bits you like which bits you don't, and you don't have to follow the main storyline if you don't want to" (P10, Skyrim). Players can do this either to avoid boredom or to continue engagement with the game overall, instead of having to put it down: "I don't have to follow particular storyline if I'm not interested in it, or if it's too difficult at some point then can just wander off and do my own thing" (P7). This highlights that just because a player is struggling with a certain aspect of an open world game, it does not mean they can no longer enjoy playing, as they can find something else to engage with:

> "If I get stuck I can still enjoy it and continue playing it. Yeah so like say on the Witcher 3 for example I got to a boss where I just couldn't beat it, I'd probably just go off and do random side quests and stuff and it wouldn't necessarily piss me off that much. Whereas if that was the only action that I could do is to get through that boss fight then I would get really annoyed with it after a while" (P8).

Building on the theme 'The Main Goal Does Not Restrict What the Player Can/Cannot Do', players enjoy being able to do tasks outside of the main goal: "I think freedom is a really big part of it so freedom of not having to do the main story quest. Not even having to do side quests if you just wanna go around on your horse and just kill monsters and stuff" (P4). Participants frequently talked about being able to do 'whatever they want', usually referring to choosing whatever tasks seem enjoyable at the time, without the game imposing on this choice: "it gave you this option of, okay sure you can go to the missions or you can poodle around Afghanistan and find some like army base and infiltrate it and see what you find" (P1). By giving the player the choice of activity, they can self-pace their enjoyment: "you can do the missions when you want to do them or they happen whenever they do like you're not forced to do them if you don't want to" (P7). This freedom allows the player to choose between the main goal and other activities, allowing each player a flexible experience depending on what they want from a gaming session. By extension, the player can also self-pace the intensity of activities engaged in. Examples of this include if the current task is too difficult, too emotionally impactful, or the narrative pacing/game progression feels too rushed. Instead of needing to leave the game to modulate this, they can choose to pursue a different in-game task that is less intense:

> "And you get more and more frustrated if you can't beat them so it's like oh I don't really wanna play the game until I'm, cause all you're doing is that one objective and the game becomes just reduced to that [...] So I think that's why they'd probably be easier to put down, for games that aren't open. [...] Whereas if you can't get past it on Assassins Creed, I can't solve a riddle and that's fine I can just go and stab someone or I can go do a mystery thing instead or I can wander around and unlock a new eagle vision part of Paris and explore and stuff" (P6).

The intensity of the activity is therefore controlled by the player instead of the game, frequently manifesting as controlling the narrative pacing; "I don't like to play through games very quickly, I like to take my time, which is why I like open world games so much is that, if I feel myself going too quickly in the main storyline I can go off and get a fish or something" (P7). This may also refer to pacing the progression of the game overall; "I took my time getting through it all because I never knew when to progress because I never knew if I'd learned everything I'd wanted to learn in a certain area

before I moved on" (P9). The execution of narrative pacing is sometimes viewed negatively in open world games, as the freedom given to the player makes it harder to control the delivery of content. For example, Participant 3 discussed how the narrative pacing of *Red Dead Redemption II* (2018) felt jarring:

> "There's a really emotionally bit where someone dies, that's quickly followed by a follow up to that, and then I can go and ride off up a mountain and then I can come back 6 months later and everyone would be like oh it's a real shame when this person died and I'm like who's, who is this? Oh I remember they're dead and we're all very touched and sad about it."

Whilst this may be assumed to create a negative gaming experience, it does not appear game-breaking. In reality, it is more jarring for the player if the pacing is inappropriate and out of *their* control, as Participant 3 went on to explain further: "I can cope more with that cause I know that's my fault rather than if the game is just paced poorly, or there's games that I've played where there's just been a random difficulty spike out of nowhere and you've been like the hell is this? How has anyone supposed to have enjoyed this? How is anyone supposed to know that was meant to happen?" Therefore, whilst players are aware of challenges to sustaining narrative pacing in open world games, they are forgiving towards this as they appreciate the ability to choose game elements more.

Open world players consequently enjoy being in control, despite negative outcomes this may bring. Such games allow players to both choose which tasks to pursue and self-pace the intensity of these activities. If a task feels too much for any reason (be it difficulty, emotionality, game progression) the player can choose to disengage and pursue something else, without leaving the game. In order to self-pace their experience then, the player must have tasks available to be pursued. Participants mentioned numerous tasks they enjoyed. Being able to explore the world in a non-restrictive way was one of the most common, and viewed as an important aspect of game design: "I think when you take the exploration factor out of it when you can't explore, that's when it becomes a closed world game" (P10). Furthermore, exploring brings enjoyment — "you can roam around freely and, part of the fun is supposed to be exploring that environment" (P1) — and the game is designed in such a way that agency over exploration is given to the player instead of feeling controlled by the game:

> "closed world could be there is the desire from the player to go further but the game doesn't allow it. Whereas open world is the game allows you to go as far as you want, and it's up to the player how much they explore it [...] So the closed world is restricted by the game, open world is restricted by what the player wants to do" (P8).

The player wants to engage with content alongside the main goal, so content must capture their attention, which is already divided between the main goal and exploring: "if you're playing a game just to play it for the story it might be pointless having the rest of the world. But I suppose that's the thing isn't it that appeals to some people is that you've got the option to explore it if it's there" (P8). Balancing these competing interests can be done either by increasing the attractiveness of the world, or decreasing the interest in the main goal: "you want to go exploring if the world looks like it's worth exploring, or if there's nothing in the main game to make you wanna play that main game" (P3). This highlights another tension that exists in the open world experience — the main goal should be interesting enough that the player believes being in the game is worthwhile, but the world should be interesting enough to explore and find new content to engage with; "you need a story that is obviously intriguing, but on the other hand not too much in your face? Again I found when I'm thinking about Fallout games there's a story and you're kind of interested but there's so much other stuff that is equally interesting. So you can wander off and find stuff that's interesting" (P9).

Overall, players expect the open world experience to let them choose which tasks to pursue at any time, without restriction in their choice. This includes the ability to explore outside of the main goal, as this enables the player to find content to engage with. As this behaviour is only enabled from the presence of Themes 1, 2 and 3, the final theme described here can be considered the 'core' aspect of the open world experience. That is not to say the other themes are not important, as without them the final theme cannot occur. Consequently, this theme is at the end of the arrows in Figure 3.2, as

the ability to self-pace sits below the themes of world size and unrestrictive main goal. Both must be true to enable self-pacing, as the player requires both the freedom from the goal and the freedom to move across the world space at will. If these are out of balance, so too is the level of self-pacing.

3.3 Discussion

The open world experience is complex and currently ill-defined, as players can have highly unique experiences within supposedly the 'same' game. Therefore, Studies 1 and 2 aimed to understand what is the 'open world experience' by using a contextually-specific approach. The contextually-specific approach involves asking players to describe their open world experiences, to identify features important to the experience and why players value them. From here, it is possible to explain what the experience is, how it is enabled in a variety of games, and how it is distinct to other gaming experiences.

3.3.1 Aim 1: What is the 'open world experience'?

Five themes describe the open world experience. These encapsulate what the experience is from a contextually-specific approach, where the combination of themes is unique to open worlds. The first theme — players are situated to scale within the world — indicates players feel they are a part of the world, rather than 'overseeing' it in some way. Consequently, building games such as *Cities: Skylines* (2015) with large interconnected worldspaces and high degrees of freedom in what to do, are not considered open worlds, as the player is not situated within them. The second theme — the world is large, connected and accessible — shows players expect open worlds to contain a space to move around in. Whilst there is flexibility in how large and how accessible a game is, generally the world must be open for the player to explore and in an order of their choosing. This is why games such as *Spyro the Dragon* (1998) are not open worlds, due to stricter progression between areas players must follow (i.e., moving linearly between one world level to the next).

The third theme — the main goal does not restrict players from engaging with other activities — indicates open worlds have more than just a main goal to follow, and so must allow players to deviate from it at will. Games that do not allow this cannot be open worlds as the player is forced to pursue only what the game tells them to, such as games with a strong narrative focus like *Detroit: Become Human* (2018). The fourth theme — content density is more important than world size — is not as necessary as the other themes, but instead reflects on the enjoyment of the experience. It is possible to have an open world that contains content outside of the main goal, but spaced out across a vast landscape making content feel sparse overall. It is also possible for there to be so much content in a small area that players feel overwhelmed and lacking room to process the content on their own. Therefore, this theme does not reflect on what an open world experience is per se, but does highlight an important factor that influences enjoyment of the experience.

Finally, the fifth theme — players can self-pace gameplay through engaging/disengaging with tasks at will — highlights the overarching experience of an open world game, which involves players 'doing what they want when they want.' This high degree of choice and flexibility over the game allows players to choose the content they find interesting, to a degree higher than other experiences. Therefore, the open world experience is a product of the above 5 themes, and can be defined as the following:

> *In an open world experience, players are situated to scale in a large, interconnected, accessible world, where the main goal does not restrict them from engaging with other activities, allowing players to self-pace gameplay through engaging/disengaging with tasks at will.*

An experience must contain these themes (with notable leeway for content density) for players to consider it to be an open world. This combination of themes is what makes the open world experience unique, where each one holds important influence.

3.3.2 Aim 2: How is this experience enabled?

The five themes identified enable the experience, as their combination defines the overarching experience of playing an open world. Figure 3.2 (in the Results section) explained how themes connected. For example, following the left-most line, the following statement is revealed: because the player is situated in the world, the world feels alive. If the world is also large and accessible, the player can access in-game content, and consequently self-pace their experience. Therefore, the contextually-specific features of the open world experience are unique in how they provide freedom to players.

Each theme contributes to the experience in important ways, whereby a lack of any one theme would be detrimental. Some themes exist in tension within themselves and between others, as they represent conflicting goals within the player. Inner-theme conflicts could for example be the world being large enough to invite exploration (but not too large as to be repetitive, sparse or overwhelming), and the main goal is engaging (but not all-encompassing of all activities available). Tension between themes mostly exists as a representation of the player's need for both meaning and agency. The player wishes to have a meaningful play experience (aided by the presence of a main goal), but also wants to choose for themselves what to engage with, as they value a sense of control.

Tensions are not something to be solved, as they are in fact the crux of the experience. The structure of the themes is that they are additive — the underlying themes support the existence of the final theme, the ability to self-pace. To use a real-world example, this structure is similar metaphorically to that of the suspension bridge. The bridge remains stable due to a mixture of components and forces at play, where all are necessary for the bridge to remain intact. Any imbalance of forces would destabilise the bridge, in the same way too much or too little of any theme in the open world would risk disrupting the experience. This helps demonstrate why the tension is crucial to the experience; without opposing forces, the bridge collapses, and the experience is no longer an open world.

3.3.3 Relation to the Literature

Studies 1 and 2 demonstrated how the open world experience can be understood from the perspective of players, by using a contextually-specific approach. Despite differences between types of open world games, players could provide a definition of the experience of playing such games, in the form of five themes that make up the central pillars of the definition. These pillars are semi-flexible by design, allowing players to evaluate games against them and how much they personally value each pillar. This is how players decide if an open world experience is a 'good' example to them, similar to how players decide what is a 'good' roleplaying games (Zagal, Mateas, Fernández-Vara, Hochhalter, & Lichti, 2007). It also explains why there is not always full agreement between players if a specific game can be considered an open world; each player will place different weight onto the importance of each theme, and use this weighting to decide where edge cases fall. For example, players who greatly value the pillar of freedom to explore outside of the main quest may 'forgive' a game that does not have a particularly large space to explore, and still consider it an open world experience. In contrast, players who greatly value having a large space to explore may not be able to forgive this misalignment in the pillars, and exclude it from the category.

Therefore, the open world experience is not a binary classification. Instead, similar to how people decide the boundaries of natural categories such as colour, the open world experience is a definition that follows Prototype Theory (Rosch, 1973). The five themes are the salient concepts that are 'fuzzy' at the boundaries, where games that strongly align with these five pillars are more likely to be considered open world games by all players. Such games can be considered 'prototypical' examples. The natural fuzziness of the concepts that make up the open world experience also allows edge cases to be considered differently by each player, depending on which themes they believe to be the 'most' salient/important to the category. Therefore, despite natural variation between players on what specific examples of games are/are not open world experiences, it was still possible to extract the salient concepts that underpin their evaluations of the category.

Overall, the open world experience maps to the summative experiences studied previously, though with a higher fidelity for why they occur. For example, players enjoyed the immersive elements of

open world games, a finding that replicates multiple previous studies (such as Cairns, Cox, & Nordin (2014)). However, *why* certain aspects are immersive within the specific context of the open world experience has also been learned — players, by being situated in the game world, can enact a will on it, and so feel as if they are really 'there'. This shows that immersion (specifically the transportation aspect) is a key feature of the open world experience, where players expect to become immersed whilst playing.

Another example is the experience of Challenge. Players enjoyed being challenged in open world games, but with a few notable caveats — typically they enjoy challenge as long as *they* are in control of the level and intensity. This provides further context to the finding of Study 1 that players do not appreciate 'easy' open world experiences; a game that is too easy is not set at the correct level of intensity for what the player wants. Therefore, difficulty per se is not important to the open world experience, but instead how much control players have over it. Players do seek some level of challenge, but whether it is 'key' to the enjoyment (as argued by Vorderer, Hartmann, & Klimmt (2003)) is questionable in this context. Instead challenge could be considered another element players wish to control, and not something they experience passively. This relates to the concept of flow (Abuhamdeh et al. (2015)), as players wish to stay within flow by dynamically adjusting the challenge to fit their competence and current level of interest in being challenged. In open world games, the player's skill may not be the only factor influencing flow, as a player could be highly skilful but in any one gaming session may not *want* to be challenged. Instead they may wish to feel overly powerful and win 'easily', an ability available to them as the game allows them to choose tasks they feel challenged by or not. Therefore, not only will there be differences between the level of challenge players desire, but also within players themselves (across and within gaming sessions). Consequently, the individual and fluctuating desires of players for the level of intensity they wish to experience should be taken into account when understanding player experiences.

In terms of uncertainty, some players described feeling overwhelmed, usually to do with the vastness of open worlds. Because the experience offers so much to do and so many places to go, players could feel uncertain on what they wanted to do at all. This relates to Decision Uncertainty discussed in the taxonomy by Kumari, Deterding, & Freeman (2019). Overall these comments were not frequent, as most players could decide fairly easily what sort of activities they wanted to engage with. What affects the uncertainty felt when navigating an open world experience will therefore require further study, and is considered later in Study 5 (Chapter 6).

Comparing to the work on individual games, there are similar trends to that of Adinolf & Türkay (2019), even though their work involved online card games. Although all open world experiences mentioned by players clustered around the same themes, there was still a large variance left between games. For example, the fourth theme of Content Density shows some open world experiences can be perceived as more enjoyable than others, depending on what the player is seeking and how the game is designed. However, the aim of Studies 1 and 2 was to look for similarities between experiences, rather than differences. Because of this, a deeper understanding of why they are perceived as similar has been found, strengthening the claim that an 'open world experience' is indeed a cohesive concept.

Overall, Studies 1 and 2 found many similarities to the summative experiences previously discussed, as well as similar trends to experiences in specific games. Using a contextually-specific approach revealed similarities between open world experiences across games, as well as how players perceive them to be similar. The presence of new and unique concepts to the open world experience supports the need to treat gaming experiences as unique entities with their own specific features.

3.3.4 Limitations

The work undertaken involved a thematic analysis, a technique that gathers deep insights from participants to understand why they enjoy and engage in certain activities. The interviews provided a large volume of data per player (60985 total words, with an average of 5544 per interview), requiring a time-intensive analysis. Because of this, it was unfeasible to gain a large volume of participants. Whilst a meaningful collection of themes has been generated from this sample, it is possible these themes do not cover the views of open world game players more broadly, limiting the generalisability of the

findings. To test the proposed themes' validity, a larger sample would be needed with a different style of analysis. For example, a survey could ask players to rate how important they feel these themes are to open world games. This would evaluate if the sample was unique due to the opportunistic nature of the recruitment process, or was more representative of players at large.

Another limitation is that participants were heavily skewed in mentioning open worlds that are also role-playing games. There are different examples of open worlds, such as *Minecraft* (2011), that have no real role-playing elements, and also online games where there are added social factors. As these were not truly represented in the data, it is difficult to know if these themes fully map onto open world games as a whole. Further research could attempt to apply these themes to more examples of open world games to see if they hold.

3.4 Summary

To understand the open world experience, there is a need to use a contextually-specific approach that accounts for how features interact together, and how players perceive these interactions. Because players have such a large amount of freedom to choose activities, no two players will experience the same game in the same way. Furthermore, there is no consensus for what the term 'open world' objectively means, making it difficult to know which games should be studied within this thesis.

From Studies 1 and 2, what the open world experience is can be explained as 5 concepts that interlock together to enable the final theme; (1) players are situated to scale within the world, (2) the world is large, connected and accessible, (3) the main goal does not restrict players from engaging with other activities, (4) content density is more important than world size, and (5) players can self-pace gameplay through engaging/disengaging with tasks at will. Content density is not essential, but provides a higher level of enjoyment. These themes exist in a state of tension, whereby each is necessary and must be in careful balance. The open world experience therefore reflects the conflicting goals of players to seek meaning and structure from their play, but also control over their actions.

Studies 1 and 2 explain how players can have varied experiences of the same type of game, whilst still having an identifiable, overarching experience. Therefore, it is accurate to say there is a centrality to 'the open world experience', even if gameplay is vastly different between players.

3.4.1 Relation to Following Studies

Using these identified features, it is possible to hypothesise why and how players differ when playing through an open world experience. Studies 1 and 2 show how players collectively define the open world experience, but they also shows the high variation in player behaviour within them. It is not possible at this stage to know what players are engaging with in the open world experience, or what draws them to certain content. Therefore, there is a need to relate the overarching experience identified here to the actions players take in open world games.

However, what framework to use to understand choice must first be explored. As identified in the literature review (Section 2.3.4), there are two concepts that may help explain differences in player behaviour; motivation and goals. Identifying which framework is most illuminating of player behaviour will help situate choices made into the wider literature. For example, if players have differing levels of interest in experiencing elements of the open world experience (such as Challenge), this could be measured via their motivations. By measuring player motivation, it may be possible to understand what motivations relate to which aspects of the open world experience they engage with. As such, motivation may explain why players differ in their behaviours, even within the same game. Therefore, this thesis explores how to measure motivation in Studies 3 and 4 (located in the following Chapter). Alternatively, as players can engage with content on their own terms, this may be done to achieve specific goals the player has. If the current goals a player is pursuing are known, what aspects of the open world experience they are likely to engage with may be revealed.

Therefore, this thesis also explores the extent to which players relate goals to their actions (Study 5, located in Chapter 6), and what this looks like in a specific gaming session (Study 6, Chapter 7).

Chapter 4

Measuring Motivation: Current Approaches

"Like everything metaphysical, the harmony between thought and reality is to be found in the grammar of the language."
— Ludwig Wittgenstein

Players are a diverse collection of individuals, each with different motivations for playing. Consequently, there is a desire to understand how differences in players impacts their preferences and behaviours within games. For example, motivation of open world players would be useful to document in this thesis, to understand how the individual desires of players shapes what content they engage with, and the contextually-situated experiences they consequently have. Unlike Studies 1 and 2 that could not rely on an established literature field to define what the open world experience is from the perspective of players, motivation for games is a well explored topic. A multitude of studies have been conducted analysing the many reasons why players play the games they do, such as Demetrovics et al. (2011) and Tondello, Arrambide, Ribeiro, Cen, & Nacke (2019). Consequently, the maturity of the concept of gaming motivation has created a body of literature to support what players may be experiencing within these games. In turn, this removes the need to ask players directly in this thesis, as the focus can instead move to understanding how best to measure motivation within open world games, and how to interpret such measurements.

As differences in player motivations are subjective and difficult to measure from gameplay data (though there have been attempts e.g., Melhart, Azadvar, Canossa, Liapis, & Yannakakis (2019)), questionnaires are a common method deployed to capture them, with numerous available to choose from. Indeed, more questionnaires are being constructed at a consistent rate. This is perhaps unsurprising, as what drives players is both complex and contextually-specific (as seen in Chapter 3).

However, the existence of multiple questionnaires makes it difficult to know which is the most appropriate to use in this thesis, and by extension any study. Not only are there numerous available, all claim to measure player traits, types, motivations, and preferences (all heavily inter-related concepts under the general idea of individual player differences, as discussed in Section 2.4.1). Some questionnaires offer unique sub-scales not captured by others, such as Arousal by Sherry, Lucas, Greenberg, & Lachlan (2006). However, most show a large degree of semantic overlap, such as the concept of 'Challenge' which appears in multiple scales (Tondello, Arrambide, Ribeiro, Cen, & Nacke, 2019; Voulgari, Komis, & Sampson, 2014; Sherry, Lucas, Greenberg, & Lachlan, 2006). This proliferation of questionnaires presents a further problem: if all questionnaires are valid, then no single questionnaire captures all the relevant aspects of player motivation. The fact there is frequent overlap in the types of sub-scales measured also suggests a degree of unnecessary repetition between different instruments. To effectively capture player motivation via questionnaires, the concepts used ought to be diverse enough to capture meaningful differences between players, but few enough to have wide applicability for reasonable groupings of large numbers of players.

Therefore, before motivation of open world players can be explored, it is important to assess which questionnaire is the most appropriate to use. Choosing an unreliable questionnaire could invalidate any findings, as could choosing a questionnaire that does not capture the most appropriate sub-types of motivation. For example, if exploration is important to open world players, as predicted from the literature discussed in Section 2.3.3.4, then choosing a questionnaire that does not contain this motivation type would be inappropriate. When considering what questionnaire to use in this thesis, a number of factors must be considered, which form the research aims of this chapter:

1. **Aim 1: What motivation questionnaires currently exist?** As shown in the literature review, there are several instruments. Choosing the most appropriate involves knowing what scales exist, which involves surveying the literature.

2. **Aim 2: Is there a consensus for how to select a questionnaire?** As there are multiple available, it is important to know if there is a consensus on what constitutes the right questionnaire for the right context. For example, is it enough to choose based on the names of the sub-scales, or is the reliability of the sub-scales more important? Current community standards for selecting questionnaires can be seen via how previous researchers have justified their use, by surveying the literature.

3. **Aim 3: How statistically reliable & sound (i.e., valid) are motivation questionnaires?** In answering Aim 2, it became clear there was no agreed standard for selecting a specific questionnaire. Therefore, the statistical reliable and structural soundness of currently available questionnaires was assessed, as these factors are important for any questionnaire regardless of context. To assess this, and because a large scale validation of this kind has not been done before, motivation questionnaires must be given to participants to analyse their answers.

4. **Aim 4: Which motivation questionnaires are the most conceptually valid?** Alongside reliability and structural soundness, it is important to consider both construct and comparative validity. This is especially true as numerous questionnaires cover the same conceptual ground (such as multiple sub-scales for challenge and escapism), so it is important to choose a questionnaire which provides the highest confidence that it measures the concept it purports to. This can be assessed in the same way as research aim 3.

Study 3 addresses the first two aims, whilst Study 4 addresses the third and fourth. Concepts and work from these studies has been repurposed in the journal paper, *"Growing Together: An Analysis of Measurement Transparency Across 15 Years of Player Motivation Questionnaires"* (Hughes, Flockton, & Cairns, 2023) and the preprint *"No Item is an Island Entire of Itself: A Statistical Analysis of Indivdual Player Difference Questionnaires"* (Hughes & Cairns, n.d.). In Study 3, a scoping review was conducted to assess how many motivation questionnaires are available. From this, questionnaire citations containing empirical uses were collected and analysed for what justifications authors gave for choosing them. Study 4 involved selecting a subset of the questionnaires found in the scoping review, formatting them into one questionnaire, and giving it to participants to answer. In doing so, the structure of the questionnaires (in terms of reliability and validity) was assessed, as well as exploratory analyses on their construct validity. For space, research aim 4 is described in the following chapter.

Overall, researchers used questionnaires for several reasons, though many stated no explicit reason. Reasons included the theory behind the questionnaire, as well as the questionnaire being reliable and valid. However, study 4 highlighted the statistical properties of many questionnaires is low to moderate, with high volumes of unreliable items and poor model fits. Therefore, whilst statistical properties are important to researchers, this does not mean they are statistically sound in practice.

When analysing questionnaires, there are many similarly sounding terminologies used. For the purposes of this thesis, the following terminologies are used: **questionnaire** refers to the overall instrument being used (e.g., player motivations), **items** are the questions asked to participants (e.g., 'I like finishing quests'), **sub-scales** are collections of related items within a questionnaire (e.g., challenge), and **factors** are suggested collections of related items not specified as a sub-scale (e.g., finding a new collection of items within a sub-scale).

4.1 Study 3: Questionnaire Usage

This study addressed the first two research aims: what motivation questionnaires currently exist, and what reasons do researchers give for selecting a questionnaire?

4.1.1 Method

To assess what questionnaires are available, it was first important to review the literature. Following this, selecting relevant citations of these questionnaires to assess justifications for selection was completed. Finally, an analysis of the reasons for selection given in those citations was analysed.

4.1.1.1 Selection of Questionnaires

A scoping review was used to collect the number of questionnaires available that measure player motivation, as this can observe research conduct as well as help identify knowledge gaps in the literature (Munn et al., 2018). The following search string was used in several search engines (such as the ACM digital library and Google Scholar): ["Video Game" OR "Game"] AND ["Player Trait" OR "Motivation" OR "Preference" OR "Player Type" OR "Typology"] AND ["Questionnaire" OR "Inventory" OR "Instrument"] AND ["Factor Analysis"] AND ["Develop"]. This resulted in a starting sample of 368 papers that purported to measure player motivation. Data cleaning steps are summarised in Table 4.1.

Search Step	Number of Papers
Starting Sample	368
Specific to Games	194
Specific to Motivation/Preference/Trait	155
No Addiction/Problematic Gaming	119
No Gamification/Serious Gaming	103
No Unidimensionality	67
General Sample	54
Peer Reviewed Publications	43
General Game Application	22
Used at Least Once	**18**

Table 4.1: Steps taken to achieve the final sample of questionnaire papers analysed.

Despite the specificity of the search term, many results were not relevant to games/digital games, so were excluded to leave 194 papers. Measures of player experience, engagement, immersion, flow and enjoyment were excluded, as such questionnaires relate to what players feel and do within games, and are therefore situational. Motivations on the other hand are supposed inherent properties of a player that drives them towards certain activities, and this study focuses on the individual differences players bring into games, rather than what they experience within them. This is with the exception of the Player Experience of Need Satisfaction, as it has been used as a motivation questionnaire in previous work (e.g., C. Lee, Lee, & Lee (2017)), and is one of the most commonly used. Therefore, removing these questionnaires left 155 papers.

Next, measures relating to addiction/problematic gaming were excluded, as these relate to effects of gaming rather than reasons to game. For example, many questionnaires ask players how excessive gaming affects their well-being (e.g., the Ten-Item Internet Gaming Disorder Test asks players to reflect on how gaming affects their work and relationships with others; Király et al. (2019)), making them out of the scope of the work, leaving 119 papers. Questionnaires relating to gamification/serious games were then also removed, as their motivations of interest are for learning rather than gaming. Many questionnaires ask players to evaluate gamified/learning environments, rather than

ask what they are motivated to do in these games. For example, the questionnaire by Zurita Ortega, Medina Medina, Gutierrez Vela, & Chacon Cuberos (2020) was excluded as items measure the user's evaluation of the game (e.g., "Indicate the degree to which it has been easy for you to learn to play"). However, questionnaires that could be applied to learning but whose main focus were understanding player motivations were included (such as the Video Game Pursuit Scale e.g., "I lose track of time when I play video games"; Sanchez & Langer (2020)). This left 103 papers.

Only questionnaires that considered multidimensional aspects of players were considered, as this work aimed to understand general player motivations (i.e., questionnaires that measure a multitude of motivations). Unidimensional scales are typically very specific (such as griefing behaviours in online multiplayer games; Ladanyi & Doyle-Portillo (2017)), and so difficult to compare their usage to one another. Therefore papers that only measure one motivation (e.g., curiosity) were removed, leaving 67 papers. Measures specifically designed for children were then excluded so that all questionnaires were designed for adults (leaving 61 papers), and those with a specific sample such as 'Chilean Millennials' and female gamers were also excluded (leaving 54 papers). Doing so left a selection of questionnaires designed for what could be considered a 'general' gaming population, though in doing so could bias the selection towards specific countries of collection, such as the United States. However, many questionnaires in the final sample collected participants online, widening the pool of potential participants outside of the author's home country.

Only those papers accepted as peer reviewed publications were included (i.e., no preprints or theses). Questionnaires had to take the form of Likert point responses (as opposed to a binary choice or open ended questions), as Likert scales are considered one of the most reliable ways to measure self-reported traits (Likert (1932); Maurer & Pierce (1998)). Questionnaires must also have been validated within the study, typically via a factor analysis. Filtering for these aspects left 43 papers.

Finally, only measures that considered games holistically were included, removing papers relating to specific genres (e.g., sport video games; Y. Kim & Ross (2006)). This left a sample of 22 questionnaires that represent statistically validated, multidimensional questionnaires of general adult player motivations across all types of digital games. However, at the time of data collection only 18 questionnaires had citations with empirical uses. Therefore, the final sample is highlighted in Table 4.2.

Questionnaire	Acronym
A Framework and Taxonomy of Videogame Playing Preferences	FTP
Beyond the "Core-Gamer": Genre Preferences and Gratifications in Computer Games	Core
An Instrument for Measuring Individual Motives for Playing Digital Games	DeGrove
The Gaming Motivation Scale (GAMS)	GAMS
Empirical Taxonomies of Gameplay Enjoyment: Personality and Video Game Preference	GEM
Falling in Love with Online Games: The Uses and Gratifications Perspective	Wu
Five-Factor Inventory of Intrinsic Motivations to Gameplay (IMG)	IMG
The Gaming Attitudes, Motives, and Experiences Scales (GAMES)	GAMES
The Electronic Gaming Motives Questionnaire	EGMQ
BrainHex: a Neurobiological Gamer Typology Survey	BrainHex
The Demographics, Motivations, and Derived Experiences of Users of MMORPGs	Yee
The Metacognitions about Online Gaming Scale	MOGS
The Motivational Pull of Video Games: A Self-Determination Theory Approach	PENS
The Trojan Player Typology	Trojan
Gameplay Activity Inventory (GAIN) for Modeling Player Profiles	GAIN
Video Game Pursuit (VGPu) Scale	VGPu
Video Game Uses and Gratifications as Predictors of Use and Game Preference	Sherry
The Motives for Online Gaming Questionnaire (MOGQ)	MOGQ

Table 4.2: The questionnaires used in the current work, with their acronym used moving forwards.

4.1.1.2 Citation Collection

In total, the 18 questionnaires had been cited 6970 times on Google Scholar at the time of collection. All citations for each questionnaire were analysed except for Yee and PENS, as they could not practically be fully analysed due to their large citation counts (1727[1] and 2656 respectively). However, as these are the two most highly cited works in the field, it was still deemed necessary to include them. Therefore, the first 1000 results from Google Scholar were analysed for each. Results consequently do not reflect their entire range of uses, but provide a large sample (roughly 39% of PENS and 59% of Yee 2006a) that can indicate trends in general use.

A further consideration was that some questionnaires have multiple versions. For example, BrainHex includes a paper for preliminary findings and the final model (Nacke, Bateman, & Mandryk (2011) and Nacke, Bateman, & Mandryk (2014)). As items did not change between papers, the citations for both papers were analysed and treated as the same BrainHex questionnaire. Other questionnaires have revised versions, such as the Gameplay Enjoyment Model (GEM; Quick, Atkinson, & Lin (2012)), but most notably the work of Yee. For GEM, citations for both versions were collected, but as the revised version had no active uses at the time of collection these were treated as one questionnaire. For Yee, the 2006a paper was used to collect citations, as it is the original version. As described above, the high volume count for Yee across its many versions made full data collection impractical, so the first 1000 citations of the 2006a paper were analysed. This means results involving Yee are limited to works citing this version, which will not represent the full range of Yee uses.

Overall 4587 papers were analysed, where only those that empirically used one of the questionnaires were included. Empirical use required a paper to deploy the questionnaire to a sample, rather than use the theory behind them to inform experimental design. Questionnaires were not always used in their entirety (e.g., selected sub-scales were lifted), and sometimes items from questionnaires were combined with others to create new scales. The latter was done either by re-using the items with minimal rewording, or were 'inspired' by the items and so not actively used. Therefore, papers using items in new sub-scales with minimal rewording were included, along with those using specified sub-scales. Furthermore, inclusion criteria were as follows: The work is published (no preprints) in a paper format (no theses or book chapters). This resulted in 270 papers in total. Of these, 32 papers used more than one of the questionnaires in the dataset, which complicated the analysis. This was because not all questionnaires were given the same amount of justification for use within the same paper, which complicated scoring how implicit or explicit justifications were per paper. Therefore, the 238 papers which only used one of the questionnaires in the set were analysed.

A list of the papers analysed can be found in Appendix C, which also assigns the number used to refer to it in this thesis. This is done to remove the intention of 'naming and shaming' any one paper, as the aim was to assess the most frequent reasons for using a specific questionnaire. Assigning numbers to papers has been done for this reason before, such as Aeschbach, Perrig, Weder, Opwis, & Brühlmann (2021). Therefore, the following results refers to papers in the format of "Paper 1".

4.1.1.3 Reason Analysis

A conceptual content analysis was performed on the papers by collecting any sentences referencing the questionnaire used, and coding aspects of the questionnaire reported within these sentences (Krippendorff, 2018). Sentences were found by searching papers for the citation of the questionnaire and its common name if relevant (e.g., BrainHex). Sentences containing the reference were selected, as well as the surrounding sentences to provide further context. Typically, sentences were extracted from literature review and methodology sections, though sometimes also discussions. The text extracted and used to code reasons for use are located in Appendix C.

Sentences were then iteratively analysed for what about the questionnaire was mentioned. Papers could be given multiple codes based on how extensive the explanation for usage was. The first pass relied on the wordings used within the papers (such as 'replicating past work' and 'comprehensive model'), which resulted in 37 codes. Initial codes were then collected and organised into more cohesive and standardised names, resulting in 15 codes which were then reapplied to the data. As 15

[1] For the original 2006a paper.

codes is large for qualitative coding, codes were also assigned into one of four meta-codes, described in the following Results section. These meta-codes provide an overview of the reasons for use, whilst preserving the nuance of the codes contained within.

After assigning codes, a separate code referring to how aspects were referenced was given; explicitly (e.g., "we used this questionnaire because...") or implicitly (i.e., features of the questionnaire detailed but never explicitly linked to why it was chosen e.g., 'reliable', 'comprehensive'). Papers that only stated what the questionnaire measured (e.g., 'motivation') were classed as providing no reason. This distinction is important for two reasons. Firstly, when no explicit sentence is included, aspects mentioned may not be justifications but rather statements of fact. For example, does stating the original Yee questionnaire had a large sample (e.g., Paper 216) mean this was the reason it was chosen, or is this mentioned only to provide context? Secondly, it is common practice when writing literature reviews sections to reference multiple questionnaires (e.g., Papers 21 and 9). This outlines the scope of the field, but highlights a problem when only one questionnaire is subsequently used without explicit reasoning for why — what about *this* questionnaire, and not the others discussed, made it the best option? Whilst highlighting specific aspects of a questionnaire does not conclusively mean this was the reason it was chosen, it does indicate what researchers value in questionnaires, reflecting their priorities. Therefore, both implicit and explicit reasons for questionnaire use were recorded.

4.1.2 Results

A total of 413 questionnaire aspects were mentioned across 238 papers, for a mean of 2.74 reasons mentioned per paper (median = 2). Of these, 44 papers gave explicit reasons for questionnaire use (e.g., Papers 55 and 134), leaving 125 with implicit reasons and 69 with no reason outside of what the questionnaire measures (e.g., "we used this questionnaire to measure player motivation"; Papers 51 and 14). Reasons given for BrainHex were most likely to be explicit (76% of reasons, such as Papers 1 and 17), whilst those using Wu or Sherry gave no explicit reasons (e.g., Papers 112 and 94). Therefore, whilst many papers give a reason for questionnaire use, this is rarely done explicitly, except for BrainHex. Overall, 72% of papers stated a reason for why a specific questionnaire was used. Within these papers, 15 types of reasons were identified, presented in Table 4.3 along with a description of the category and the type of reason it is classified as. Figure 4.1 shows the distribution of each reason. Following is an overview of each reason with examples to illustrate the categories.

Reason	Type of Reason	Definition: The Questionnaire...
Based on X	Structural	Has a theoretical underpinning
Used to Measure X	Community Practice	Has been used to measure a construct
Valid	Soundness	Has been demonstrated as valid
Mature	Community Practice	Is comprehensive, has existed for a length of time, or built from previous works
Reliable	Soundness	Has been demonstrated as reliable
Structure	Structural	Has specific qualities that make it appropriate for use e.g., non-genre specific
Data Approach	Structural	Has been based on a specific type of data
Sample Size	Structural	Has been developed from a large sample size
Used in Previous Work	Community Practice	Has been used by others in the past
Popular	Community Practice	Has been frequently used by others
Replication	Replication	Structure is being tested in a new setting
Original Sample	Structural	Has an appropriate original sample
Recent	Community Practice	Has recently been developed
Ease of Use	Structural	Is easy to access and use
First	Community Practice	Is the first to measure a specific construct

Table 4.3: The 15 reasons given for using a specific questionnaire in order of frequency.

The most common reason for choosing a questionnaire, **Based on X**, was that it was based on a theory of relevance (65 papers; 16%). For example, the most common theory referenced was Self Determination Theory (41 out of 65 papers), where papers drew attention to this fact; "Based on SDT and other relevant theories (e.g., presence), Przybylski and colleagues developed the Player Experience of Need Satisfaction (PENS) measure" (Paper 159). Uses and Gratifications Theory from Media

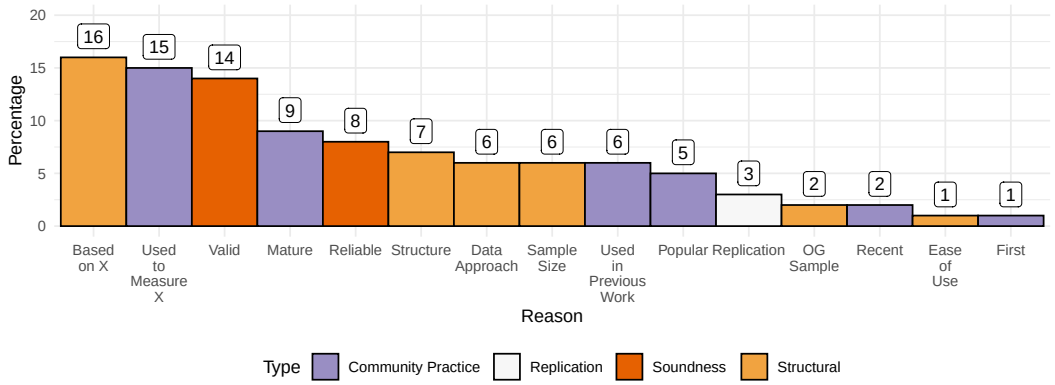


Figure 4.1: A histogram of reasons given for using a specific questionnaire.

was also mentioned (8 papers): "Students' preference for competition was assessed before the serious game started by using a selfreport questionnaire adapted from the uses and gratifications scale by Sherry et al. (2006)" (Paper 94). Neurobiology was also referenced when using BrainHex in 9 papers; e.g., "we have also collected [...] their player profile according to the BrainHex model, which is based on neurological research related to gameplay" (Paper 19).

The second most common reason, **Used to Measure X**, refers to questionnaires that have been used to measure a specific variable of interest (62 papers; 15%). This could refer to how the original publication established criterion validity (e.g., Paper 4; "Consistent with this assumption, Lafrenière et al. (2012) observed that a stronger intrinsic motivation toward gaming was associated with perceiving higher needs satisfaction during gaming"), or by referencing what others have used the questionnaire to measure such as Paper 161; "[PENS] has led to a better understanding of how vitality is maintained or enhanced, how personality interacts with need satisfaction, and what compels people to play as opposed to why people choose to play." Therefore, this reason considers what constructs the questionnaire can be associated to, and what correlations have been found previously.

Thirdly, papers made reference to questionnaires that were **Valid** (59 papers; 14%). This could refer to the psychometric properties of the questionnaire/how the questionnaire was originally validated (17 papers). For example, Paper 7 states, "This measure has demonstrated good reliability (i.e., internal consistency) and validity (i.e., relating to need satisfaction and gaming frequency as expected)." This could also refer to the questionnaire having been validated by others (15 papers, such as Paper 40: "Research indicates that the GAMS has adequate levels of validity and reliability." Other times this referred to who the questionnaire was validated with (7 papers), such as Paper 31: "all participants completed the Digital Games Motivation Scale (DGMS), an internationally validated questionnaire used to assess different motivations for playing games." However, it was common for papers to simply state the questionnaire was valid without further elaboration (20 papers, such as Paper 5: "Recently, Lafrenière, et al. (2012) developed a gaming motivation scale, a valid assessment of gaming motivation"). This makes it difficult to assess what the authors mean by valid in their context, as it could refer to the validation performed by the original authors, others, or the sample used.

38 papers referenced a questionnaire being **Mature**, where researchers described the questionnaire as comprehensive/complete in a way to suggest it is more appropriate than other measures (9% of papers). For example, the term 'complete' was used to distinguish BrainHex from other questionnaires: "We chose the BrainHex model to classify our students regarding their gameplay style because it is one of the most complete works in the field" (Paper 19). This could also refer to the questionnaire being established and therefore mature in its existence; "The measurement was adapted from well-established constructs in the literature" (Paper 223). Further, some papers argued the chosen questionnaire covers the 'full' range of motivations such as Paper 66: "[MOGQ] is a 27-item self-report measure used to assess the full range of motives for online gaming."

31 papers highlighted the chosen questionnaire was **Reliable** (8% of papers). Similar to Valid,

reliability was not always specified as to what exactly this meant. For example, it was commonly alpha scores (19 papers), but 3 papers only referred to 'internal consistency' — "The scale has previously shown good reliability in terms of internal consistency" (Paper 61). Further, 9 papers did not specify what reliability referred to, such as Paper 137:"The PENS scale used in previous studies (Przybylski et al., 2009, Tamborini et al., 2010) revealed a good reliability."

29 papers referenced the **Structure** of the original questionnaire, typically an aspect that made it uniquely useful for the current setting (7% of papers). For example, it could be appropriate for a specific genre, such as Paper 69; "Demetrovics and colleagues were able to identify seven primary motivational factors in gaming behavior applicable to all types of online games." It could also be useful as it is non-genre specific, such as Paper 192; "The PENS scale has been utilized to assess players' in-game needs satisfaction in various game genres." Further papers commented on the number of sub-scales available, which could provide nuance to results, such as Paper 164; "We selected them on the basis that they offer multiple subscales designed to assess different components of player experience."

26 papers mentioned the **Data Approach** of the original questionnaire, such as what data and analyses were used in its development (6% of papers). This was frequently mentions of factor analysis (12 papers), but equally could also be a previous data collection step such as focus groups or interviews to generate items (12 papers) — "This instrument is based on a number of recurring motives reported in interviews"; (Paper 83). Other papers either mentioned a combination of the two (4 papers), or discussed the empirical nature of item creation (6 papers).

25 papers referenced the **Sample Size** of the original questionnaire (6% of papers), especially if it was notably large; "the BrainHex model was selected because of its large number of respondents" (Paper 21). It was often unclear what specifically about the large sample was appealing to authors, as the statement was provided in isolation (e.g., Paper 209; "Yee, 2006a, Yee, 2006b looked at gamer motivations by surveying a sample of 3000 online gamers"). However, some papers used original sample size as a proxy for questionnaire validity/reliability; "The PENS subscales were created for research by Ryan et al. (2006) and further validated in two rounds of confirmatory factor analysis using survey data from 2,000 regular video game players" (Paper 170).

23 papers stated the questionnaire had been **Used in Previous Work** (6% of papers). This reason is subtly different to 'Used to Measure X', which focuses on what specific constructs have been related to the questionnaire. In contrast, this reason identifies the questionnaire being used by others as a compelling reason for use (e.g., Paper 149; "participants were asked to fill in the Player Experience and Needs Satisfaction (PENS) Questionnaire as this has previously been applied in games research"). This reasons states because the questionnaire is already in use, it is therefore valid to use in the current setting (e.g., Paper 150; " To assess player experience, we used validated instruments that have been used to measure player experience before"). Therefore, whilst the reasons are similar (what the questionnaire has measured versus the questionnaire has been used by others), they are still separable — indeed, the two only occurred in the same paper in 7 cases (e.g., Paper 126).

19 papers stated the chosen questionnaire was **Popular** within the field (5% of papers). This typically meant the questionnaire had been used frequently before, implying this indicates it is widely accepted by the field;"The Game Motivation Scale, developed by Yee (2006a), has been the most popular measure employed in game-related research for nearly a decade" (Paper 268). This is therefore slightly different to 'Used in Previous Work.' Popular refers specifically to the *frequency* of use, whereas papers in the previous reason only stated the work has been used *at all*. As such, only four papers contained both Used in Previous Work and Popular as reasons for use, making them distinct.

12 papers performed a **Replication** of one of the original questionnaires, and so were testing it in a new sample/setting (3% of papers). A variety of questionnaires underwent replication studies, however PENS was the most common (5 papers).

9 papers referenced the **Original Sample** used in questionnaire creation (2% of papers), usually to highlight a diverse sample:"We selected this model because these authors have recently validated it with videogame players of multiple genres across cultures such as Japan, Canada, and Finland" (Paper 49). This was unlike 'Sample Size,' which was concerned only with the number of people involved.

8 papers mentioned a questionnaire's creation was **Recent** (2% of papers), where 6 referenced BrainHex and the remaining two were GAMS and GAMES. This is almost contradictory to some of the

more common reasons, which cite the maturity or age of the work as an indication it is well accepted by the field. In contrast, papers using this reason did so as recency meant it was more 'advanced', so would be based on the most amount of prior work; "Although the BrainHex survey still has to be improved, it seems to be yet the most advanced player type survey" (Paper 24).

5 papers referenced the questionnaire for its **Ease of Use** (1% of papers). Four were in relation to BrainHex and one for MOGS, but all referred to the ability to access and administer the questionnaire online (e.g., Paper 19: " an online questionnaire for this model is available, which makes it of easy access and easy administration"). Therefore, ease of use refers both to researchers and participants.

Finally, the least common reason for usage was that the questionnaire was the **First** of its kind. This could be first to use a specific theory (e.g., Paper 74: "Spada and Caselli (2017) developed and validated the first self-report measure designed to assess metacognitions about online gaming"), or the first to study the area empirically — "Yee conducted the first empirical studies aimed at identifying the various motivations of online game players" (Paper 153).

When comparing types of reasons overall, many relate to the Structure of the questionnaire, such as how it was built and what it measures. Indeed, many common reasons relate to how the questionnaire was conceptualised (38% of reasons). Other reasons stated it has been used in the past and how often, indicating reasoning based on Community Practices. These are equally common, accounting for 37% of stated reasons. A final large number of reasons relates to demonstrated proof the questionnaire is fit for purpose (questionnaire Soundness), in that they are valid or reliable (22% of reasons).

4.1.3 Summary & Relation to Study 4

To assess the existence of common practice for how to select a specific player motivation questionnaire, the reasons authors gave for choosing a specific questionnaire were assessed. Few papers (19%) stated an explicit reason for why a questionnaire was used and not another from the multiple options available. In contrast, 52% provided implicit reasons, where factors typically associated with 'good' questionnaire design (e.g., reliable, large sample, diverse sample) were reported but not explicitly stated as the reason for a questionnaire's selection. The final 29% of papers stated no reason at all. The top four most common aspects (Used to Measure X, Valid, Based on X, and Reliable) explained more than 50% of reasons. This indicates the most common reasons for questionnaire use are based around what it has been used for previously, the theory it is built on, and that it has sound structural properties.

It is therefore clear whilst there is no overall consensus on how to select a player motivation questionnaire, validity and reliability are key concerns for researchers. Study 4 consequently builds on this work by empirically assessing the reliability and validity of a selection of these questionnaires, to assess the claim they are indeed reliable and valid ways to measure player motivation. From this, it may be possible to select the best questionnaire for use with open world players, that is both well justified and structurally sound.

4.2 Study 4.a: Questionnaire Statistical Analysis

This study addresses research aims three and four: how statistically reliable & sound (i.e., valid) are motivation questionnaires, and how much do motivation questionnaires overlap conceptually? For space, research aim four is answered in the following chapter.

4.2.1 Method

To assess the statistical properties of motivation questionnaires, it was first important to reduce the collection to a manageable amount of items for participants to answer. This was done by selecting a representative selection of questionnaires from the 22 identified, and from within those a refined list of sub-scales. Once complete, items required formatting into the questionnaire, before being given to participants. After data cleaning, it was then possible to run reliability and validity analyses.

4.2.1.1 Selection of Questionnaires for Statistical Analysis

The scoping review identified 22 questionnaires, which would be impractical to administer to participants as the number of items could lead to boredom or fatigue. To reduce these effects, half of the questionnaires were selected, for the following reasons:

- They represent a mixture of old and new questionnaires, to counteract a bias in newer papers building on pre-existing work and consequently being more robust
- They represent questionnaires originating from a range of disciplines (games, media, psychology, and education)
- They represent questionnaires typically used for all types of gaming rather than specific to online games. Two exceptions were the inclusion of Yee and VKS, explained in their respective sections.

The chosen questionnaires are described and presented in their order of publication, to show how the field has evolved over time. Figure 4.2 shows how questionnaires have influenced one another over time, to illustrate their expected conceptual overlaps. The labels given in bold for each questionnaire are used following this section.

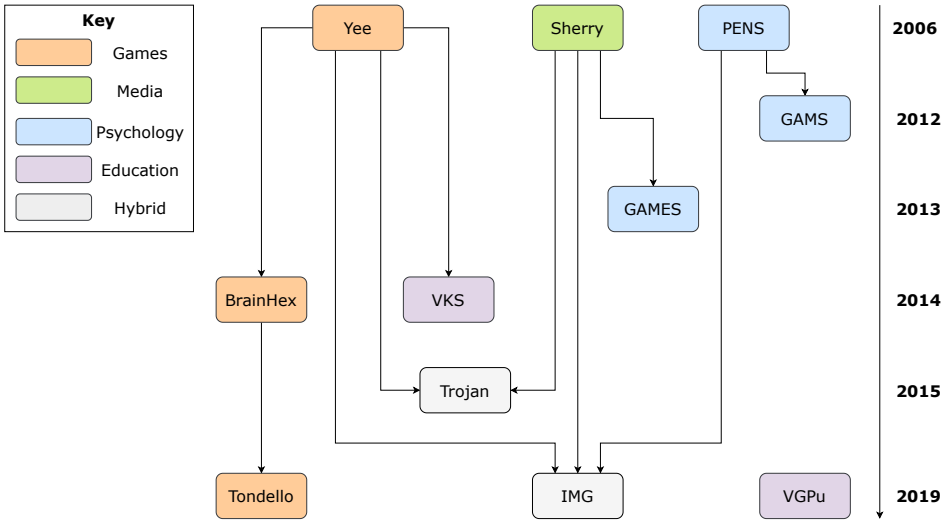


Figure 4.2: How questionnaires influenced one another over time. Colour indicates discipline of origin.

1. Video Game Uses and Gratifications, **Sherry**

One of the first motivation scales was created by Sherry, Lucas, Greenberg, & Lachlan (2006), known as the Video Game Uses and Gratifications Scale. This questionnaire emerged from the field of Media Effects, which explores why games are appealing and what players seek from them. It consists of 20 items in 6 uses and gratifications — Competition, Challenge, Social Interaction, Diversion, Fantasy and Arousal. It has been used to study many variables, such as how play of *The Sims 2* (2004) varies by gender (Jansz, Avis, & Vosmeer, 2010), and how consumption varies between traditional sports and esports (D. Lee & Schoenstedt, 2011). Therefore, this questionnaire is included to represent the Media perspective on what players want from an experience and how this influences their game preference.

2. Motivations for Play in Online Games, **Yee**

Yee (2006b) created the Motivations for Play in Online Games scale in the same year as Sherry, inspired by the player types discussed by Bartle (1996). Sampling a large sample of over 3000 players,

Yee found 3 overarching motivations with 10 sub-factors for play; Advancement, Mechanics, Competition, Socialising, Relationship, Teamwork, Discovery, Roleplaying, Customisation, and Escapism. These were revised in 2012 (Yee, Ducheneaut, & Nelson, 2012) and sorted into 3 overarching motivations. Research has used both versions, such as Kuss, Louws, & Wiers (2012) who used the original scale to measure how motivations to play relate to addictive play behaviours, and Billieux et al. (2013) who sought to understand the specific motivations to play *World of Warcraft* (2004). Yee was chosen for this study because it represents one of the first attempts to measure player traits from a games research perspective. The questionnaire published in 2006 (Yee, 2006b), not to be confused with Yee (2006a), was chosen over the revised 2012 version (Yee, Ducheneaut, & Nelson, 2012) as it has seen more usage in the field than the revised set (see Appendix C), and has a wider range of traits that may provide more nuanced insights. Whilst Yee was originally designed to be specific to online games, rather than all games, it has been used by others in the past to evaluate general player motivation. For example, Skalski et al. (2012) used the Yee questionnaire to assess the need for presence across multiple game genres, including offline games. Therefore, due to its strong popularity in the field and its past usage by other researchers, it was included in this study.

3. Player Experience of Needs Satisfaction, **PENS**

The Player Experience of Needs Satisfaction (PENS) questionnaire (Ryan, Rigby, & Przybylski, 2006), also originally published in 2006, is widely used in player research. Inspired by Self Determination Theory (SDT), it posits motivation to perform actions is a desire to fulfil innate 'needs' in a self-directed way. The PENS questionnaire comes from Psychology, which reflects its backing by a psychological theory of needs satisfaction. It originally consisted of 5 sub-scales from 21 items; Competence, Autonomy, Relatedness, Presence (though sometimes referred to as measuring Immersion Ryan, Rigby, & Przybylski (2006); for the purpose of this paper it is called Presence/Immersion), and Intuitive Controls. Researchers have used it to show those who preferred sport/simulation games tended to score low on Autonomy and Presence/Immersion sub-scales (Johnson & Gardner, 2010) PENS is arguably one of the most commonly used questionnaire in player research — recent work by Tyack & Mekler (2020) showed how of 110 papers submitted to CHI and CHIPLAY conferences that referenced SDT, 40% used some or all of the PENS scale.

PENS has been validated independently by other researchers in the past (e.g., Johnson & Gardner (2010)), though conclusions drawn from these studies are not always in agreement. Brühlmann & Schmid (2015) found the factor structure of PENS to be consistent with the original study, but in 2 separate works (Johnson & Gardner (2010), Johnson, Gardner, & Perry (2018)) the sub-scales Competence and Intuitive Controls required combining. This disagreement in factor structure warrants further investigation, and so is investigated in this study. As discussed previously, PENS is not presented as a motivation questionnaire, but has been used as such previously. Therefore, PENS is included in this analysis. However, as PENS is a commercial product the items cannot be published here. Items reflect those presented in the 2007 copy of the PENS documentation — for example, the first item in the Competence sub-scale is referred to as Competence 1.

4. Gaming Motivation Scale, **GAMS**

Inspired by Self Determination Theory (SDT) and by extension the PENS scale, Lafrenière, Verner-Filion, & Vallerand (2012) developed the Gaming Motivation Scale in 2012. The questionnaire consists of 18 items across 6 sub-scales; Intrinsic Motivation, Integrated Regulation, Identified Regulation, Introjected Regulation, External Regulation, and Amotivation. Studies have used this scale to understand how consumer motivation relates to player engagement (Banyte & Gadeikiene, 2015), how the experience of need frustration mediates the link between gaming motivation and problematic gaming (Mills, Milyavskaya, Heath, & Derevensky, 2018), and why cancer patients are motivated to play games (Comello, Francis, Marshall, & Puglia, 2016). The questionnaire has not been validated by others in its original form, though an adapted Italian version did show adequate validity and reliability (Peracchia, Presaghi, & Curcio, 2019). Therefore this questionnaire is included to investigate how GAMS differs from PENS/SDT, the inspiration for the items.

5. Gaming Attitudes, Motives, and Experiences Scale, **GAMES**

Though similar in name and in discipline to GAMS (as both come from Psychology), the GAMES scale by Hilgard, Engelhardt, & Bartholow (2013) is instead inspired from Sherry. It consists of 59 items in 9 sub-scales; Story, Violent Catharsis, Violent Reward, Social Interaction, Escapism, Loss-Sensitivity, Customisation, Grinding, and Autonomy. As the sub-scale names may suggest, the authors were motivated to understand problematic behaviours such as violence, a topic too large and contentious to examine here (see Ferguson (2007) for an overview). Uses of this scale include investigating how factors such as age and ethnicity affect gaming preferences (Loffredo & Tavakkoli, 2016), as well as how Native English speakers differ from non-native speakers in motivations to play (Tekofsky, Miller, Spronck, & Slavin, 2016). There has been little validation work on this questionnaire, and so this work investigates its structure as well as how the influence of Sherry has shaped the work in comparison to other questionnaires from the discipline of psychology.

6. **BrainHex**

Following on from Yee, the BrainHex scale was created by Nacke, Bateman, & Mandryk (2014), that aimed to provide a measurement of traits from a top-down approach. This was done by relating the theory behind it to neuro-biological findings. It consists of 21 items in 7 sub-scales; Seeker, Survivor, Daredevil, Mastermind, Conqueror, Socialiser, and Achiever. An example of its usage is correlations of scores on BrainHex to attention as measured with eye-tracking data (Moreira & Okimoto, 2018). Whilst this questionnaire has been used in research, it has not been without critique. Validation studies have struggled to replicate the validity and reliability of the structure. Busch et al. (2016) found whilst they could confirm the structure of the Socialiser and Achiever factors, the other 5 were unclear and contained many cross-loaded items. Therefore, BrainHex is included to assess these structural concerns, as well as compare it to other questionnaires from Games research.

7. Player Motivations in Massively Multiplayer Online Games, **VKS**

Voulgari, Komis, & Sampson (2014) was similarly inspired by Yee, but wished to situate this within the context of learning. It consists of 25 items in 5 sub-scales; Sociability, Competition, Immersion, Achievement, and Challenge. Whilst this questionnaire is not as widespread or actively in use, it provides a comparison to BrainHex — both were inspired by Yee, but originate from different disciplines, and so how these emerged differently is of interest. Similar to Yee, this questionnaire was also originally designed to be for online games. However, it was included as its comparison to BrainHex was of interest to study. It also represented a questionnaire originating from the Education discipline, which provided an interesting comparison to questionnaires from the other disciplines.

8. The Trojan Player Typology, **Trojan**

The questionnaire developed by Kahn et al. (2015) is different in that, unlike the others mentioned so far, it draws inspiration across disciplines. Items are built both from Yee and Sherry, and so combines Games research literature with Media. There are 15 items in 6 sub-scales; Socialiser, Completionist, Competitor, Escapist, Story-Driven, and Smarty-Pants. As the original sample used for this study was *League of Legends* (2009) players, studies using this questionnaire typically study related topics. For example, studies have looked into the motivation of esports players (García-Lanzo & Chamarro, 2018), and the motivations to play online collectable card games (Turkay & Adinolf, 2018). As a fusion of disciplines, the Trojan questionnaire is included to assess whether this joint influence affects the structure of the sub-scales and the concepts it purports to measure.

9. Trait Model and Scale of Game Playing Preferences, **Tondello**

The questionnaire developed by Tondello, Arrambide, Ribeiro, Cen, & Nacke (2019) is the latest iteration in the chain of questionnaires from the Games research discipline. Inspired by both Yee and BrainHex, the questionnaire has 25 items and 5 sub-scales; Aesthetic, Narrative, Goal, Social, and Challenge. As this questionnaire has only been published recently it was yet to be used by others at

the time of data collection. Therefore, Tondello is included to explore the structure, and because it the latest iteration from the field of Games research, where concepts measured are expected to be clearer.

10. Five-Factor Inventory of Intrinsic Motivations to Gameplay, **IMG**

Similarly to Trojan, the IMG scale by Hamari & Tuunanen (2014) draws inspiration across three research fields; Games, Media, and Psychology. It consists of 15 items in 5 sub-scales; Relatedness, Competence, Autonomy, Fun, and Immersion. As another example of a recently published work there is little usage in the field. This work aims to explore its structure, and if it presents a clearer conceptualisation of player motivation by virtue of being newer and based on multiple disciplines.

11. Video Game Pursuit Scale, **VGPu**

Finally, the questionnaire by Sanchez & Langer (2019) is included in the analysis. Similarly to VKS, this questionnaire was built to understand motivation in learning environments. It consists of 19 items in 4 sub-scales; Intentional Game Play, Generalised Game Self-Efficacy, Enjoyment of Games, and Prone to Game Immersion. Interestingly however, the study did not use any of the previously mentioned studies as a source of inspiration for item generation. Therefore, it is included to assess how items will perform in relation to the others, and assess any overlap.

4.2.1.2 Selection of Sub-Scales

The previous section explained the reasons for selecting the 11 questionnaires for this study. However, even by narrowing down to these questionnaires, there are still an excessive amount of items for participants to fill out. If all of items were used, there would be 283 items in 68 sub-scales. This would be a challenging survey to complete for many participants, which might lead to higher rates of attrition and fatigue. To reduce this, a number of sub-scales were not placed into the survey. Sub-scales were removed instead of individual items to preserve the structure of sub-scales. Omitting sub-scales is common practice in the field, as it is unlikely new research requires all concepts to be measured in every context (see Appendix C). The types of sub-scales removed and why is presented below.

Social Gaming

Social aspects of gaming are widely studied in the literature, and almost all the questionnaires sampled had at least one sub-scale related to how players feel towards other players. This is understandable, as in the meta-analysis of player types by Hamari & Tuunanen (2014) Sociability was one of the most common concepts. These can assess cooperative behaviour (e.g., Socialiser by BrainHex), competitive behaviours (e.g., Competition by Yee), or friendship formation (e.g., Social Interaction by GAMES). The social aspect of games is seen as fun and important to the gaming experience (Griffiths et al., 2011), sometimes the most important reason for players to engage with a game (Klimmt, Schmid, & Orthmann, 2009), where the social aspect does not need to be purely cooperative, as socialising is considered fun even in competitive settings (Kaye & Bryce, 2012).

However, socialising is not present in all games, and for this thesis, there are many single-player open world games. Indeed, literature surrounding social play typically focuses on Massively Multiplayer Online Games (MMOGs), such as *World of Warcraft* (2004). Not all players may partake in multiplayer games, and so could not answer these questions. Furthermore, many social sub-scales ask about the relationships players form in these games, which is not related to individual player differences per se as they are reflecting on the relationships they form within games. Therefore, any sub-scale that referenced the social aspects of games (even if only one or two items mentioned other players) were removed. Overall, this reduced the number of sub-scales by 20, and items from 283 to 208.

Violence

Some questionnaires contained sub-scales that assessed enjoyment/engagement with violent content. However, the topic of violence in video games is contentious. A brief overview will be given of

the gaming violence literature to position the current work, but for further information see Ferguson (2007). Generally, the main concern of violent video games is that violent content exposure will lead to more violence/aggression in real life, especially amongst children. Those who play violent games for an extended period of time may be more likely to commit violent acts in real life, as the behavioural response has been 'primed' (see Zendle, Cairns, & Kudenko (2018) for an overview). However, many researchers dispute this link as being causal. Cross-sectional studies on longitudinal data show no short or long term predictive power of violent games on behaviour (Ferguson, Garza, Jerabeck, Ramos, & Galindo, 2013), and fMRI data shows no link between excessive use of violent video games and a decrease in empathy responses (Szycik et al., 2017). Another consideration is that players may be aware of the research surrounding violence and video games, due to widespread media coverage around the topic. Players may take offence to any item asking them about this connection in their own play, and so their inclusion could provide unnecessary discomfort.

Therefore, unlike the other sub-scales relating to motivation, violence is uniquely contentious to both researchers and players. To avoid this debate, sub-scales referring to violence were removed; this applied only to GAMES with 2 sub-scales (Violence Catharsis and Violent Reward). Removing these scales reduced the number of items from 208 to 195.

Non-Motivational Sub-Scales

The final sub-scales removed were those concerned with concepts outside of motivation. For example, Intuitive Controls from PENS is about the experience of the controls of a game, and not about a quality the player possesses. Therefore, this sub-scale was removed. Amotivation from GAMS was also removed, as this assesses players who feel they no longer feel motivated to play games. For example, 'I used to have good reasons, but now I am asking myself if I should continue' asks players to reflect on why they don't wish to play anymore. This would be counter-intuitive to add to the item pool, as the goal was to assess players who had motives to play.

The final sub-scales removed were from VGPu: Intentional Pursuit of Game Play, and Intimidation with Games. Similarly to the above reasons, these sub-scales assessed concepts outside of motivation. The item 'I deliberately seek out video games to play' from Intentional Pursuit of Game Play asks players about their gaming habits generally rather than what they enjoy about games specifically. Further, the item 'Video games are intimidating to me' from Intimidation with Games assesses if players are reluctant to play due to a fear of games, which is a perception of games rather than a reason for engaging with them. Neither sub-scale assesses motivation, and so were removed. Therefore, the final item pool decreased from 195 to 177.

Overall, these changes helped reduce the item list from 283 to 177, and the number of sub-scales from 68 to 45. This is still a large item set, but less so than the original, and so more manageable for participants. Table 4.4 displays the questionnaires used, and the sub-scales selected for analysis.

4.2.1.3 Item Preparation

The 177 items were compiled into a Qualtrics questionnaire, and the order of items was randomised to avoid fatigue in later answers skewing responses. Due to the mix of 7-point and 5-point Likert scales present in the original scales, questions were refactored to all be 7-points for consistency. This refactoring does not significantly influence how participants respond (as explained in Cairns (2019)), and is a common practice in the field (see Appendix C).

A further inconsistency between questionnaires was the wording of items, which may introduce unnecessary processing load on participants. For example, most items refer to 'games' generally, except for VKS and PENS which refer to a specific game. To standardise this, items were reworded to read in the same style; agree/disagree statements that refer to games generally. This was done whilst being mindful to not change the meaning of items. As an example, the first item in the Yee Mechanics sub-scale is worded as 'How interested are you in the precise numbers and percentages underlying the game mechanics?' This item was rewritten to be, 'I am interested in the precise numbers and percentages underlying the game mechanics.' Overall, rewording was done with minimal adjustments (see Appendix C for a comparison), where stems were changed to reflect agree/disagree Likert scales, and

Table 4.4: A table of the questionnaires used, and the sub-scales used in this study.

Questionnaire	Sub-Scales Used
Tondello Tondello et al. (2019)	Aesthetic, Narrative, Goal, Challenge
Yee Yee (2006b)	Mechanics, Discovery, Role-Playing, Customisation, Escapism
Trojan Kahn et al. (2015)	Completionist, Escapist, Story Driven, Smarty Pants
VKS Voulgari et al. (2014)	Immersion, Achievement, Challenge
BrainHex Nacke et al. (2014)	Seeker, Survivor, Mastermind, Daredevil, Achiever
GAMES Hilgard et al. (2013)	Story, Escapism, Customisation, Grinding/Completion, Autonomy/Exploration
PENS Ryan et al. (2006)	Competence, Autonomy, Presence/Immersion
Sherry Sherry et al. (2006)	Challenge, Diversion, Fantasy, Arousal
GAMS Lafrenière et al. (2012)	Intrinsic Motivation, Integrated Regulation, Identified Regulation, Introjected Regulation, External Regulation
IMG Vahlo & Hamari (2019)	Competence, Immersion, Fun, Autonomy
VGPu Sanchez & Langer (2019)	Generalised Game Self-Efficacy, Enjoyment of Games, Prone to Game Immersion

items rephrased to reflect games generally rather than on a specific gaming experience. This allowed for a coherent flow in items which increased the ease of reading for participants. Consequently, this reduced the risk of confusion, fatigue, and attrition, which could bias results.

This does mean items are not identical to those in the original papers. However, it is common practice to reword items in such a way: 39% of papers using motivation questionnaires explicitly reword items, where only 6% of papers made it explicitly clear items were exactly the same, and 55% not providing information (see Appendix C). This rewording varies from simple changes for clarity (e.g., specifying the game in the items; Davies & Hemingway (2014)), to fully rewriting items (e.g., Monterrat, Lavoué, & George (2017)). Small degrees of rewording do not always affect the statistics of questionnaires (Cairns (2019)), though it is advised to be done sparingly to maintain validity. Therefore, whilst rewording items in this study reduces the ability to infer the reliability and validity of the original scales, as this is a common practice it does inform on how questionnaires perform in the ways they are used. This makes the findings comparable to previous uses of questionnaires.

Overall, wording was changed for 49 out of 177 items, from Yee, VKS, BrainHex, PENS and GAMS sub-scales. A comparison of the original to reworded items used can be found in Appendix C.

4.2.1.4 Procedure

Ethical approval was first gained from the University of York Computer Science department. The questionnaire was distributed through websites such as *Reddit* (posted on the subreddits r/SampleSize and r/TrueGaming), *Facebook* (participant survey groups) and *Twitter*. When the link was clicked, participants were briefed on what they were expected to do, with a specific focus on the length of the survey. This was to encourage them to decide if it would be too much work up front, to reduce attrition. To thank participants for their time, upon completion of the questionnaire participants were invited to enter a prize draw to win one of 20 Steam or Amazon vouchers worth £20 each.

After consent was given, participants were asked to fill in information about their gaming habits (time spent playing games and average weekly play time), as well as their age and gender. Participants were then asked to complete the questionnaire items, with an attention question at the halfway point ('Please tick the box "Second" before continuing to the next set of questions'). After completing all items, participants could opt to provide an email address to take part in the prize draw. All analysis was completed using R version 4.1.0 (R Core Team (2021)). The data collected in this study, along with further analyses not covered in the following result sections, can be found in Appendix C.

4.2.1.5 Data Cleaning

To prepare data for analysis, a number of cleaning steps were performed. Table 4.5 illustrates this process, along with the number of participants left after each step. An initial 3004 participants responded, and after cleaning, 1683 responses remained. Exclusion criteria included those that did not complete the questionnaire, insincere responses (e.g., answering strongly disagree to all items), failing the control question, and answering under 18 for participant age. Specifically for the last group, a number of participants (9 in total) answered no to the age question, thereby ending the survey. However, they then proceeded to complete the questionnaire by answering yes within a minute of being taken to the end of the survey. Because of this, they were removed from the analysis as it was unclear how old they truly were, thereby breaking the ethical concern of involving minors.

Table 4.5: Data cleaning steps undertaken to achieve the sample used.

Removal Steps Taken	**Participants Remaining**
Starting sample	3004
Did not complete survey	1757
Did not pass control question	1748
Answered under 18	1693
Fake answers (e.g. all 1s)	1684
Answered under 18, then over 18	1683
Final sample	**1683**

4.2.1.6 Reliability Analyses

Before analysing reliability, it is first important to explain how to measure reliability, and what is meant by 'good' reliability in this thesis. Reliability is the degree to which any measure provides the same results when applied to the same situation. In the context of questionnaires, this typically means statistical reliability or internal consistency; the degree to which the different items of a sub-scale give a consistent indication of the overall value of the sub-scale (Cairns, 2019). Typically, reliability is measured using Cronbach's Alpha, which can analyse the contribution of individual items in a sub-scale. By assessing how the Alpha score changes if an item is dropped, the importance of each item for achieving reliability can be seen. For example, some items may be unrelated to the other items (i.e., the underlying concept they measure is not the same), and so their inclusion would reduce the overall reliability. By removing such items, the overall reliability can be improved.

However, calculating Alpha scores requires items and sub-scale to behave according to Classical Test Theory (Cairns, 2019). This is not always the case, particularly for sub-scales with significant skew. The more robust Omega measure (Dunn, Baguley, & Brunsden, 2014) can be deployed in such cases to help interpret statistical reliability. Alpha and Omega scores typically agree, especially when using a 95% Confidence Interval (CI); indeed, in this study all but two sub-scales (Integrated Regulation from GAMS and Competence from IMG) had Alpha and Omega scores in agreement to within 0.10 of each other. In both cases, Omega was higher than Alpha, possibly due to skew in the distributions of individual items. Therefore, both were calculated in this study.

When to consider a score an indication of 'good' reliability is dependent on the context the sub-scale is to be used in. Nunally & Bernstein (1978) suggest a 0.70 cutoff as the minimum for when a sub-scale becomes reliable, but for use as a 'basic research tool' this ideally should be higher than 0.80. Score cutoffs should be increased to above 0.90 for clinical settings, as concluding diagnostic categories requires more stringent reliability. Not all researchers agree on these cutoffs however, and instead argue any sub-scale above 0.90 is too high, as this likely means items are too similar to one another, making their inclusion redundant (Streiner, 2003). When items are too similar to one another, this can lead to a 'bloated specific' — when asking participants the same question slightly reworded each time creates an unintentional sub-factor where items cluster (Cattell, 2012).

Bloated specifics create two problems. Firstly, if there are too many similar items in a sub-scale, reliability can be artificially inflated as the strong correlations between items skews the overall score. Secondly, too similar items change the nature of the sub-scale to be about the *item*, and not the *concept* it is supposed to measure — participants respond to an item they feel they have seen multiple times, rather than responding to the underlying concept intended to be measured e.g., immersion. This is also a validity problem, as the sub-scale is no longer measuring what it is predicted to. Relatedly, high reliability can arise when there are a small number of items in a sub-scale. Cattell (2012) goes on to explain it is unlikely a sub-scale with a handful of items (for example, less than 3) can accurately capture something as complex as human behaviour.

Therefore, for the purpose of this thesis any sub-scale above 0.70 is considered moderately reliable, while those above 0.80 indicate strong reliability. Further, any sub-scale with lower than 3 items is considered an unreliable measurement of the concept it is associated with.

4.2.1.7 Validity Analyses

To assess how well each item fits onto its proposed factor, Confirmatory Factor Analysis (CFA) was used (Cairns, 2019); a technique that evaluates how well a hypothesised model 'fits' a data set. In this case, the proposed factor structures of the questionnaires are tested against the data collected, and an evaluation of fit is made. Typically when reporting a CFA, certain measures of fit would also be reported on, such as Chi-Squared (χ^2) or Root Mean Square Error of Approximation (RMSEA). However, these measures are useful specifically when comparing between models. This is not the aim of this work, which is instead to simply assess the fit of the proposed models to the data collected. Therefore, measures of fit are not reported.

To calculate the CFAs, the mirt package in R was used (Chalmers, 2012). As there were more than 3 factors for each questionnaire, the Metropolis-Hastings Robbins-Monro (MHRM) method was used (Cai, 2010). The output is assessed, and then compared to reliability measures calculated earlier. Similarly to reliability, there is no definitive cutoff for when a loading becomes sufficient, yet each item is expected to reasonably measure its underlying concept. A loading above 0.30-0.40 is considered adequate, but when used in questionnaire creation, researchers tend to seek higher (T. A. Brown, 2015). For example, Matsunaga (2010) suggests that, whilst 0.40 may be the lowest loading considered appropriate, a more conservative cut-off is 0.70. Others suggest items above 0.60 indicate strong fit (Cabrera-Nguyen, 2010). For the purpose of this work, items above 0.60 are considered adequate fit, though items below this cut-off are commented upon when appropriate.

4.2.2 Results

4.2.2.1 Demographics

220 females (13.07%), 1353 males (80.39%), 35 nonbinary (2.08%), 67 preferred not to answer/-gave no response (3.98%), and 8 gave insincere responses for their gender (such as objects or profanities; 0.48%). The length of gaming habits are as follows: 2 had played for less than a year (0.12%), 18 for 1-5 years (1.07%), 106 for 5-10 years (6.30%), 318 for 10-15 years (18.89%), 474 for 15-19 years (28.16%), and 765 had played for 20+ years (45.45%). In relation to their per week hourly gaming, 12 played for less than an hour (0.71%), 57 for 1-2 hours (3.39%), 148 for 3-4 hours (8.79%), 146 for 4-5 hours (8.67%), 181 for 5-6 hours (10.75%), and 1339 for 6+ hours (67.68%). On average, participants took 29.37 minutes to complete the survey (median = 18.05). Overall, the sample was heavily skewed towards well-experienced male gamers that played for multiple hours a week.

4.2.2.2 Reliability Analyses

Reliability tests were run on each sub-scale of the 11 questionnaires given to participants; Table 4.6 shows the obtained Alpha and Omega scores. Of the 45 sub-scales, 27 were reliable above 0.70 on

Table 4.6: Reliability tests for all questionnaire scales (95% CIs in brackets). Scales in bold highlight scores over 0.70 on either Cronbach's alpha (α) or omega (ω) tests.

Questionnaire	Scale	Alpha	Omega
Yee	Mechanics	0.66 (0.63-0.69)	0.66 (0.63-0.69)
	Roleplaying	0.73 (0.72-0.75)	0.79 (0.77-0.81)
	Discovery	0.69 (0.66-0.71)	0.69 (0.66-0.72)
	Customisation	0.76 (0.74-0.78)	0.76 (0.74-0.78)
	Escapism	0.61 (0.58-0.64)	0.68 (0.65-0.71)
Tondello	**Aesthetic**	0.73 (0.70-0.75)	0.72 (0.69-0.75)
	Narrative	0.84 (0.82-0.85)	0.84 (0.82-0.86)
	Goal	0.81 (0.80-0.82)	0.84 (0.83-0.85)
	Challenge	0.87 (0.86-0.88)	0.88 (0.87-0.89)
Trojan	Completionist	0.62 (0.59-0.65)	0.66 (0.62-0.69)
	Escapist	0.79 (0.77-0.81)	0.79 (0.76-0.82)
	Story Driven	0.77 (0.75-0.79)	-
	Smarty Pants	0.74 (0.71-0.76)	0.74
VKS	Immersion	0.66 (0.63-0.68)	0.67 (0.64-0.70)
	Achievement	0.73 (0.71-0.75)	0.77 (0.75-0.79)
	Challenge	0.53 (0.49-0.56)	0.58 (0.54-0.62)
GAMES	**Story**	0.88 (0.87-0.89)	0.88 (0.87-0.89)
	Escape	0.86 (0.85-0.87)	0.88 (0.87-0.89)
	Customisation	0.87 (0.86-0.88)	0.88 (0.87-0.89)
	Grinding/Completion	0.81 (0.79-0.82)	0.81 (0.80-0.83)
	Autonomy/Exploration	0.75 (0.73-0.77)	0.76 (0.74-0.78)
PENS	**Competence**	0.71 (0.69-0.74)	0.72 (0.69-0.75)
	Autonomy	0.65 (0.62-0.68)	0.66 (0.62-0.70)
	Immersion	0.87 (0.86-0.88)	0.88 (0.87-0.89)
BrainHex	Seeker	0.63 (0.59-0.66)	0.64 (0.60-0.68)
	Survivor	0.45 (0.40-0.49)	0.45 (0.41-0.50)
	Mastermind	0.63 (0.60-0.66)	0.64 (0.60-0.68)
	Daredevil	0.55 (0.52-0.59)	0.56 (0.52-0.60)
	Achiever	0.87 (0.86-0.88)	0.88 (0.87-0.89)
Sherry	Challenge	0.60 (0.57-0.63)	0.60 (0.57-0.64)
	Diversion	0.88 (0.87-0.90)	-
	Fantasy	0.83 (0.81-0.84)	0.83 (0.81-0.84)
	Arousal	0.68 (0.65-0.70)	0.68 (0.66-0.71)
GAMS	Intrinsic	0.50 (0.46-0.55)	0.51 (0.46-0.55)
	Integrated	0.58 (0.55-0.62)	0.70 (0.65-0.75)
	Identified	0.71 (0.68-0.73)	0.75 (0.72-0.77)
	Introjected	0.77 (0.75-0.79)	0.78 (0.76-0.80)
	External	0.58 (0.54-0.61)	0.58 (0.54-0.62)
IMG	Competence	0.57 (0.53-0.60)	0.68 (0.62-0.74)
	Immersion	0.72 (0.70-0.74)	0.73 (0.70-0.75)
	Fun	0.62 (0.59-0.65)	0.62 (0.58-0.67)
	Autonomy	0.80 (0.79-0.82)	0.80 (0.79-0.83)
VGPu	**Generalised Game Self-Efficacy**	0.83 (0.82-0.84)	0.85 (0.83-0.86)
	Enjoyment of Games	0.87 (0.86-0.88)	0.86 (0.84-0.89)
	Prone to Immersion	0.64 (0.62-0.67)	0.68 (0.65-0.71)

either Alpha or Omega tests, and 14 above 0.80. Only two questionnaires had all sub-scales with reliability over 0.70 — Tondello and GAMES — indicating these may be the most reliable questionnaires, though further testing is required.

Due to the large number of questionnaires and sub-scales analysed, it is not possible to explore

in detail each reliability test for each sub-scale. Therefore, a selection of sub-scales has been chosen that highlight the range of outcomes; an example of a highly reliable questionnaire, a weakly reliable questionnaire, as well as an 'averagely' reliably questionnaire. These show the general trends in sub-scale reliability to overview the questionnaires. For a full analysis of reliability, see Appendix C.

Highly Reliable Questionnaire; Tondello

As shown in Table 4.6, each sub-scale in the Tondello questionnaire has a reliability above 0.73, indicating each item is relevant to its sub-scale. The reliability tests performed on the items are shown in Table 4.7. All sub-scales apart from Narrative can be improved by removing an item (as overall sub-scale reliability increases if dropped). For example, removing 'I like to customise how my character looks in a game' from Aesthetic improves the reliability from 0.73 to 0.75. This makes sense, as the other items discuss the gameworld rather than customisation. Removing 'I like finishing quests' from Goal improves the sub-scale from 0.81 to 0.83, possibly as it is the only item not containing the word 'complete'. Alternatively, 'quests' is a vague example of a task, whereas the other items are more specific. Finally, removing 'I usually play games at the highest difficulty setting' from Challenge improves the sub-scale from 0.87 to 0.89, a small increase for a question that appears semantically similar.

Table 4.7: Cronbach's Alpha scores for Tondello items, and overall sub-scale reliability (CI in brackets). Bold Alpha if Dropped scores would improve overall reliability if dropped. Bold Overall Alpha scores indicate scores above 0.70.

Sub-Scale	Item	Alpha if dropped	Overall Alpha
Aesthetic	I like games with detailed worlds or universes to explore	0.66	**0.73 (0.70-0.75)**
	I like games which make me feel like I am actually in a different place	0.66	
	I often feel in awe with the landscapes or other game imagery	0.67	
	I like to customize how my character looks in a game	**0.75**	
	I like to spend some time exploring the game world	0.66	
Narrative	I feel like storytelling often gets in the way of actually playing games	0.81	**0.84 (0.82-0.85)**
	Story is not important to me when I play games	0.79	
	I like games that pull me in with their story	0.80	
	I enjoy complex narratives in a game	0.81	
	I usually skip the story portions or the cutscenes when I am playing	0.81	
Goal	I like finishing quests	**0.83**	**0.81 (0.80-0.82)**
	I feel stressed if I do not complete all the tasks in a game	0.79	
	I usually do not care if I do not complete all optional parts of a game	0.75	
	I like completing games 100%	0.74	
	I like to complete all the tasks and objectives in a game	0.73	
Challenge	I like it when games challenge me	0.85	**0.87 (0.86-0.88)**
	I like it when progression in a game demands skill	0.85	
	I enjoy highly difficult challenges in games	0.81	
	I like it when goals are hard to achieve in games	0.83	
	I usually play games at the highest difficulty setting	**0.89**	

However, if the Challenge sub-scale items are inspected closer, the final item does not show the same distribution of responses as the others, shown in Figure 4.3. The final item in fact has a bi-modal distribution, where players either agreed they played on the highest difficulty, or not at all. This highlights the importance of inspecting items to check for unusual distributions, and justifies its removal from the sub-scale to improve reliability. Indeed, no other sub-scale has a bimodal distribution (see Appendix C for more information). Overall, even though Tondello is one of the most reliable questionnaires analysed, it can still be improved by removing unreliable items.

Averagely Reliable Questionnaire; Yee

The Yee questionnaire has high reliability in some sub-scales but low reliability in others. 2 out of 5 sub-scales have Alpha scores over 0.70 (Roleplaying and Customisation), with Discovery just under at 0.69, as shown above in Table 4.6. Table 4.8 shows reliability scores for individual items.

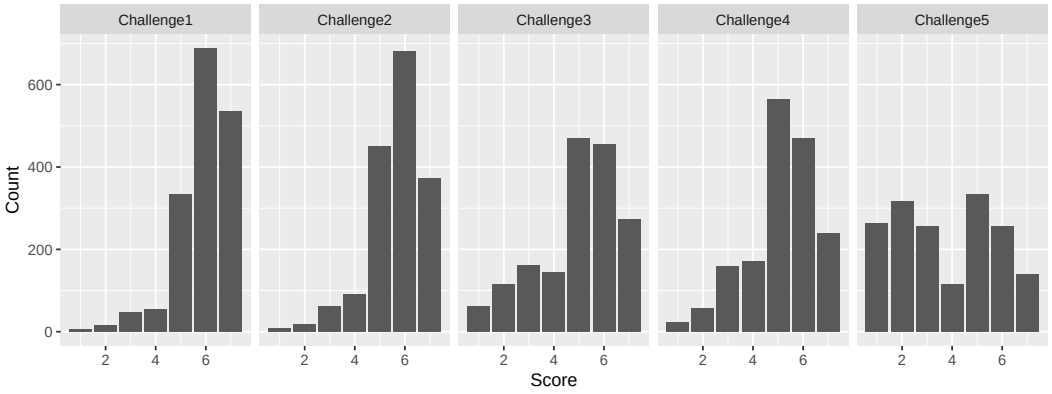


Figure 4.3: Individual histograms of each item from the Tondello Challenge sub-scale.

Table 4.8: Cronbach's Alpha scores for Yee items, and overall sub-scale reliability (CI in brackets). Bold Alpha if Dropped scores would improve overall reliability if dropped. Bold Overall Alpha scores and sub-scale names indicate scores above 0.70.

Sub-Scale	Item	Alpha if dropped	Overall Alpha
Mechanics	I often use a character builder or a template to plan out my character's advancement at an early level	**0.67**	0.66 (0.63-0.69)
	It is important that my character is as optimised as possible for their profession/role	0.58	
	It is important for me to know as much about the game mechanics and rules as possible	0.54	
	I am interested in the precise numbers and percentages underlying the game mechanics	0.58	
Roleplaying	I often make up stories and histories for my characters	0.61	**0.73 (0.72-0.75)**
	I enjoy being immersed in a fantasy world	**0.74**	
	I often role-play my character	0.57	
	I enjoy trying out new roles and personalities with my characters	0.71	
Discovery	I enjoy finding quests, NPCs or locations that most people do not know about	0.63	0.69 (0.66-0.71)
	I enjoy exploring every map or zone in the world	0.57	
	I enjoy exploring the world just for the sake of exploring it	0.57	
	I enjoy collecting distinctive objects or clothing that have no functional value in games	**0.72**	
Customisation	It's important that my character's armour/outfit matches in colour and style	0.68	**0.76 (0.74-0.78)**
	It's important that my character looks different from other characters	0.69	
	I spend a lot of time customising my character during character creation	0.65	
Escapism	It's important that games allow me to escape from the real world	0.38	0.61 (0.58-0.64)
	I often play to relax from the day's work	**0.69**	
	I often play so you I avoid thinking about some of my real-life problems or worries	0.32	

Only Customisation does not have any items highlighted for removal. Coincidentally, it is the most reliable sub-scale of the questionnaire. Mechanics, Roleplaying, Discovery and Escapism are all highlighted for the removal of one item each. When inspecting items this is understandable, as they share little semantic similarity to their sub-scales. For example, 'I often use a character builder or a template to plan out my character's advancement at an early level' from Mechanics relates to strategic thinking rather than making the character unique. 'I enjoy being immersed in a fantasy world' from Roleplaying refers to the immersion in the game world rather than embodying a character, and 'I enjoy collecting distinctive objects or clothing that have no functional value in games' from Discovery relates more to collecting than simply finding objects. The item 'I often play to relax from the day's work' from Escapism shows the largest increase in reliability with its removal (from 0.61 to 0.69), most likely as it is about relaxing rather than escaping. However, removing this item would create a 2-item sub-scale, making it less reliable for measuring the concept of Escapism (and by extension less valid).

In summary, Mechanics, Roleplaying and Discovery can be improved by removing unreliable items, however removing the item from Escapism could make the sub-scale less valid for measuring the concept. Therefore, Yee is a questionnaire with room for improvement to its reliability, but some improvements would call into question its validity. This mixed collection of reliable and unreliable elements is common across many of the questionnaires analysed; see Appendix C for details.

Weakly Reliable Questionnaire; BrainHex

Table 4.6 shows only the Achiever sub-scale has a reliability score over 0.70, making the questionnaire mostly unreliable. How each item performs in its respective sub-scale is shown in Table 4.9. Only one sub-scale has an item that can be removed to increase reliability. Removing 'I enjoy hanging from a high ledge in a game' from Daredevil increases reliability from 0.55 to 0.58, but even this is a low reliability. Furthermore, removing this item would only leave 2 items in the sub-scale, making it more likely to be a bloated specific, a larger validity problem. The items in the reliable sub-scale Achiever do load well with each other, making it the most reliable sub-scale in the questionnaire. Overall, BrainHex has deep reliability flaws and could not be recommended for player research.

Table 4.9: Cronbach's Alpha scores for BrainHex items, and overall sub-scale reliability (CI in brackets). Bold Alpha if Dropped scores would improve overall reliability if dropped. Bold Overall Alpha scores and sub-scale names indicate scores above 0.70.

Sub-Scale	Item	Alpha if dropped	Overall Alpha
Seeker	I enjoy exploring to see what I can find	0.44	0.63 (0.59-0.66)
	I often wonder what's behind a locked door	0.62	
	I enjoy looking around just to enjoy the scenery	0.52	
Survivor	I enjoy frantically escaping from a terrifying foe	0.37	0.45 (0.40-0.49)
	I often feel scared, terrified or disturbed in games	0.32	
	I feel relief when I escape to a safe area	0.36	
Mastermind	I enjoy working out what to do on my own	0.50	0.63 (0.60-0.66)
	I enjoy devising a promising strategy when deciding what to try next	0.58	
	I enjoy working out how to crack a challenging puzzle	0.52	
Daredevil	I enjoy being in control at high speed in a game	0.38	0.55 (0.52-0.59)
	I enjoy responding quickly to an exciting situation in a game	0.41	
	I enjoy hanging from a high ledge in a game	**0.58**	
Achiever	I enjoy picking up every single collectible in an area	0.78	**0.87 (0.86-0.88)**
	I enjoy finding what I need to complete a collection	0.86	
	I enjoy getting 100% (completing everything in a game)	0.80	

Summary

A number of unreliable items can be removed to increase the reliability of sub-scales. A full summary of the reliability of each sub-scale (and how each item performs) can be found in Appendix C. These changes are summarised in Table 4.10. 22 sub-scales have items removed, leading to 15 2-item sub-scales (4 were not created from removing items, but existed beforehand). If these items are removed, the result is 29 sub-scales with alpha scores above 0.70. Removing the 2-item sub-scales leaves 20 (44%) that could be reliably used to measure player motivation.

However, high reliability is not an indicator of conceptual coherence, another important factor for questionnaires. Reliability can be falsely high if sub-scales are not unidimensional (which they ought to be). To assess sub-scale structures, factor analyses are needed, performed in the next section.

4.2.2.3 Validity Analyses

The aim of this section is to assess how well each item fits onto its proposed factor, achieved by Confirmatory Factor Analysis (CFA; Cairns (2019)). Similarly to the reliability analyses, a selection of questionnaires are presented to summarise the range of model fits found from the analysis. The full analyses can be found in Appendix C.

Good Model Fit; GAMES

GAMES is an example of a factor structure well supported by the data, and was also highly reliable. The CFA is shown in Table 4.11, along with the reliability of each item for comparison.

Table 4.10: A summary of the reliability analyses of all sub-scales. Alpha scores above 0.70 are bolded.

Questionnaire	Sub-Scale	Item dropped?	Improved Reliability	Two-Item Sub-Scale
Yee	Mechanics	✓	0.67	-
	Roleplaying	✓	**0.74**	-
	Discovery	✓	**0.72**	-
	Customisation	-	**0.76**	-
	Escapism	✓	0.69	✓
Tondello	Aesthetic	✓	**0.75**	-
	Narrative	-	**0.84**	-
	Goal	✓	**0.83**	-
	Challenge	✓	**0.89**	-
Trojan	Completionist	-	0.62	-
	Escapist	-	**0.79**	✓
	StoryDriven	-	**0.77**	✓
	SmartyPants	-	**0.74**	✓
VKS	Immersion	-	0.66	-
	Achievement	✓	**0.76**	✓
	Challenge	✓	0.57	✓
GAMES	Story	-	**0.88**	-
	Escapism	✓	**0.88**	-
	Customisation	✓	**0.88**	-
	Grinding/Completion	✓	**0.82**	-
	Autonomy/Exploration	-	**0.75**	-
PENS	Competence	-	**0.71**	-
	Autonomy	-	0.65	-
	Presence/Immersion	✓	**0.88**	-
BrainHex	Seeker	-	0.63	-
	Survivor	-	0.45	-
	Mastermind	-	0.63	-
	Daredevil	✓	0.58	✓
	Achiever	-	**0.87**	-
Sherry	Challenge	✓	0.61	-
	Diversion	-	**0.88**	✓
	Fantasy	-	**0.83**	-
	Arousal	-	0.68	-
GAMS	IntrinsicMotivation	-	0.50	-
	IntegratedRegulation	✓	**0.70**	✓
	IdentifiedRegulation	✓	**0.75**	✓
	IntrojectedRegulation	✓	**0.79**	✓
	ExternalRegulation	✓	0.60	✓
IMG	Competence	✓	0.64	✓
	Immersion	-	**0.72**	-
	Fun	✓	**0.78**	✓
	Auto-my	-	**0.80**	-
VGPu	GeneralisedGameSelfEfficacy	-	**0.83**	-
	EnjoymentOfGames	-	**0.87**	-
	ProneToGameImmersion	✓	0.67	✓

Table 4.11: CFA of GAMES. Loadings above 0.60 are in bold. Alpha if dropped scores in bold indicate items flagged as unreliable in the reliability analysis.

Sub-Scale	Item	Story	Escapism	Customisation	Grinding/ Completion	Autonomy/ Exploration	Alpha if Dropped	Overall Alpha
Story	Some of my favourite stories are in video games	**0.685**	0	0	0	0	0.87	0.88
	I really do my best to put myself into the main character's shoes	**0.613**	0	0	0	0	0.87	
	I'm interested in learning the lore and history of video game worlds	**0.669**	0	0	0	0	0.87	
	I'm excited to find out what happens next in the story	**0.835**	0	0	0	0	0.86	
	In video games, it's hard for me to identify with my character	0.477	0	0	0	0	0.88	
	It's hard for me to play a game if I can't relate to my character	0.412	0	0	0	0	0.88	
	I mostly play video games for their stories	**0.774**	0	0	0	0	0.86	
	Video game stories aren't important to me	**0.802**	0	0	0	0	0.86	
	I feel emotionally attached to the characters in my favourite games	**0.694**	0	0	0	0	0.87	
	I love to learn about the backstories of the character in video games	**0.804**	0	0	0	0	0.86	
	The feeling of immersion is important to me	0.593	0	0	0	0	0.87	
	Stories in video games just get in the way	**0.755**	0	0	0	0	0.87	
Escapism	I play video games because they let me do things I can't do in real life	0	**0.694**	0	0	0	0.84	0.86
	I play video games to keep my mind off my problems	0	**0.875**	0	0	0	0.83	
	I play video games because it allows me to escape real life	0	**0.925**	0	0	0	0.81	
	I like to do something that I could not normally do in real life through a video game	0	**0.649**	0	0	0	0.85	
	Games calm me down when I'm feeling nervous	0	0.488	0	0	0	**0.88**	
	Video games allow me to escape from the problems associated with everyday life	0	**0.949**	0	0	0	0.81	
Customisation	I really like to customise my character's outfit	0	0	**0.903**	0	0	0.82	0.87
	I like making things in video games, like houses or outfits	0	0	**0.689**	0	0	**0.88**	
	I like to personalise and customise my character	0	0	**0.917**	0	0	0.83	
	I'll put considerable time into designing my character's appearance (e.g. clothes, face)	0	0	**0.912**	0	0	0.81	
Grinding/ Completion	I like taking the time to pick up every single collectible item in games	0	0	0	**0.817**	0	0.76	0.81
	I'm excited to unlock achievements or earn trophies in games	0	0	0	**0.635**	0	0.79	
	I will often level up my characters until they reach the level cap	0	0	0	0.563	0	0.79	
	I rarely complete collections of in-game items	0	0	0	**0.843**	0	0.76	
	I don't mind grinding for an hour or two to get an item I want	0	0	0	0.421	0	**0.82**	
	I'll play a game until I get 100% on it, completing everything in games	0	0	0	**0.859**	0	0.75	
Autonomy/ Exploration	I like games that offer you a lot of options and choices	0	0	0	0	**0.644**	0.71	0.75
	I like games that offer different ways to get to the next level or area	0	0	0	0	0.591	0.72	
	I like having a choice of several different places or levels to try	0	0	0	0	0.587	0.72	
	I like games that do not put a lot of constraints on the player	0	0	0	0	**0.736**	0.72	
	I prefer games that allow me to play however I want	0	0	0	0	**0.869**	0.66	

The proposed factors fit the data well, with all items loading onto their respective sub-scales above 0.40, and 25 out of 33 loading above 0.60. 2 items flagged earlier as unreliable do not load as strongly as other items, further suggesting these be removed. However, a few items in Story do not load as strongly as expected; they load together around 0.40, but were not flagged as unreliable. This suggests there may be more than one factor in this sub-scale — a question explored later in the following chapter. Overall the proposed factor structure of GAMES is good, confirming its structure.

Average Model Fit; IMG

The CFA for IMG reflects the majority of the CFAs for the data set, demonstrating good to average model fit. Table 4.12 shows this, along with the reliability of individual items. IMG consists of small sub-scales where items load well together, but with a few unreliable items flagged earlier contributing to low loadings. Indeed, only 2 items are below 0.60, flagged as unreliable previously. This is reflective of many questionnaires, where they show good model fit once unreliable items are removed. However, IMG also highlights a trend in sub-scales containing a small number of items. If so much as one item is unreliable, the sub-scale is only left with 2 items, making it more likely to be a bloated specific rather than the proposed concept. This means that, whilst the sub-scale may be reliable, the validity of the sub-scale is questionable. Overall, IMG has a good structure that can explain most aspects of the data, but the small construction of sub-scales decreases their validity.

Poor Model Fit; GAMS

GAMS is an example of a poor model fit. The CFA for GAMS is shown in Table 4.13. The large amount of unreliable items flagged earlier highlighted concerns for the structure, as only Intrinsic Motivation did not have any unreliable items. Even then, Intrinsic Motivation had an Alpha score of 0.50, considered very low and is reflected in the factor loading; only the item 'I find it stimulating to play' loaded above 0.60. The remaining sub-scales contain unreliable items flagged before, where these items loaded considerably lower than the others. Removing them would improve both the reliability of all sub-scales and allow each item to load above 0.60. However, doing so would create 2-item sub-scales, reducing the validity of the sub-scales to capture their intended concepts. Therefore, GAMS reflects a questionnaire with a poor model fit, where many items across multiple sub-scales have low reliability and associated weaker loadings.

Table 4.12: CFA of IMG. Loadings above 0.60 are in bold. Alpha if dropped scores in bold indicate items flagged as unreliable in the reliability analysis.

Sub-Scale	Item	Competence	Immersion	Fun	Autonomy	Alpha if Dropped	Overall Alpha
Competence	I play because of the challenge	**0.621**	0	0	0	0.41	0.57
	I play to master my skills and to win myself	**0.867**	0	0	0	0.24	
	I play to make progress and to achieve objectives	0.374	0	0	0	**0.64**	
Immersion	I play because game events bring about emotions	0	**0.620**	0	0	0.70	0.72
	I play because I want to identify with the game characters	0	**0.760**	0	0	0.60	
	I play because I want to be part of the gameworld and its events	0	**0.804**	0	0	0.59	
Fun	I play because games are enjoyable	0	0	**0.922**	0	0.44	0.62
	I play because games are entertaining	0	0	**0.890**	0	0.41	
	I play because playing games is relaxing	0	0	0.462	0	**0.78**	
Autonomy	I play because in games I can make meaningful choices	0	0	0	**0.824**	0.73	0.80
	I play because in games I can make my own decisions	0	0	0	**0.804**	0.74	
	I play because in games I can make a difference with my actions	0	0	0	**0.819**	0.73	

Table 4.13: CFA of GAMS. Loadings above 0.60 are in bold. Alpha if dropped scores in bold indicate items flagged as unreliable in the reliability analysis.

Sub-Scale	Item	Intrinsic	Integrated	Identified	Introjected	External	Alpha if Dropped	Overall Alpha
Intrinsic Motivation	I enjoy the feeling of efficacy I experience when I play	0.501	0	0	0	0	0.43	0.50
	I find pleasure in trying/experiencing new game options (e.g., classes, characters, teams, races, equipment)	0.482	0	0	0	0	0.47	
	I find it stimulating to play	**0.767**	0	0	0	0	0.33	
Integrated Regulation	I think the games I play align with my personal values	0	0.312	0	0	0	**0.70**	0.58
	I think games are an integral part of my life	0	**0.769**	0	0	0	0.40	
	I think games are an extension of me	0	**0.849**	0	0	0	0.25	
Identified Regulation	I think games are a good way to develop important aspects of myself	0	0	**0.899**	0	0	0.46	0.71
	Games have personal significance to me	0	0	0.511	0	0	**0.75**	
	I think are a good way to develop social and intellectual abilities that are useful to me	0	0	**0.766**	0	0	0.55	
Introjected Regulation	I feel that I must play regularly	0	0	0	**0.648**	0	**0.79**	0.77
	If I don't play I would feel bad about myself	0	0	0	**0.897**	0	0.62	
	I must play to feel good about myself	0	0	0	**0.828**	0	0.67	
External Regulation	I like the prestige of being a good player	0	0	0	0	0.461	**0.60**	0.58
	I like to acquire powerful and rare items and virtual currency or to unlock hidden/restricted elements of games	0	0	0	0	**0.783**	0.41	
	I like to gain in-game awards and trophies or character/avatar's levels and experiences points	0	0	0	0	**0.668**	0.44	

Summary

Overall, the CFAs confirm many unreliable items flagged earlier also fit poorly onto their respective sub-scales, furthering the need to remove them. Tondello and GAMES therefore seem the most reliable and structurally sound questionnaires from the sample, whereby all sub-scales show good fit to the data, and could be used in this thesis (though some items may still need removing to increase reliability). The remaining questionnaires do contain sub-scales that could also be reliably and validly used, though many only contain a small number of items each. Multiple sub-scales suffer from being short, and made shorter when unreliable items are removed, decreasing their validity.

A summary of all sub-scales is in Table 4.14, which shows the percentage of items that load above 0.60. A full analysis can be found in Appendix C. The majority of sub-scales have more than 50% of items load above 0.60 (41 out of 45). Indeed, 17 sub-scales had all items above 0.6, indicating strong structures. Further, 16 sub-scales have more than half of items above 0.80, an even more stringent measure. However, it should be noted many strong structures come from sub-scales with a low number of items — 7 sub-scales had all items above 0.80, but 4 came from 2-item sub-scales. Therefore, the CFA structures indicate most sub-scales have an adequate structure, but those at the highest end are small and likely invalid for use as measurements.

In the majority of cases, items that showed poor sub-scale loading were also unreliable. There were however a few exceptions such as Story from GAMES, which showed weaker loading than other sub-scales but items were not deemed unreliable. This suggests the potential for sub-factors, with similar evidence in Immersion by VKS. This is explored in the following chapter.

Table 4.14: The percentage of items that load above 0.60 and 0.80 for each sub-scale. Names in bold indicate sub-scales where 100% of items load above 0.60.

Questionnaire	Sub-Scale	Items above 0.60	Items above 0.80
Yee	Mechanics	50% (2/4)	25% (1/4)
	Roleplaying	50% (2/4)	50% (2/4)
	Discovery	75% (3/4)	25% (1/4)
	Customisation	100% (3/3)	0% (0/3)
	Escapism	66% (2/3)	33% (1/3)
Tondello	Aesthetic	80% (4/5)	20% (1/5)
	Narrative	100% (5/5)	60% (3/5)
	Goal	80% (4/5)	40% (2/5)
	Challenge	100% (5/5)	80% (4/5)
Trojan	Completionist	33% (1/3)	33% (1/3)
	Escapist	100% (2/2)	100% (2/2)
	Story Driven	100% (2/2)	100% (2/2)
	Smarty Pants	100% (2/2)	100% (2/2)
VKS	Immersion	43% (3/7)	0% (0/7)
	Achievement	66% (2/3)	33% (1/3)
	Challenge	66% (2/3)	0% (0/3)
GAMES	Story	75% (9/12)	25% (3/12)
	Escapism	83% (5/6)	50% (3/6)
	Customisation	100% (4/4)	75% (3/4)
	Grinding/Completion	66% (4/6)	50% (3/6)
	Autonomy/Exploration	60% (3/5)	20% (1/5)
PENS	**Competence**	100% (3/3)	33% (1/3)
	Autonomy	100% (3/3)	0% (0/3)
	Presence/Immersion	89% (8/9)	33% (3/9)
BrainHex	Seeker	66% (2/3)	33% (1/3)
	Survivor	0% (0/3)	0% (0/3)
	Mastermind	100% (3/3)	0% (0/3)
	Daredevil	66% (2/3)	0% (0/3)
	Achiever	100% (3/3)	100% (3/3)
Sherry	Challenge	50% (2/4)	0% (0/4)
	Diversion	100% (2/2)	100% (2/2)
	Fantasy	100% (4/4)	50% (2/4)
	Arousal	75% (3/4)	0% (0/4)
GAMS	Intrinsic Motivation	33% (1/3)	0% (0/3)
	Integrated Regulation	66% (2/3)	33% (1/3)
	Identified Regulation	66% (2/3)	33% (1/3)
	Introjected Regulation	100% (3/3)	66% (2/3)
	External Regulation	66% (2/3)	0% (0/3)
IMG	Competence	66% (2/3)	33% (1/3)
	Immersion	100% (3/3)	33% (1/3)
	Fun	66% (2/3)	66% (2/3)
	Autonomy	100% (3/3)	100% (3/3)
VGPu	Generalised Game Self Efficacy	83% (5/6)	33% (2/6)
	Enjoyment of Games	100% (4/4)	100% (4/4)
	Prone to Game Immersion	66% (2/3)	33% (1/3)

4.3 Discussion

Studies 3 and 4.a sought to empirically assess motivation questionnaires currently available, to explore what measurement tool is best for this thesis. With an ever-increasing number of questionnaires available for researchers to use, it has become increasingly difficult to understand which are the best suited for assessing unique concepts. Furthermore, whilst questionnaires and their sub-scales can be compared at face value (such as the work of Hamari & Tuunanen (2014)), little empirical testing has been done to confirm semantic comparisons do indeed reflect the statistical nature of the concepts.

4.3.1 Aim 1: What motivation questionnaires currently exist?

Following a systematic review, 22 questionnaires were found that measured general motivations for players. 18 of these had been used by other researchers at least once, indicating a large volume of active measurement tools. The two most popular in use were Yee (Yee, 2006b) and PENS (Ryan, Rigby, & Przybylski, 2006). The questionnaires found represent an array of disciplines, including those created from psychological theories, media theories, and games research. Therefore, this thesis could choose from one of the questionnaires found in this sample.

4.3.2 Aim 2: Is there a consensus for selecting a questionnaire?

Overall, it was uncommon for researchers to state explicit reasons for choosing a specific questionnaire. Aeschbach, Perrig, Weder, Opwis, & Brühlmann (2021) also found justifications were uncommon for why a particular measure was selected in CHIPLAY 2020 papers using self-reported measures (16 out of 84 measurements; 19%). This is very similar to the number of explicit justifications found here (18.5%), though including implicit reasons increased the number to 72%. Furthermore, there was a high diversity in reasons given for choosing a questionnaire, suggesting there is no commonly accepted community standard for how they should be selected. The most common reason was the specific theory the questionnaire was built from, followed closely by what the questionnaire has been used to measure previously, and that the questionnaire is demonstrably valid.

Therefore, there is no observable community consensus on how to select a motivation questionnaire. By extension, this makes it harder to select a motivation questionnaire for use in this thesis. It is unclear what features of questionnaires are most appropriate to use for their selection, though a mixture of theory and structural soundness are commonly mentioned. A motivation questionnaire used to understand open world players should consequently be based on a relevant theory, have been used in previous similar work, and should be demonstrably reliable and valid. For example, the PENS questionnaire could be selected as it is based on the idea that players satisfy intrinsic needs, where autonomy may be relevant to open world gameplay. It has been used numerous times by other researchers, and is considered both reliable and valid. However, to truly confirm the latter requires empirical analysis, conducted in Study 4.a and summarised below.

4.3.3 Aim 3: How statistically sound are questionnaires?

To analyse statistical soundness, both reliability and validity were assessed in studies 3 and 4.a. Many questionnaires had unreliable sub-scales due to the inclusion of unrelated items or the proliferation of small sub-scales (such as only containing 2-items each). Overall, only 20 of the 45 sub-scales were both reliable above a Cronbach's Alpha score of 0.70 and contained more than 2 items. Even sub-scales with good reliability could be improved, indicating many questionnaires may not reliably measure motivation, and so any work founded upon them is open to false conclusions.

Reflecting on the performance of questionnaires overall, there is a general trend in newer questionnaires being more reliable. For example, BrainHex is more reliable than Yee, and Tondello is more reliable than BrainHex. However, other questionnaires predicted to perform better do not share this

trend. GAMS is less reliable than PENS despite being newer, and IMG has only two sub-scales reliable above 0.70 — less than PENS and Yee, two of the questionnaires that inspired it. On a more granular analysis, there are 3 sub-scales that IMG shares with PENS; Autonomy, Competence, and Immersion. However, only Autonomy is more reliable in IMG than PENS, indicating it has not improved the original questionnaire. Therefore, whilst new questionnaires may build on previous work, this does not always mean the resulting questionnaire will be more reliable.

However, high reliability is not an indicator of conceptual coherence. Reliability can be falsely high if a sub-scale is not unidimensional (which it ought to be). Therefore, to assess the structure of the sub-scales, confirmatory factor analyses were needed to assess their structural validity. Confirmatory Factor Analyses indicated a range of model fits for the proposed sub-scales. 17 sub-scales had all items load onto their sub-scales above 0.60, but there was no questionnaire where all sub-scale items were above 0.60. Consequently, whilst Tondello and GAMES may be the most reliable, they may not be the most descriptive tools to measure player motivation.

Overall, the presence of numerous short sub-scales raises the concern of what is truly being measured by these instruments. The reliability of many questionnaires are questionable, bringing into question their usefulness. If they cannot reliably measure concepts, any conclusions based on answers to these items may not be accurate. For this thesis, measuring player motivation of open world players is unlikely to produce reliable and valid results if using currently available questionnaires.

4.4 Summary

Overall, Tondello (Tondello, Arrambide, Ribeiro, Cen, & Nacke, 2019) and GAMES (Hilgard, Engelhardt, & Bartholow, 2013) were the most reliable questionnaires (though would benefit from certain items being removed). This may be because these scales built upon previous work. For example, Tondello performs better than both Yee and BrainHex, the two questionnaires that influenced its creation, whilst GAMES is similarly more reliable than Sherry. Whilst Trojan and Sherry also had high reliability, they also had very short sub-scales (2-4 items). Their sub-scales are consequently unlikely to be concepts but rather singular questions reworded several times. However, Tondello and GAMES had only adequate model fits to the data (an indication of their validity). Therefore, these questionnaires are the most reliable of those analysed, but still contain problems that would need addressing to improve their use.

4.4.1 Relation to Study 4.b

Whilst Tondello or GAMES could be chosen to assess open world players, these only contain a small subset of all known motivational sub-scales. Indeed, neither contains a sub-scale for immersion, which was mentioned by participants in Study 2 to be important to the experience. This limits the usefulness of their application to the thesis topic. Furthermore, despite the above analysis there are still concerns about their structure — the GAMES Story sub-scale shows indications of unaccounted sub-factors, and an item in the Tondello Challenge sub-scale contained an unexpected bimodal distribution. Their sub-scales also share similar names to other sub-scales, such as Challenge appearing in Tondello, Sherry and VKS. This raises the following question: are Tondello and GAMES the best to measure these *concepts* (i.e., they have good construct validity), or are they simply the most statistically reliable in structure? It is possible to have a highly reliable set of sub-scales which do not in fact measure the underlying concept they purport to (i.e., they have low construct validity).

A more in-depth analysis of the conceptual validity of the questionnaires is therefore required before the feasibility of using any questionnaire for this thesis can be confirmed. Therefore, the aim of the following chapter is to perform exploratory analyses on the questionnaires to assess the extent to which they offer valid measures of the concepts they purport to relate to.

Chapter 5

Measuring Motivation: Conceptual Validity

"If you try and take a cat apart to see how it works,
the first thing you have on your hands
is a nonworking cat."
— Douglas Adams

This chapter extends the previous chapter by exploring the conceptual validity of motivation questionnaires in terms of construct and comparative validity. It answers Research Aim 4 specified in the introduction of the previous chapter: **Which motivation questionnaires are the most conceptually valid?** The previous chapter analysed the reliability and fit of currently proposed model structures, but it is unclear if the sub-scales measure the concepts they purport to (construct validity; Cairns (2019)). Furthermore, multiple questionnaires measure the same/similar concepts. This raises the question of comparative validity, that is, which measures are the most valid for measuring concepts. The previous analyses suggested either Tondello or GAMES would be the most reliable questionnaire to use in this thesis to explore the motivations of open world players. Therefore, this chapter assesses whether they also have high construct validity, in comparison to the other available questionnaires.

There are several ways to assess conceptual validity. Consequently, this chapter considers three sub-questions. Firstly, in the previous analysis some items within sub-scales did not load as predicted in the Confirmatory Factor Analyses (CFA). For example, the Story sub-scale from GAMES showed good reliability for all items, but some loaded below 0.60. It is possible Story contains distinct sub-factors, which would affect the sub-scale structure and what it measures if not taken into account. Therefore, to assess construct validity it is important to consider if sub-factors exist within sub-scales. This can be done by identifying which sub-scales may contain sub-factors via a parallel analysis, and exploring alternative factor structures for any sub-scale that suggests a component larger than one.

Secondly, new questionnaires are commonly compared to previous works. This helps authors situate them in the literature and supports the assertion they capture new concepts. For example, Trojan (Kahn et al., 2015) compares its Competitors sub-scale to the Competition sub-scale of Yee (2006b), as well as the similarities between the Socialisers and Socialising sub-scales. Trojan then explains the Smarty Pants sub-scale is a concept not measured previously, highlighting the questionnaire's uniqueness. However, this comparison implies sub-scales are similar in ways moreso than their namesake. Is it enough to say that, because Competitors from Trojan is named similar to Competition from Yee, they share any commonalities in what they measure statistically? Therefore, to assess both construct and comparative validity, it is important to assess if semantically similar sub-scales are statistically similar.

Finally, the dataset consisting of 177 items in 45 sub-scales indicates a wide variety of player motivation concepts. However, the previous analyses indicated some sub-scale structures were unclear, and overlaps between sub-scales is difficult to predict from names alone. If items are allowed to load

freely onto factors, rather than constraining them to their original models, it may be possible to observe the overarching motivation concepts currently available to measure. This would indicate what current questionnaires are measuring overall, to assess their construct validity. Therefore, these questions form the research aims of this chapter:

1. Do factors exist within sub-scales?
2. Do semantically similar sub-scales behave statistically similar?
3. What is the extent of conceptual overlap between all items?

Overall, this chapter suggests the conceptual validity of current questionnaires is questionable. Sub-factors exist within sub-scales, and sub-scales with similar names do not always measure the same underlying concepts. Further, when items are allowed to load freely, 19 factors are suggested which are not currently captured from any one questionnaire. Therefore, despite the reliability of the Tondello and GAMES questionnaires, their lack of coverage of these potential motivation factors calls into question what they are truly measuring.

5.1 Method

As this study is an extension of the analysis conducted in the previous chapter, the same cleaned dataset was used. However, the analyses conducted here are exploratory in nature rather than confirmatory. Three were conducted in total: an analysis of the likelihood of factors present within sub-scales, an analysis of how semantically similar sub-scales behave statistically, and an analysis where all 177 items are allowed to load together. These are described below.

5.1.1 Factors within Sub-Scales

To explore the likelihood of sub-scales containing sub-factors, a parallel analysis was run on each sub-scale, followed by an Exploratory Factor Analysis (EFA). Parallel analysis compares the eigenvalues of a data set to those of a randomly generated data set of the same size, and outputs the number of factors to keep (Horn, 1965). If a sub-scale is truly 1 factor, the parallel analysis should reflect this and the number of components would be 1, calculated in R with the psych package (Revelle, 2018). Any sub-scale with more than 1 component was investigated further by running an EFA, which assesses the underlying relationships between variables with no prior assumptions (i.e., no specified sub-scales) of how data should be structured (Floyd & Widaman, 1995). The mirt package in R was used (Chalmers, 2012) with an oblique rotation (oblimin) to allow correlations between factors.

Whilst factors are typically associated with Exploratory Factor Analysis and components with Principal Component Analysis, for this analysis and those in following sections, components were used to establish the number of factors to extract for analysis. There is a mathematical difference between components and factors, but for practical use the difference is minimal as they perform similarly (Kline, 2000). Furthermore, in this study the suggested components provided a clearer number than suggested factors, as sometimes factors would return as 0. The difference between component and factor numbers were also consistently minimal, leading to the choice of components over factors for extraction. Finally, as EFA is exploratory and not a guarantee that specified factors will provide the clearest structure, further EFAs were computed either side of the suggested component. For example, if 3 components were suggested, 2 and 4 factor solutions were also computed.

5.1.2 Semantically Similar Sub-Scales

A series of comparative assessments were performed on similarly named sub-scales to explore their statistical overlap. The following concepts were selected for analysis: Escapism (Yee, Trojan and GAMES), Challenge (Tondello, VKS and Sherry), and Customisation (Yee and GAMES), as these

were sub-scales with the same name. Firstly, correlations were run between sub-scales to indicate the likelihood they measured similar concepts. Note that, as this work is purely exploratory, no significance testing is run. Correlations above 0.30 were considered weak, and correlations above 0.60 were considered moderate (Akoglu, 2018). This is because, if sub-scales that purport to measure the same concept correlate below 0.30, the extent of their conceptual similarity is questionable; in this case, more than two thirds of the variance would be unaccounted for. Secondly, items from sub-scales were combined and a parallel analysis was run. Similarly to the above analysis, it is expected the number of components will be 1 if sub-scales all measure the same concept. Following this, a 1-factor EFA was run to assess the structure, and if there was a poor model fit, further solutions were explored.

Building upon findings in the previous chapter, a further comparison was made: many items from sub-scales were deemed unreliable, and so potentially unrelated to the concept being measured. These may alter the relationship between sub-scales unfairly, and so each assessment was run with two sets of data; the original items from the sub-scales, and an 'altered' set with unreliable items removed. Differences in findings are discussed when appropriate.

5.1.3 Item Comparisons

This final analysis assessed how all 177 items across the 11 questionnaires compare to one another. A parallel analysis was computed on the 177 items, and an Exploratory Factor Analysis (EFA) was run on the proposed factor solution. By doing so, factors could form across sub-scales, indicating where there are overlaps between questionnaires and sub-scales. Factors were then assessed in terms of reliability, and correlations between factors were considered. A parallel analysis suggested a 19-factor solution from the 177 items. Ideally, running 18, 19, and 20-factor solutions would have been conducted at this stage. However, due to high computational costs and time to compute for running factor analyses of this size, it was only feasible to run one computation. Therefore, only the 19-factor solution was run.

5.2 Results

5.2.1 Factors within Sub-Scales

To identify potential sub-factors, parallel analyses were run on each sub-scale to identify sub-scales with more than 1-component solutions. As Table 5.1 shows, 3 sub-scales do not indicate a 1-component solution; Story from GAMES, Immersion from VKS, and Presence/Immersion from PENS. Therefore, these sub-scales were investigated more closely. Each parallel analysis suggested 2-factor solutions, but this may not be the most accurate description of the data due to the somewhat arbitrary cutoff imposed for a purely exploratory technique (Fabrigar, Wegener, MacCallum, & Strahan, 1999). Therefore, 1-factor and 3-factor solutions were also calculated for each and compared. Once a solution was chosen as the most accurate, a reliability analysis was run on the newly proposed factors, and correlations between factors were considered.

Story from GAMES

As mentioned in the previous chapter, Story from GAMES has a large range of item loadings (from 0.412 to 0.835), where none were flagged as unreliable. This implies there may be more than one factor, supported by the parallel analysis. A 1-factor solution EFA was conducted, compared to 2 and 3-factor solutions to identify the most descriptive data solution, shown in Table 5.2. The loading of each item in the 1-factor solution is adequate, with none below 0.40. There is however still a large variance, similarly to the solution provided in the previous CFA. The 2-factor solution pulls apart 2 distinct groups, but with a strong cross-loading for the final 2 items. In comparison, the 3-factor solution produces 3 groups with only one cross-loaded item, 'I feel emotionally attached to the characters in my favourite games.' This suggests the best description is the 3-factor model, with

Table 5.1: Parallel Analyses for each sub-scale analysed. Components higher than 1 are bolded.

Questionnaire	Sub-Scale	Factors	Components
Yee	Mechanics	2	1
	Roleplaying	2	1
	Discovery	1	1
	Customisation	1	1
	Escapism	1	1
Tondello	Aesthetic	2	1
	Narrative	2	1
	Goal	2	1
	Challenge	2	1
Trojan	Completionist	1	1
	Escapist	1	1
	Story Driven	1	1
	Smarty Pants	1	1
VKS	**Immersion**	**3**	**2**
	Achievement	1	1
	Challenge	0	1
GAMES	**Story**	**4**	**2**
	Escapism	3	1
	Customisation	3	1
	Grinding/Completion	2	1
	Autonomy/Exploration	2	1
PENS	Competence	1	1
	Autonomy	1	1
	Presence/Immersion	**3**	**2**
BrainHex	Seeker	1	1
	Survivor	0	1
	Mastermind	1	1
	Daredevil	0	1
	Achiever	1	1
Sherry	Challenge	3	1
	Diversion	1	1
	Fantasy	2	1
	Arousal	2	1
GAMS	Intrinsic	0	1
	Integrated	1	1
	Identified	1	1
	Introjected	1	1
	External	1	1
IMG	Competence	1	1
	Immersion	1	1
	Fun	1	1
	Autonomy	1	1
VGPu	Generalised Self Efficacy	3	1
	Enjoyment	2	1
	Prone To Immersion	1	1

Table 5.2: EFA of the Story scale from GAMES. Loadings above 0.30 are bolded.

Item	1 Factor	2 Factor		3 Factor		
	F1	F1	F2	F1	F2	F3
Video game stories aren't important to me	**0.669**	**-0.939**	0.078	**-0.968**	0.020	0.061
Stories in video games just get in the way	**0.776**	**-0.913**	0.090	**-0.829**	0.069	-0.088
I mostly play video games for their stories	**0.837**	**-0.729**	-0.112	**-0.711**	-0.151	-0.011
I'm excited to find out what happens next in the story	**0.759**	**-0.655**	-0.246	**-0.498**	-0.137	-0.291
Some of my favourite stories are in video games	**0.687**	**-0.507**	-0.236	**-0.410**	-0.164	-0.186
I really do my best to put myself into the main character's shoes	**0.615**	0.059	**-0.835**	0.060	**-0.802**	-0.080
In video games, it's hard for me to identify with my character	**0.805**	0.031	**-0.631**	-0.016	**-0.645**	0.031
It's hard for me to play a game if I can't relate to my character	**0.481**	0.004	**-0.515**	-0.096	**-0.602**	0.155
The feeling of immersion is important to me	**0.804**	-0.161	**-0.538**	-0.172	**-0.492**	-0.055
I feel emotionally attached to the characters in my favourite games	**0.413**	-0.246	**-0.564**	-0.108	**-0.403**	**-0.334**
I love to learn about the backstories of the character in video games	**0.697**	**-0.476**	**-0.412**	-0.023	-0.030	**-0.903**
I'm interested in learning the lore and history of video game worlds	**0.592**	**-0.417**	**-0.315**	-0.021	0.023	**-0.784**

the cross-loaded item removed to improve clarity (as the loading is still far lower than items in either factor).

The following factor names are proposed: Story, Character Identification, and Lore Learning[1]. To further assess the suitability of the 3-factor solution, Cronbach's alpha was calculated on the new factors, shown in Table 5.3. The overall reliability of the new Story factor is strong at 0.85, as well as the reliability of Lore Learning at 0.80. Lore Learning however only has 2 items, so is not likely useful as its own sub-scale, but may indicate a distinct concept requiring future study. The reliability of Character Identification is lower at 0.69, although no items are flagged as unreliable.

Table 5.3: Reliability of the proposed sub-factors of the GAMES Story sub-scale.

Proposed Sub-Scale	Item	Alpha if Dropped	Overall Alpha
Story	Video game stories aren't important to me	0.79	0.85 (0.84 - 0.86)
	Stories in video games just get in the way	0.81	
	I mostly play video games for their stories	0.82	
	I'm excited to find out what happens next in the story	0.81	
	Some of my favourite stories are in video games	0.84	
Identification	I really do my best to put myself into the main character's shoes	0.54	0.69 (0.66 - 0.71)
	In video games, it's hard for me to identify with my character	0.64	
	It's hard for me to play a game if I can't relate to my character	0.67	
	The feeling of immersion is important to me	0.63	
Lore Learning	I love to learn about the backstories of the character in video games	0.67	0.80 (0.78 - 0.82)
	I'm interested in learning the lore and history of video game worlds	0.66	

Correlations between proposed factors were calculated and shown in Table 5.4. There are moderate to strong correlations between the 3 factors, indicating they are distinct but likely related. Therefore, whilst Story is presented as a single concept, this analysis suggests it may contain 2-3 distinct sub-factors. The 3rd factor is notably smaller, indicating it is not currently a fully elaborated concept, but is distinct enough to be considered on its own.

Table 5.4: Correlations between the proposed Story sub-factors.

	Story	Identification	Lore Learning
Story	-		
Identification	0.55	-	
Lore Learning	0.69	0.59	-

Immersion from VKS

[1] or 'Lorening' if you will

The parallel analysis of Immersion from VKS suggested 2 components, and the exploratory 1-factor solution indicated a large range of loaded items (from 0.332 to 0.768), with only 3 items above 0.60. 1, 2, and 3-factor solutions are shown in Table 5.5. Overall, no solution fully captures the data. The lack of highly loaded items in the 1-factor solution makes it unlikely there is a unidimensional factor. The item 'I enjoy learning in games new skills that may be useful in real life' does not strongly load onto any factor, with the item 'Games are an important activity in my life' showing a similar trend (though does slightly cross-load). This makes sense, as these items consider wider impacts of gaming rather than immersion. Discarding these 2 items provides a clearer factor structure, with the item 'The satisfaction I feel when I accomplish a task successfully in games is stronger than the satisfaction I feel when I accomplish a task successfully in real life' loading on its own factor in both the 2 and 3-factor solutions. Correlations between these factors are shown in Table 5.6.

Table 5.5: EFA of the Immersion scale from VKS. Loadings above 0.30 are bolded.

Item	1 Factor	2 Factor		3 Factor		
	F1	F1	F2	F1	F2	F3
I like taking up quests or missions in games	**0.503**	**-0.594**	-0.118	**-0.724**	-0.037	0.103
I enjoy immersing in the world of games	**0.768**	**-0.831**	-0.037	**-0.714**	0.034	-0.152
The satisfaction I feel when I accomplish a task successfully in games is stronger than the satisfaction I feel when I accomplish a task successfully in real life	**0.353**	0.011	**0.787**	0.015	**0.792**	0.007
Games are an important activity in my life	**0.489**	**-0.334**	**0.354**	-0.289	**0.357**	-0.089
I enjoy the feeling of escape from real life through games	**0.706**	**-0.592**	0.171	0.019	0.046	**-0.807**
I enjoy transforming to somebody else in games	**0.630**	**-0.601**	0.030	-0.064	-0.067	**-0.681**
I enjoy learning in games new skills that may be useful in real life	**0.332**	-0.290	0.088	-0.299	0.130	0.007

Table 5.6: Correlations between the proposed Immersion sub-factors.

	F1	F2	F3
F1	-		
F2	0.28	-	
F3	-0.60	-0.47	-

There are a range of correlations between the 3 factors, though some are negative. This is most likely an artefact of the factor analysis, where the direction of the second factor has 'flipped.' This can be seen in Table 5.5, where the 1-item sub-factor is positively loaded, but the other factors are negative. The correlation therefore suggests negative relationships, but this is unlikely to be true. For the purpose of this interpretation, the sign is ignored and negative correlations are treated as positive. The 1-item factor shows weak to moderate correlation with the other 2 factors (0.28 and 0.47 respectively), but is not as strong as the correlation between them (0.60). Therefore, discarding this 1-item factor would leave 4 items in total across 2 factors (shown in the 3-factor solution). However, this leaves 2 items in each, and as the correlation between these factors is moderate to high, it may be best to combine these items into a singular 4-item sub-scale. Put another way, the VKS sub-scale could be reduced from the original to improve its structure. To test this, Cronbach's alpha was computed on this new 4-item sub-scale, shown in Table 5.7.

Table 5.7: Reliability of the proposed new Immersion sub-scale from VKS. The item in bold would improve the overall relaibility if dropped.

Proposed Sub-scale	Item	Alpha if Dropped	Overall Sub-scale
New Immersion	I enjoy transforming to somebody else in games	0.57	0.67 (0.65 - 0.70)
	I enjoy the feeling of escape from real life through games	0.58	
	I enjoy immersing in the world of games	0.57	
	I like taking up quests or missions in games	**0.68**	

The new immersion factor does not reach the 0.70 threshold, even if the item 'I like taking up

quests or missions in games' is dropped to increase alpha to 0.68. This means this sub-scale, even after considerable alterations, has a questionable structure.

Presence/Immersion from PENS

The parallel analysis suggested a 2-factor solution, so a 1-factor solution was first computed to see the likelihood of sub-factors. Apart from one item, all items loaded above 0.60 in the 1-factor solution, suggesting if there are sub-factors, they will be highly related. 2 and 3-factor solutions were computed to explore the most descriptive model of the data, shown in Table 5.8 (note that item wording is not included as PENS is a proprietary questionnaire). The one item to load below 0.60 in the 1-

Table 5.8: EFA of the PENS Presence/Immersion sub-scale. Loadings above 0.30 are highlighted in bold.

Item	1 Factor	2 Factor		3 Factor		
	F1	F1	F2	F1	F2	F3
Item 1	**0.691**	**-0.802**	0.010	**-0.843**	0.024	-0.017
Item 7	**0.636**	**-0.846**	0.109	**-0.817**	0.076	-0.008
Item 2	**0.721**	**-0.704**	-0.105	**-0.721**	-0.095	0.008
Item 9	**0.763**	**-0.760**	-0.104	**-0.658**	-0.139	0.130
Item 3	**0.446**	**-0.396**	-0.098	-0.002	0.006	**0.960**
Item 5	**0.803**	**-0.330**	**-0.535**	**-0.319**	**-0.552**	-0.015
Item 8	**0.827**	0.036	**-0.939**	0.050	**-0.959**	-0.005
Item 6	**0.804**	0.001	**-0.869**	-0.019	**-0.847**	0.004
Item 4	**0.765**	-0.032	**-0.795**	-0.021	**-0.789**	0.031

factor solution is understandable, as it relates to the feeling of pride rather than immersion. The 2-factor solution appears the most descriptive, especially if discarding the pride item mentioned above (which loads strongly as a 1-item factor in the 3-factor solution). Doing so would leave one strongly cross-loaded item, which appears to bridge between the two sub-factors of immersion. To clarify the structure, it may be necessary to also remove this item from the sub-scale. This leaves 2 factors, named Emotional Immersion and Transportation Immersion. The reliability of these factors was then tested, shown in Table 5.9.

Table 5.9: Reliability of the proposed subfactors of the PENS Presence/Immersion sub-scale.

Proposed Sub-Scale	Item	Alpha if dropped	Overall Sub-scale
Emotional	Item 1	0.74	0.81 (0.80 - 0.83)
	Item 7	0.78	
	Item 2	0.77	
	Item 9	0.77	
Transportation	Item 8	0.76	0.85 (0.83 - 0.86)
	Item 6	0.78	
	Item 4	0.82	

The alpha for both sub-scales is strong, with both over 0.80. This supports the plausibility of splitting the sub-scale into 2 factors. Furthermore, the correlation between factors in the 2-factor solution is 0.67, indicating they are highly related (as predicted by the strong 1-factor solution). This means the 2 factors could be considered unidimensional when combined, meaning the original structure is still feasible. Overall, the sub-scale measures Immersion, but has 2 distinct sub-factors if two items are dropped for being unrelated/strongly cross-loaded. Being aware of these sub-factors would improve the sub-scale's validity when explaining presence/immersion.

5.2.2 Semantically Similar Sub-Scales

This section explores the structure of semantically similar sub-scales (i.e., those with similar names), in this case escapism, challenge, and customisation. In doing so, the ability to use questionnaires interchangeably is assessed. This was done by comparing correlations between sub-scales, computing a 1-factor EFA, and finally a factor solution suggested by a parallel analysis.

Escapism

Firstly, the Escapism sub-scales from Yee, Trojan and GAMES were analysed. A Spearman's correlation was run on both the original and altered sub-scales (i.e., removing items flagged as unreliable in the previous chapter), shown in Table 5.10.

Table 5.10: Spearman's correlations for the Escapism sub-scales, both original and altered.

Original			
	Trojan	**GAMES**	**Yee**
Trojan	-	0.74	0.55
GAMES		-	0.83
Yee			-

Altered			
	Trojan	**GAMES**	**Yee**
Trojan	-	0.74	0.55
GAMES		-	0.85
Yee			-

There are strong correlations between sub-scales, though the correlation between Yee and Trojan is notably weaker. This suggests they may measure similar concepts. To explore this, a 1-factor EFA was computed to assess their overall statistical similarity. The 1-factor solutions are shown in Table 5.11.

Table 5.11: A 1-factor EFA for Escapism sub-scales, both original items and altered.

Questionnaire	Item	Original	Altered
GAMES	Video games allow me to escape from the problems associated with everyday life	0.938	0.933
GAMES	I play video games because it allows me to escape real life	0.934	0.941
Yee	I often play so you I avoid thinking about some of my real-life problems or worries	0.866	0.860
GAMES	I play video games to keep my mind off my problems	0.856	0.852
Yee	It's important that games allow me to escape from the real world	0.802	0.804
Trojan	Video games allow me to pretend I am someone/somewhere else	0.750	0.752
GAMES	I play video games because they let me do things I can't do in real life	0.748	0.751
Trojan	I like to do things in games which I cannot do in real life	0.736	0.738
GAMES	I like to do something that I could not normally do in real life through a video game	0.711	0.711
GAMES	Games calm me down when I'm feeling nervous	0.502	-
Yee	I often play to relax from the day's work	0.399	-

All items load above 0.70 in the 1-factor solution, except for 2 items flagged as unreliable earlier. This suggests the items form an overarching concept, but sub-factors may still exist. Therefore, a parallel analysis was run to determine the potential number of sub-factors, which suggested 3 components for the original sub-scales and 2 components for the altered. Therefore, 2 and 3-factor solutions were run on both the original and altered sub-scales to find the best description of the data, shown in Table 5.12.

The 2-factor solution for the original sub-scales shows a clear split, with one item not loading onto either factor. The altered 2-factor solution shows a similar trend, with the unloaded item removed for unreliability. The 3-factor solution is similar, with a clear separation of 3 factors and the unreliable item loading onto no factor, however the altered 3-factor solution created a cross-loaded item, 'I play video games because it allows me to escape real life.' It also contains a loading smaller than -1.00, a rare occurrence that can happen when highly correlated factors are present in an oblique rotation, as the measurement is based on regression coefficients instead of correlations (Jöreskog, 1999). Therefore both solutions are descriptive, but the 2-factor has a cleaner structure (especially in the altered version).

Table 5.12: 2 and 3-factor solutions for original and altered Escapism sub-scales. Loadings above 0.30 are highlighted in bold.

Questionnaire	Item	Original					Altered				
		2 Factor		3 Factor			2 Factor		3 Factor		
		F1	F2	F1	F2	F3	F1	F2	F1	F2	F3
Yee	I often play so you I avoid thinking about some of my real-life problems or worries	**0.975**	0.076	**0.994**	0.009	-0.052	**-0.975**	0.076	**-0.975**	0.043	-0.025
GAMES	I play video games to keep my mind off my problems	**0.962**	0.087	**0.849**	0.053	0.113	**-0.960**	0.082	**-0.978**	0.035	-0.065
GAMES	Video games allow me to escape from the problems associated with everyday life	**0.936**	-0.050	**0.785**	-0.070	0.163	**-0.931**	-0.056	**-0.902**	-0.068	0.033
GAMES	I play video games because it allows me to escape real life	**0.737**	-0.256	0.226	-0.082	**0.719**	**-0.736**	-0.260	**-0.597**	-0.155	**0.332**
Yee	It's important that games allow me to escape from the real world	**0.562**	-0.293	0.032	-0.101	**0.743**	**-0.559**	-0.299	**-0.439**	-0.293	0.200
GAMES	Games calm me down when I'm feeling nervous	**0.413**	-0.131	**0.524**	-0.223	-0.188	-	-	-	-	-
Yee	I often play to relax from the day's work	0.233	-0.223	0.284	-0.267	-0.075	-	-	-	-	-
Trojan	Video games allow me to pretend I am someone/somewhere else	0.219	**-0.669**	0.030	**-0.586**	0.284	-0.218	**-0.671**	-0.125	**-0.588**	0.231
GAMES	I play video games because they let me do things I can't do in real life	0.067	**-0.867**	-0.010	**-0.818**	0.135	-0.066	**-0.870**	-0.033	**-0.834**	0.089
GAMES	I like to do something that I could not normally do in real life through a video game	-0.030	**-0.947**	0.031	**-0.946**	-0.053	0.030	**-0.946**	0.003	**-0.965**	-0.058
Trojan	I like to do things in games which I cannot do in real life	-0.045	**-0.998**	-0.012	**-1.000**	-0.024	0.046	**-0.998**	0.029	**-1.017**	-0.043

The sub-scale consequently contains 2 sub-factors — assessing the items, the names escaping *from* the real world, and escaping *into* a game, are suggested. Overall, Escapism can be considered a single factor with 2 sub-factors, where using any of these sub-scales to measure 'Escapism' is likely valid. However, the 2 sub-factors are lost by using only one of the sub-scales instead of combining them, as the items are split across all 3. GAMES contains some but not all items from both sub-factors, meaning the sub-scale could measure Escapism as a whole but not the sub-factors. This can only be done by using all 3 sub-scales together.

Challenge

The Challenge sub-scales came from Tondello, VKS and Sherry; correlations between each sub-scale are shown in Table 5.13. Unexpectedly, the sub-scales do not strongly correlate — the highest

Table 5.13: Spearman's correlations for Challenge sub-scales, both original and altered.

Original			
	Tondello	**Sherry**	**VKS**
Tondello	-	0.32	0.21
Sherry		-	0.30
VKS			-

Altered			
	Tondello	**Sherry**	**VKS**
Tondello	-	0.36	0.11
Sherry		-	0.24
VKS			-

correlation is 0.36 between Tondello and Sherry for the altered sub-scales. This is especially small in comparison to those seen for Escapism mentioned above. If sub-scales measure the same concept of Challenge, correlations should be higher. Furthermore, the parallel analysis suggested 3 components for both the original and 3 altered sub-scales, indicating there may not be an overarching single factor. Therefore, 1 and 3-factor solutions were run for both sub-scale variations. Table 5.14 shows the 1-factor solutions.

The original sub-scales show a large range of loaded items, between a very low 0.136 to a high 0.926. Even with unreliable items removed the altered sub-scales show a similar trend, with a low of 0.129 and a high of 0.922. This suggests the sub-scales do not measure the same overarching concept. To investigate this further 3-factor solutions were calculated, shown in Table 5.15.

Interestingly, the 3 factors are exactly the original sub-scales in both versions (with a weak loading of a VKS item onto Sherry in the original). Each Challenge sub-scale is measuring a different concept, with little relation to one another. It is highly unlikely each sub-scale can be used interchangeably, or indeed semantically compared to. Therefore, the concept of 'Challenge' should be treated with caution.

Customisation

The two customisation sub-scales come from Yee and GAMES, where only one item from GAMES was flagged as unreliable. The sub-scales correlated at 0.80 on a Spearman's correlation for both the original and altered sub-scales, which are strong and support the notion the two are related. The par-

Table 5.14: A 1-factor EFA for Challenge sub-scales, both original items and altered. Loadings above 0.30 are highlighted in bold.

Questionnaire	Item	Original	Altered
Tondello	I enjoy highly difficult challenges in games	**0.926**	**0.922**
Tondello	I like it when goals are hard to achieve in games	**0.893**	**0.897**
Tondello	I like it when games challenge me	**0.869**	**0.871**
Tondello	I like it when progression in a game demands skill	**0.825**	**0.832**
Tondello	I usually play games at the highest difficulty setting	**0.715**	-
VKS	I try to think of new ways to react to ingame situations	**0.443**	-
Sherry	I feel proud when I master an aspect of a game	**0.433**	**0.431**
Sherry	I enjoy finding new and creative ways to work through video games	**0.409**	**0.403**
Sherry	I play until I complete a level or win a game	0.285	-
Sherry	I find it very rewarding to get to the next level	0.277	0.280
VKS	Before taking up a quest, I analyse it and plan my tactics	0.191	0.183
VKS	Before I begin a task or quest, I try to find out more about it	0.136	0.129

Table 5.15: 3-factor EFAs for Challenge sub-scales, both original items and altered. Loadings above 0.30 are highlighted in bold.

Questionnaire	Item	Original			Altered		
		F1	F2	F3	F1	F2	F3
Sherry	I find it very rewarding to get to the next level	**-0.716**	0.085	-0.008	0.073	**0.752**	-0.022
	I enjoy finding new and creative ways to work through video games	**-0.588**	-0.086	-0.076	-0.130	**0.507**	-0.074
	I feel proud when I master an aspect of a game	**-0.523**	-0.258	-0.011	-0.272	**0.527**	-0.001
	I play until I complete a level or win a game	**-0.449**	-0.059	-0.036	-	-	-
Tondello	I enjoy highly difficult challenges in games	0.037	**-0.968**	0.021	**-0.963**	-0.054	0.015
	I like it when goals are hard to achieve in games	-0.001	**-0.899**	-0.006	**-0.917**	-0.042	-0.020
	I like it when games challenge me	-0.071	**-0.834**	-0.015	**-0.851**	0.036	-0.017
	I like it when progression in a game demands skill	-0.199	**-0.735**	0.023	**-0.757**	0.169	0.008
	I usually play games at the highest difficulty setting	0.132	**-0.788**	-0.044	-	-	-
VKS	Before taking up a quest, I analyse it and plan my tactics	0.055	-0.034	**-0.758**	-0.044	-0.059	**-0.740**
	Before I begin a task or quest, I try to find out more about it	-0.139	0.088	**-0.596**	0.068	0.112	**-0.625**
	I try to think of new ways to react to ingame situations	**-0.303**	-0.249	-0.190	-	-	-

allel analyses also supported this, as they suggested only 1 component. To complete this investigation a 1-factor EFA was run, presented in Table 5.16.

Table 5.16: A 1-factor EFA for Customisation sub-scales, both original items and altered.

Questionnaire	Item	Original	Altered
GAMES	I'll put considerable time into designing my character's appearance (e.g. clothes, face)	0.967	0.968
Yee	I spend a lot of time customising my character during character creation	0.926	0.927
GAMES	I like to personalise and customise my character	0.873	0.868
GAMES	I really like to customise my character's outfit	0.865	0.863
Yee	It's important that my character's armour/outfit matches in colour and style	0.681	0.679
GAMES	I like making things in video games, like houses or outfits	0.677	-
Yee	It's important that my character looks different from other characters	0.676	0.676

The lowest loading is 0.676, supporting a strong 1-factor solution. Therefore, it is highly likely these customisation sub-scales measure the same concept, and can be used interchangeably.

5.2.3 Item Comparisons

In the previous section, sub-scales with similar names were assessed for statistical overlap. However, sub-scales with different names may still overlap with other sub-scales. Further, items unreliable in some sub-scales may load better with items in different sub-scales. The logical next step was to assess how sub-scales load together in an EFA using mean scores as data. This was completed, and can be found in Appendix C, which showed similar findings to this section. Therefore, the next section

allows items to move freely into factors by computing an EFA with all 177 individual items.

A parallel analysis suggested a 19-factor solution, and so a 19-factor EFA was run. The output is presented in Table 5.17 and Table 5.18, split due to size. Some items cross-loaded across factors (15 in total), such as the item 'I enjoy exploring every map or zone in the world' from the Yee Discovery sub-scale, which loaded onto factors 3 and 5. This is understandable, as the item contains aspects of both factors, being both about Completionism ('every map or zone') and Exploration ('enjoy exploring'). Due to the high volume of items cross-loaded items were removed to allow for a clearer structure. Further, some items did not load onto any factor, and so are also absent from this table (20 items; for example the item 'I feel proud when I master an aspect of a game' from the Challenge sub-scale of Sherry). Overall, 142 items were left across 19 factors. The following factor names are proposed, ordered the same as the factor analysis, and discussed in depth in the Discussion section:

1. Transportation Immersion
2. Competence
3. Completionism
4. Escape From
5. Exploration
6. I Like Games
7. Customisation
8. Smarten
9. I Like Stories
10. Play My Way
11. Games as Life
12. Forward Thinking
13. Roleplaying
14. Escape To
15. Challenge
16. Strategic Thinking
17. Emotional Engagement
18. Progression
19. Emotional Reaction

Next, the correlations between factors were considered, shown in Table 5.19. In total, 12 correlations were above 0.30 or below -0.30, indicating some factors share weak to moderate relationships. Interestingly, no factors correlated above 0.60, suggesting overall the proposed factors represent interrelated but distinct concepts. Many strong correlations relate to Emotional Engagement, as well as Competence, Escape From, and Escape To. Each factor and its relations to other factors is described in the Discussion, to explore what it informs about the conceptual overlap in the measurement of player motivation.

5.3 Discussion

The overarching research aim of this chapter, as specified in the previous chapter, is as follows:

Aim 4: Which motivation questionnaires are the most conceptually valid?

This is because, whilst Tondello and GAMES showed the highest reliability and strongest structures, this does not mean they are the most valid in measuring the underlying concepts they purport to. Therefore, questionnaires were assessed in terms of their construct validity and comparative validity. To answer this research aim, three sub-research aims were explored: what factors exist within sub-scales, do semantically similar sub-scales load together, and how do all items load together. How questionnaires and their sub-scales compare to one another was assessed via a series of exploratory correlations and factor analyses. Findings of these analyses are discussed below.

Table 5.17: The first 8 factors for the 177 item EFA; bolded items load over 0.60. Any item below 0.30, and items cross-loaded above 0.30, are removed.

Factor	Item	F1	F2	F3	F4	F5	F6	F7	F8
Transportation Immersion	The feeling of immersion is important to me	**-0.646**							
	Immersion PENS 8	-0.598							
	I like games which make me feel like I am actually in a different place	-0.575							
	Immersion PENS 6	-0.571							
	I enjoy immersing in the world of games	-0.561							
	I enjoy being immersed in a fantasy world	-0.490							
	I play because I want to be part of the gameworld and its events	-0.309							
Competence	Competence PENS 3		**-0.886**						
	I have good video game skills		**-0.863**						
	I am good at video games, compared to others		**-0.794**						
	I am confident playing video games		**-0.628**						
	I can keep up with a video game that moves quickly		**-0.615**						
	I have a lot of experience with playing video games		-0.598						
	Competence PENS 2		-0.508						
	Based on my knowledge of previous video games, I can easily see through the rules of a game		-0.425						
	Competence PENS 1		-0.416						
	I like the prestige of being a good player		-0.367						
Completionism	I enjoy getting 100% (completing everything in a game)			**-0.966**					
	I like completing games 100%			**-0.964**					
	I'll play a game until I get 100% on it, completing everything in the game			**-0.852**					
	I like to complete all the tasks and objectives in a game			**-0.851**					
	I enjoy picking up every single collectible in an area			**-0.825**					
	I rarely complete collections of in-game items			**-0.778**					
	I like taking the time to pick up every single collectible item in games			**-0.714**					
	I usually do not care if I do not complete all optional parts of a game			**-0.698**					
	I enjoy finding what I need to complete a collection			**-0.692**					
	I'm excited to unlock achievements or earn trophies in games			-0.573					
	I like to gain in-game awards and trophies or character/avatar's levels and experiences points			-0.508					
	I like to try everything that is possible to do in a game			-0.433					
	I will often level up my characters until they reach the level cap			-0.339					
Escape From	I often play to avoid thinking about some of my real-life problems or worries				**-0.925**				
	Video games allow me to escape from the problems associated with everyday life				**-0.920**				
	I play video games to keep my mind off my problems				**-0.911**				
	I play video games because it allows me to escape real life				**-0.756**				
	I enjoy the feeling of escape from real life through games				**-0.612**				
	It's important that games allow me to escape from the real world				-0.579				
	Games calm me down when I'm feeling nervous				-0.388				
Exploration	I enjoy exploring the world just for the sake of exploring it					**-0.797**			
	I enjoy exploring to see what I can find					**-0.734**			
	I like to spend some time exploring the game world					**-0.727**			
	I enjoy looking around just to enjoy the scenery					-0.599			
	I often wonder what's behind a locked door					-0.354			
	I enjoy finding quests, NPCs or locations that most people do not know about					-0.337			
I Like Games	I play because games are enjoyable						**0.754**		
	I like playing video games						**0.709**		
	I play because games are entertaining						**0.699**		
	I enjoy playing video games						**0.671**		
	I think video games are entertaining						0.510		
	Video games are fun						0.471		
	I play video games because they excite me						0.422		
	I find it stimulating to play						0.403		
	I play because playing games is relaxing						0.375		
	I often play to relax from the day's work						0.373		
	I like finishing quests						0.365		
	Autonomy PENS 1						0.314		
Customisation	I like to customize how my character looks in a game							**-0.946**	
	I'll put considerable time into designing my character's appearance (e.g. clothes, face)							**-0.917**	
	I like to personalise and customise my character							**-0.894**	
	I really like to customise my character's outfit							**-0.894**	
	I spend a lot of time customising my character during character creation							**-0.871**	
	It's important that my character's armour/outfit matches in colour and style							**-0.682**	
	It's important that my character looks different from other characters							**-0.629**	
	I like making things in video games, like houses or outfits							-0.599	
	I enjoy collecting distinctive objects or clothing that have no functional value in games							-0.494	
Smarten	I play games to enhance my intellectual abilities								**0.796**
	Games make me smarter								**0.755**
	I think are a good way to develop social and intellectual abilities that are useful to me								**0.747**
	I think games are a good way to develop important aspects of myself								**0.693**
	I enjoy learning in games new skills that may be useful in real life								0.584

Table 5.18: Factors 9-19 for the 177 item EFA, with bolded items over 0.60. Any item below 0.30, and items cross-loaded above 0.30, are removed. Strategic Thinking has no items in this table, as all items cross-loaded above 0.30

Factor	Item	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19
I Like Stories	Video game stories aren't important to me	**-0.896**										
	I like stories in a game	**-0.875**										
	Stories in video games just get in the way	**-0.865**										
	Story is not important to me when I play games	**-0.846**										
	I like games that pull me in with their story	**-0.756**										
	I mostly play video games for their stories	**-0.733**										
	I feel like storytelling often gets in the way of actually playing games	**-0.724**										
	I enjoy complex narratives in a game	**-0.711**										
	I usually skip the story portions or the cutscenes when I am playing	**-0.691**										
	I'm excited to find out what happens next in the story	**-0.615**										
	I like to the feeling of being part of a story	-0.494										
	I love to learn about the backstories of the character in video games	-0.478										
	Some of my favourite stories are in video games	-0.444										
	I'm interested in learning the lore and history of video game worlds	-0.402										
Play My Way	I prefer games that allow me to play however I want		**0.694**									
	I like games that offer different ways to get to the next level or area		**0.625**									
	I like games that do not put a lot of constraints on the player		0.561									
	I like games that offer different ways to get to the next level or area		0.494									
	I like games that offer you a lot of options and choices		0.492									
	Autonomy PENS 3		0.334									
	Autonomy PENS 2		0.302									
Games as Life	I think games are an integral part of my life			**-0.727**								
	Games are an important activity in my life			**-0.679**								
	If I don't play I would feel bad about myself			-0.551								
	I feel that I must play regularly			-0.513								
	I think games are an extension of me			-0.492								
	I must play to feel good about myself			-0.465								
	The satisfaction I feel when I accomplish a task successfully in games is stronger than the satisfaction I feel when I accomplish a task successfully in real life			-0.359								
	Games have personal significance to me			-0.352								
Forward Thinking	It is important for me to know as much about the game mechanics and rules as possible				**0.691**							
	I am interested in the precise numbers and percentages underlying the game mechanics				**0.652**							
	I like to figure out how game work inside and out				0.510							
	It is important that my character is as optimized as possible for their profession/role				0.491							
	I often use a character builder or a template to plan out my character's advancement at an early level				0.392							
Roleplaying	I often role-play my character					**0.610**						
	I often make up stories and histories for my characters					0.562						
	I really do my best to put myself into the main character's shoes					0.445						
	I enjoy the excitement of assuming an alter ego in a game					0.376						
	I often role-play my character					0.350						
	Immersion PENS 5					0.316						
Escape To	I like to do things in games which I cannot do in real life						**-0.954**					
	I like to do something that I could not normally do in real life through a video game						**-0.921**					
	I like to do something that I could not normally do in real life through a video game						**-0.915**					
	I play video games because they let me do things I can't do in real life						**-0.846**					
	I play video games because they let me do things I can't do in real life						**-0.806**					
	Video games allow me to pretend I am someone/somewhere else						-0.463					
	Video games allow me to pretend I am someone/somewhere else						-0.367					
	I play because in games I can make my own decisions						-0.351					
	I play because in games I can make a difference with my actions						-0.328					
Challenge	I enjoy highly difficult challenges in games							**-0.903**				
	I like it when goals are hard to achieve in games							**-0.867**				
	I like it when games challenge me							**-0.792**				
	I play because of the challenge							**-0.740**				
	I like it when progression in a game demands skill							**-0.727**				
	I usually play games at the highest difficulty setting							**-0.605**				
	I enjoy frantically escaping from a terrifying foe							-0.408				
	I play to master my skills and to win myself							-0.336				
	I enjoy working out how to crack a challenging puzzle							-0.336				
	I enjoy responding quickly to an exciting situation in a game							-0.325				
Strategic Thinking*												
Emotional Engagement	Immersion PENS 1									**0.700**		
	Immersion PENS 7									**0.681**		
	Immersion PENS 9									**0.638**		
	Immersion PENS 2									0.594		
	I feel emotionally attached to the characters in my favourite games									0.572		
	I play video games because they stimulate my emotions									0.571		
	I play because game events bring about emotions									0.516		
	In video games, it's hard for me to identify with my character									0.317		
Progression	I play to make progress and to achieve objectives										0.313	
Emotional Reaction	A failure in games makes me feel stressed											**-0.705**
	A failure in games makes me feel disappointed											**-0.617**
	In games, very often I feel stressed and pressured											-0.543
	I feel relief when I escape to a safe area											-0.397
	Immersion PENS 3											-0.382

Table 5.19: A Correlation matrix between the 19 factors. Correlations above 0.30 are in bold.

	Transportation Immersion	Competence	Completionism	Escape From	Exploration	I Like Games	Customisation	Smarten	I Like Stories	Play My Way	Games as Life	Forward Thinking	Roleplaying	Escape To	Challenge	Strategic Thinking	Emotional Engagement	Progression	Emotional Reaction
Transportation Immersion	1																		
Competence	0.041	1																	
Completionism	0.011	0.057	1																
Escape From	0.213	-0.054	0.088	1															
Exploration	0.277	0.038	0.245	-0.007	1														
I Like Games	-0.174	**-0.339**	-0.118	-0.051	-0.182	1													
Customisation	0.18	-0.028	0.11	0.121	0.229	-0.015	1												
Smarten	-0.163	-0.289	-0.122	-0.087	-0.077	0.127	-0.052	1											
I Like Stories	0.258	-0.02	0.036	0.006	0.197	-0.248	0.138	-0.082	1										
Play My Way	-0.186	-0.179	-0.036	-0.145	**-0.324**	0.182	-0.218	0.164	-0.089	1									
Games as Life	0.094	0.206	0.059	**0.306**	-0.023	-0.132	0.071	-0.287	0.017	0.027	1								
Forward Thinking	0.014	**-0.304**	-0.265	-0.031	-0.105	0.052	-0.047	0.203	0.071	0.201	-0.093	1							
Roleplaying	-0.289	0.039	-0.02	-0.098	-0.123	-0.066	-0.225	0.14	-0.273	0.174	-0.012	0.031	1						
Escape To	**0.374**	0.069	0.033	**0.487**	0.131	-0.21	0.204	-0.208	0.091	**-0.327**	0.081	-0.014	-0.239	1					
Challenge	-0.01	**0.539**	0.042	-0.086	0.102	-0.157	-0.077	-0.208	-0.144	-0.119	0.096	**-0.339**	0.06	-0.015	1				
Strategic Thinking	0.025	0.152	-0.04	-0.071	0.116	-0.175	0.031	0.008	0.03	-0.167	0.01	-0.09	0.06	0.017	0.232	1			
Emotional Engagement	**-0.334**	-0.071	0.042	-0.143	-0.119	0.141	-0.144	**0.318**	**-0.363**	-0.007	-0.212	-0.055	0.284	-0.208	-0.007	-0.002	1		
Progression	-0.117	-0.064	-0.202	-0.101	-0.057	0.106	-0.106	0.194	-0.055	0.124	-0.013	0.116	0.077	-0.119	-0.095	-0.022	0.107	1	
Emotional Reaction	0.064	-0.035	0.165	0.268	0.057	-0.061	0.069	-0.1	0.033	-0.04	0.233	-0.191	0.008	0.117	0.066	0.068	-0.115	-0.251	1

5.3.1 Aim 4.1: What factors exist within sub-scales?

Three of the 45 sub-scales indicated the presence of sub-factors via a parallel analysis. Story from GAMES contained at least two sub-factors that were distinct from one another (Story and Identification). Similarly, Presence/Immersion from PENS also contained two related sub-factors: emotional and transporation immersion. However, in the case of Immersion from VKS, it was not possible to confirm a stable structure when items could freely load together. Only four of the eight items appeared related to one another, but their overall reliability was low.

Therefore, whilst it can be possible to predict where sub-factors exist, such as Story from GAMES with its reliable but low factor loadings, it is not always obvious. For example, the lack of structural stability in Immersion by VKS was not seen until further testing via a parallel analysis. Consequently, sub-scales can be reliable but have questionable conceptual validity, furthering the need to conduct more tests than only confirming their proposed structures.

5.3.2 Aim 4.2: Do semantically similar sub-scales behave statistically similar?

This aim explored if semantically similar sub-scales can be considered the same. Whilst it is possible to compare questionnaires and their sub-scales at face value (such as the work of Hamari & Tuunanen (2014)), little empirical testing has been done to confirm that semantic comparisons do indeed reflect the statistical nature of the concepts. This relates to the jingle-jangle fallacy first outlined by Marsh (1994). When comparing sub-scales, it is possible to falsely believe two sub-scales measure the same concept because they share the same name (jingle), and it is also possible to believe two sub-scales are unrelated concepts because they do not (jangle). When comparing sub-scales by name alone, the likelihood of either a jingle or jangle fallacy occurring is high, as it is not possible to know their true convergence/divergence without statistical analysis. In this study, both jingle and jangle have been observed. Challenge sub-scales share the same name, but behave different statistically. In the 177-item factor analysis, many items from different sub-scales loaded together, such as Aesthetic items and Discovery items in the Exploration factor. Therefore, motivation sub-scales appear similarly prone to the jingle-jangle fallacy, which means only considering sub-scales names is likely not enough to choose the right sub-scale.

In this analysis, Customisation was the only concept that appears to be one single factor. Escapism did also show evidence of 1 factor, but also contained 2 distinct sub-factors; escaping *from* and escaping *to*. Challenge had 3 separate factors, each unrelated to the other, which represented the original sub-scales the items came from. This indicates the motivation for challenge is as complex as the experience of it. For example, Denisova, Cairns, Guckelsberger, & Zendle (2020) found the experience of perceived challenge has four sub-types; cognitive, performative, emotional, and decision-making. It is consequently important to consider what type of challenge is being measured by a questionnaire, as it cannot be assumed to be the same underlying concept.

Therefore, sub-scales cannot be considered to measure the same concept based on name alone. The jingle-jangle fallacy outlined in Marsh (1994) is observed in motivation questionnaires, undermining their conceptual validity. This means that, even if a sub-scale is reliable and has a strong model fit, it can still be unclear what it is in fact measuring.

5.3.3 Aim 4.3: What is the extent of conceptual overlap between all items?

An EFA run on the 177 items indicated a 19-factor solution, that summarises what concepts can currently be measured from the questionnaires in use. Each is now discussed in terms of what its composition tells us about the concept, what is already known about it in the literature, and what it tells us about the field as a whole.

The first factor, **Transportation Immersion**, contains 7 items where only 1 loads above 0.60. It has formed from several sub-scales across questionnaires, and is players who enjoy feeling like they are 'in' the gameworld. Only items from 2 of the 4 scales named 'Immersion' loaded here, suggesting the concept of immersion as a motivation is more nuanced than currently measured by these questionnaires. No Immersion items from VGPu loaded here, though 2 items from PENS, 1 from VKS, and 1 from IMG did, indicating this concept shows some overlap across Psychology and Games research. This factor is a specific type of immersion, discussed by Jennett et al. (2008). The authors found whilst Immersion can be seen as a unified concept, it has distinct sub-components. One of these is Transportation; the extent to which players feel they are 'in' a game rather than the real world. This is similar to Presence, where players feel they exist in the game world (Tamborini & Skalski, 2006). This factor understandably correlated with *Escape To*, as entering into a gameworld may make players feel more connected to it. The fact it is the only Immersion factor is interesting however, implying it is the most coherent sub-component currently measured by these questionnaires. Overall, this factor highlights players enjoy feeling Immersion, though the current measurement is specific to transportation into a game.

The second factor, **Competence**, contains 10 items where 5 items loaded over 0.60. Items address players feeling good about their gaming skills, and by extension think they are good at playing them. Competence has been widely studied, as a player's confidence is seen as key to their enjoyment. For example, players enjoy a gaming experience more if they also feel competent in their playing abilities (Ryan, Rigby, & Przybylski, 2006). Because of this, Competence has been measured by a few separate questionnaires, such as PENS, IMG, and VGPu (in the form of the Generalised Game Self Efficacy sub-scale). Interestingly, each item on this factor above 0.60 came only from PENS and VGPu, with no item from the IMG Competence sub-scale. This is especially interesting as IMG was inspired by PENS, so it was expected they would share similarities in loading. 2 of the IMG Competence items instead load into the *Challenge* factor, and the item 'I play to make progress and to achieve objectives' loaded onto its own single-item factor. Therefore, the IMG Competence sub-scale does not measure the same concept of Competence as PENS. The PENS Competence sub-scale instead shows more similarity to the VGPu sub-scale Generalised Game Self Efficacy. This factor has a medium correlation with the *Challenge* factor at 0.54, the strongest correlation found in this analysis. This is understandable, as players who wish to feel good about their skills also may seek a way to push the boundary of them, which in turn may give higher feelings of competence. Overall, this factor highlights the similarities between the PENS and VGPu Competence sub-scales, and captures players who enjoy games because they wish to feel good about their skills.

The third factor, **Completionsim**, contains 13 items where 9 loaded over 0.60. These items assess whether players seek to engage with all tasks and achievements available in games. Specifically, the language around '100%' is common here, implying it is not simply a desire to engage with a lot of content, but to interact with *everything* a game offers. The items mostly come from Achiever from BrainHex, Grinding/Completion from GAMES, and Goal from Tondello. In fact, all items from these sub-scales loaded here except 1 from GAMES and 2 from Tondello. The item 'I feel stressed if I do not complete all the tasks in a game' from Tondello did load weakly onto this factor, but also weakly onto the *Emotional Reaction* factor, and so was dropped. The other Tondello item 'I like finishing quests' instead loaded onto *I Like Games*. The item 'I don't mind grinding for an hour or two to get an item I want' from GAMES did not load anywhere above 0.30. Interestingly, the names of each of original sub-scales would not imply they are so closely related — Achiever, Grinding/Completion, and Goal, sound like similar yet distinct concepts. This shows it can be difficult to semantically compare sub-scales, as naming conventions can obscure similarities. Overall, the fact these sub-scales load together is understandable, as the items all assess the concept of seeking to complete objectives. Although they are named differently, they address the same underlying concept. The level of commitment a player has to game content has been discussed before, and is mostly associated with a need to achieve. Specifically, players are motivated by the rewards given by a game, such as achievements (Cruz, Hanus, & Fox, 2017). Therefore, this factor shows players can be motivated to achieve the objectives available.

The fourth factor, **Escape From**, has 7 items with 5 loading above 0.60. This factor specifically discusses using games to leave some aspect of real life behind, and so is about escaping from some-

thing. All items originate from Escapism sub-scales, except 'I enjoy the feeling of escape from real life through games' from the VKS Immersion sub-scale. This is not surprising however, as the item does contains the phrase 'escape from real life.' 4 items from Escapism by GAMES loaded here, with the other 2 loading onto the *Escape To* factor. One item is missing from the Yee Escapism sub-scale, 'I often play to relax from the day's work,' that loaded onto the *I Like Games* factor. This makes sense at it relates to relaxing, a weakly related form of escaping. This factor showed a medium correlated with *Escape To* at 0.49, the other Escapism factor identified in this analysis. The relationship is unsurprising, as when the Escapism sub-scales were discussed in Section 5.2.2 there were strong correlations. It also makes conceptual sense, as escaping from something and escaping into a game involve similar motivations. However, they were distinct enough to form separate concepts, meaning they should be considered as related but unique types of escapism. There was also a weak correlation with *Games as Life* at 0.31, again highlighting players may use games to escape because it makes them feel better about themselves. Interestingly, the *Escape To* factor showed little correlation to *Games as Life* at 0.08. Using games as an escape has been noted before, as games can help people to alleviate their real-life problems. Players sometimes use games to cope with real-life stressful events, or to help understand their own feelings towards a topic (Iacovides & Mekler, 2019). Therefore, this factor demonstrates players can use games as an escape from real life, potentially to help improve mood.

The fifth factor, **Exploration**, contains 6 items where 3 loaded above 0.60. It was created from 3 sub-scales; Discovery by Yee, Seeker by BrainHex, and Aesthetic by Tondello. Further, all items from Seeker load here, and half of Discovery. This factor relates to players exploring game environments, and finding enjoyment from doing so. Interestingly, no items from Autonomy/Exploration by GAMES loaded here, despite the name, as all 5 items loaded instead onto *Play My Way*. When considering the items this is not surprising — they assess control over actions (the 'Autonomy' of Autonomy/Exploration), and have little to do with exploring. It does however again highlight the need to carefully assess items within a sub-scale, as the name may not accurately capture what items measure. Exploration is considered an important behaviour in certain games. Open world games are especially known for this ability, as seen in previous chapters. Indeed, the definition of open world games is inherently tied to this ability; Szymanezyk, Dickinson, & Duckett (2011) defines them as "the use of large open worlds with a distinct gameplay focus on player exploration and discovery". Overall, this factor shows players wish to explore environments within games. However, as this factor only exists by combining sub-scales, it is currently difficult to assess as a trait in players. No one sub-scale is currently apt to capture Exploration, meaning further work is needed to understand the concept.

The sixth factor, **I Like Games**, contains 12 items where 4 items loaded over 0.60. The wording of many items relates to enjoying games, and shows a high degree of overlap. This indicates the structure may be bloated, where many similar items have been repeated without providing extra nuance. The items with lower loadings provide more interesting variance, such as 'I play video games because they excite me' (Arousal, Sherry) that loaded at 0.422. This item shows the enjoyment of games may relate to the feeling of excitement. Interestingly, there are also items that relate to relaxing, such as 'I play because playing games is relaxing' (Fun, IMG) that loaded at 0.375. It is possible highly loaded items with very similar wordings may be affecting this factor, but it is also possible players enjoy games in a variety of ways, with different intentions. Overall, this factor is not surprising, as players do indeed enjoy games. This topic has been widely studied in the past, as games are, after all, a form of entertainment (Vorderer, Bryant, Pieper, & Weber, 2006). Therefore, this factor does not add new knowledge to the field, but reaffirms players can be motivated to play because they are fun. It also highlights similarities in item wording across various questionnaires.

The seventh factor, **Customisation**, contains 9 items where all but two load above 0.60. All items from the original Yee and GAMES Customisation sub-scales loaded here, which was expected due to the similar findings in Section 5.2.2. Apart from the last 2 items, this factor exclusively refers to customising the player character. The items mention both time spent customising and what players choose to customise (e.g., outfit, appearance). Research has focused on player customisation in games previously, as they are a number of motivations for players to do so (Lin & Wang, 2014). The ability to customise a character is positively related to the experience of flow (Soutter & Hitchens, 2016), as well as enjoyment (Trepte & Reinecke, 2010). Therefore this factor is unsurprising, and reflects a player's

desire to control how they appear in games.

The eighth factor, **Smarten**, contains 5 items where all but one loaded above 0.60. All items from Smarty Pants by Trojan loaded here, 2 of the 3 from Identified Regulation by GAMS, and a single item from VKS Immersion sub-scale. The factor mostly reflects improving skills and learning beyond the game environment, which has been studied in the literature before, as whether games can transfer skills to other domains, or can enhance skills, has been of interest. For example, due to the socialising present in multiplayer online games such as *World of Warcraft* (2004), players could use these environments to learn key social skills, such as cooperation and group dynamics (Ducheneaut & Moore, 2005). There is also evidence that those who play action games show improved visual skills outside of games (Green & Bavelier, 2003). Therefore, this factor shows items that assess how players view games as places to improve themselves via learning and developing skills.

The ninth factor, **I Like Stories**, consists of 14 items where 10 loaded above 0.60. Items primarily come from Story by GAMES and Narrative by Tondello. Indeed, all of the Narrative sub-scale loaded here, as well as 7 from GAMES' original 11, and both items of Story Driven by Trojan. However, the factor appears bloated, with little nuance of any specific aspect of narratives. This may indicate the field has keenly focused on this concept at a general level, resulting in numerous sub-scales with little depth. The concept of appreciating game narratives is not new, and has been discussed at length. Adding narratives to previously non-narrative games can increase enjoyment and presence (Schneider, Lang, Shin, & Bradley, 2004), and players typically enjoy complex, branching narratives moreso than 'linear' ones (Moser & Fang, 2015). Therefore, this factor does not add new understanding, but does highlight a notable yet shallow focus on asking players about their feelings towards stories.

The tenth factor, **Play My Way**, contains 7 items with two loaded above 0.60. The entirety of the Autonomy/Exploration of GAMES sub-scale can be found here, along with two Autonomy items from PENS. Interestingly, no items from the IMG Autonomy sub-scale load here, despite being based on PENS. Paired with the fact most of this sub-scale loaded weakly (5 out of 7 item below 0.60), this raises the question how clearly 'autonomy' is measured by the current questionnaires. Autonomy was expected to be a more cohesive concept, as it has been discussed extensively before. Indeed, 3 questionnaires studied here contained sub-scales related to Autonomy, highlighting its popularity. Self Determination Theory (SDT) for example states Autonomy is a key to the enjoyment of games, that games are particularly good at providing (Ryan, Rigby, & Przybylski, 2006). Autonomy, alongside a sense of control, is a good predictor of game enjoyment when customising characters, moreso than the attachment a player has to a character (Kim et al., 2015). It is therefore considered an important concept, but was relatively weak here — especially in comparison to other concepts equally discussed in the literature, such as *Challenge*. Furthermore, this factor did not show a strong correlation to the *Customisation* factor (r = -0.218), despite the association found by Kim et al. (2015). This suggests the concept of Autonomy may need further theoretical work. Overall, the items inform on how players wish to control how they play games, though does not seem particularly related to exploration as named by GAMES. More work may be needed to further explore how this concept is measured.

The eleventh factor, **Games as Life**, contains 8 items where 2 loaded above 0.60. The items relate to players finding games an important aspect of their lives, and something they actively seek out. Many items came from a variety of GAMS sub-scales, as well as 2 from the VKS Immersion sub-scale. It has been known that games are meaningful to players; they hold importance both in a person's culture and their identity (e.g., Muriel & Crawford (2018)). Therefore, this factor highlights that games are important to players, and is a motivation to play them.

The twelfth factor, **Forward Thinking**, contains 5 items where 2 loaded above 0.60. Most items originate from Mechanics by Yee, where all original items load here, and a single item from Completionist by Trojan. This factor discusses players 'meta-gaming' (a term coined by Garfield (2000)), where they consider their tactics by bringing in other experiences and strategies, sometimes before the playing has truly started. This concept of strategising has been discussed in the past; Donaldson (2017) explores how the ability to 'metagame' can help expert players in *League of Legends* (2009), a competitive multiplayer game. Players who score highly look beyond the game to bring in information that will give them an 'edge', and so makes sense this factor weakly correlated with both *Competence* and *Challenge* due to overlaps in wishing to achieve and to perform optimally. Therefore, this

factor highlights how players wish to think tactically about their play, using the mechanics of a game to achieve the best outcome.

The thirteenth factor, **Roleplaying**, consists of 6 items where only 1 item loaded above 0.60. Three of the four Roleplaying sub-scale items from Yee are found here, along with items from three separate sub-scales. The Yee item 'I enjoy being immersed in a fantasy world' instead loaded onto *Transportation Immersion*. Roleplaying and embodying characters has been studied extensively in the past. Players typically form attachments by roleplaying a character, as they can embody their actions (e.g., Lewis, Weber, & Bowman (2008)). Roleplaying can also allow players to reflect on their own identity (Bowman, 2010), by experimenting with different aspects of themselves. However, this sub-scale consists of mainly low-loaded items, suggesting more work is needed to increase its measurability.

The fourteenth factor, **Escape To**, contains 9 items, with 5 loaded above 0.60. The fact items load together is unsurprising, as many are repeated items — many questionnaires were inspired from Sherry, and so used the same items in their sub-scales. Many of the items found here come from Escapism sub-scales. For example, all items of Fantasy by Sherry loaded here, except for 'I enjoy the excitement of assuming an alter ego in a game' that instead loaded onto *Roleplaying* (an understandable loading), as well as both items from Escapist by Trojan. Other items came from sub-scales such as 2 of 3 items of Autonomy by IMG (the final item 'I play because in games I can make meaningful choices' loaded onto no other factors). Escape To was created from a variety of sub-scales, in contrast to *Escape From* which was formed solely from 2 Escapism sub-scales (and 1 item from Immersion by VKS). This makes it currently a less defined concept, potentially because engaging with a game and the reason for doing so are not always distinct in questions asked of players. A player could enjoy embodying a character, and therefore be asked a question from an Immersion sub-scale such as VKS. However, if they are doing so because they wish to escape into a game, the reason is overlooked and treated only as a question of Immersion. Overall, Escape To indicates players engage with activities in games that do not occur in real life, and implies they wish to experience something different and/or unique. This could be done in several ways, such as taking on the role of a character, or simply being a part of a fantasy world that provides a new life experience. However, the distinction between the types of Escapism found in this study is not deeply explored in the literature. The two are typically discussed in close proximity to one another, such as Lazarro (2004) who explains players can play games to escape the real world, as well as experience new things they could not do otherwise do so (e.g., flying). Despite this, the conceptual difference is noticeable; whilst escaping *from* something implies a negative association with real life, this is not inherent for escape *to*. Players can experience new things purely for the enjoyment it brings, and so 'escape' the real world in search of them. This may explain why *Roleplaying* and *Transportation Immersion* factors correlated stronger with Escape To and not *Escape From*. The distinction indicates a need to look more closely at the separation of escapism, to understand how and when they differ. Overall, there appears to be two distinct instances of Escapism that highlights how people can escape from a negative experience in their real life, or experience something new and different within a game. This distinction may help explain how games affect players differently, as it may account for some of the variance found in Escapism-focused studies.

The fifteenth factor, **Challenge**, contains 10 items where 6 loaded above 0.60. The majority of items come from the Challenge sub-scale by Tondello (all 5), with 2 items from the Competence sub-scale by IMG, and the final 3 from a variety of BrainHex sub-scales. Notably, no other sub-scales named Challenge loaded onto this factor, a point previously discussed in the semantically-similar analysis. 2 items from Challenge by Sherry cross-loaded onto other factors, whilst the other 2 loaded onto no factors above 0.30. This is similar for the Challenge sub-scale from VKS, where two items cross-loaded elsewhere and the final item loaded nowhere. This further highlights how 'Challenge' is not a unified concept, and will require further defining. Challenge has been studied widely from a number of perspectives. An important distinction to make here is the difference between enjoying Challenge in games, and the experience of a Challenging game. The factor found here relates to the trait of enjoying Challenge, rather than the outcomes associated with experiencing Challenges (as explored by Denisova, Cairns, Guckelsberger, & Zendle (2020)). Work focused on trait Challenge is mostly associated with flow theory (Csikszentmihalyi & Csikszentmihalyi, 1992), which states players can achieve a state of flow when the game difficulty matches their current skill level. Because of this,

players with higher skill need more challenges to stay in flow and enjoy the game: higher skilled players experience greater flow with more difficult game settings, whereas lower skilled players do not (Jin, 2012). Therefore, Challenge here refers to players enjoying games that put their skill level to the test, and overcoming adversity. This factor also highlights the concept of Challenge must be considered more closely, as sub-scales measuring 'Challenge' are not interchangeable.

The sixteenth factor, **Strategic Thinking**, contains 3 items, however all cross-loaded above 0.30 with other factors. These items are two from the BrainHex Mastermind sub-scale ('I enjoy working out what to do on my own' and 'I enjoy devising a promising strategy when deciding what to try next'), and one from the Sherry Challenge sub-scale ('I enjoy finding new and creative ways to work through video games'). The factors all relate to players strategising in some way, and so the cross-loading is understandable — Strategic Thinking items cross-loaded with *Play My Way*, *Forward Thinking*, and *Challenge*. This makes the factor small and not a complete concept, though strong enough to exist above 0.30, unlike many items that did not load onto any factor. Strategic Thinking appears to be a sub-factor/related concept of players analysing their behaviour and formulating tactics to overcome game challenges. It will however need further investigation to understand how distinct it is.

The seventeenth factor, **Emotional Engagement**, contains 8 items where 3 loaded above 0.60. Many items originate from Presence/Immersion of PENS, though each item specifically relates to players feeling as though games engaged their emotions. This is not the same as *reacting* emotionally to in-game situations, a factor covered later in this discussion. Instead these items are specific to the feeling of emotional attachment, and how the game presents experiences that allow these feelings. Indeed, this factor showed correlations to other factors such as *I Like Stories* and *Transportation Immersion*, which is understandable as players are emotionally engaged by taking on the role of a character and being 'transported' into the game. Emotional Engagement shares links to Presence in the literature. Games can provide players with many emotional experiences from a range of sources, such as the Story, the Artwork, or the Game Environment (Frome, 2007). These emotional experiences can help keep players engaged, often by giving players a character to embody (Dickey, 2005). Overall, this factors highlights how players seek to feel engaged in games in an emotional sense.

The eighteenth factor, **Progression**, contains a single item; 'I play to make progress and to achieve objectives'. It comes from Competence by IMG, and refers to players wishing to progress in games. The loading is weak, but for a single factor to load onto itself is impressive, highlighting 'progression' is distinct enough to provide a unique variance in the model. There has been discussion in the literature around progression. Juul (2002) discusses the difference between games of Emergence and games of Progression, explaining that Progression games are a series of challenges for a player to complete. This progression helps keep players motivated, as it presents them with a series of tasks and a sense of achievement when completed. The enjoyment of completing tasks in sequence appears separate to simply achieving objectives overall, covered in the *Completionism* factor. Therefore, this factor highlights how Progression is a distinct concept not specifically measured in the questionnaires sampled. It would require further study before this is possible, as only 1 item out of 177 captured this concept.

The final factor, **Emotional Reaction**, has 5 items where 2 loaded above 0.60. These items came from Achievement by VKS, with one item from Survivor by BrainHex and 1 Presence/Immersion by PENS. These items refer to general emotional reactions, such as pride, relief, and the feeling of adrenaline. This implies the original VKS sub-scale is fairly unique, as all items loaded together with only a few items from other sub-scales. However, 'Achievement' is perhaps not the best name, as these items did not load with other similarly named sub-scales (such as Achiever from BrainHex, or Goal from Tondello). This factor is similar to *Emotional Engagement*, but it is not related to being engaged. Instead, this factor represents the feelings a game elicits, the emotional consequences of playing, which can be both positive or negative (e.g., stressed vs relieved). Whilst there was a correlation between the factors ($r = 0.115$) this is weak, furthering their distinction. Reacting to in-game scenarios emotionally has been studied in the past, as games can cause similar emotional reactions as though they are happening in real-life. Usually, this is related to the moral decision-making literature, which shows people react the same to moral dilemmas in games as they do in real-life (Weaver & Lewis, 2012). Emotional reactions may influence the experience of a game in a similar way to being emotionally engaged. Therefore, this factor highlights how reacting to emotional events is not the

same as engaging with them, as the process of reacting may imply a reflection process.

In summary, the above 19 factors highlight what concepts have been studied in the field, many of which have been observed previously. To see them here provides further evidence to their existence, such as how players enjoy narratives and customising their characters. However, there are also examples of concepts that have been understudied, or currently lack nuance. For example, there are potentially two types of Escapism, which at current cannot accurately be assessed with the questionnaires in use. Another example is Progression, which is a distinct enough concept to load by itself, but has not been extensively studied or measured. This analysis also highlights that, just because a sub-scale is unreliable does not mean its items are poorly made. Of the 177 items, only 20 did not load onto any items, and so many were salvaged and could provide important insights by allowing each item to form clearer and stronger structures. From this, the state of the field can be observed, highlighting what concepts are currently studied, understudied, and in need of further nuance.

5.3.4 Relation to Previous Studies

The previous chapter indicated Tondello and GAMES were the most reliable and structurally sound questionnaires. However, there are concerns for their conceptual and comparative validity. For Tondello, the Challenge sub-scale was statistically distinct from two other Challenge sub-scales, making it unclear what it actually measures. The items from this sub-scale did load onto a new factor in the final 177-item analysis, indicating they assess a unique concept, but it is not clear what it is at this time. For GAMES, the Story sub-scale was found to contain at least two sub-factors, which alters what the sub-scale is in fact measuring. Furthermore, its items formed a variety of factors in the 177-item analysis; sometimes in expected ways (such as Story items loading into the I Like Stories factor), but also in unexpected ways (such as no Autonomy/Exploration items loading into the Exploration factor). Therefore, whilst Tondello and GAMES may be the most structurally sound, they are not conceptually coherent to a degree that gives confidence in what they are actually measuring.

5.3.5 Relation to the Literature

The previous sections have situated findings in the literature, but this section considers the act of comparing questionnaires in this way overall. There are overall few examples of statistical overlap testing between motivation questionnaires. The synthesis of player types conducted by Hamari & Tuunanen (2014) is the closest large scale comparison of motivation questionnaires, though it was not a statistical comparison. Typically, research comparing questionnaires statistically focuses on a smaller sub-set centering around a singular concept, such as different player experience questionnaires (Denisova, Nordin, & Cairns, 2016; Brühlmann & Schmid, 2015). Other examples include re-evaluations of specific questionnaires, such as Johnson et al. (2018) who explored the factor structure of PENS and found similar structural weaknesses as this work. However, whilst Johnson et al. (2018) also found discrepancies in the factor structure of PENS, in that some sub-scale items cross-loaded onto other sub-scales, they did not find any sub-factors. Therefore, this work has highlighted the need to extend current practices to include more widespread statistical overlap testing when considering conceptual validity of motivation questionnaires.

5.3.6 Limitations

There are a number of limitations with this work. Firstly, this work uses 11 questionnaires, though there are certainly more available and in use in the literature (at least 22 as identified by Study 3). These 11 were chosen to give an overview of the field, though it may be that those not included are more structurally sound and/or assess distinct concepts. As these are not included, they cannot be discussed.

Secondly, to reduce the number of items, all sub-scales relating to social interactions with other players were removed. This was a large number of items, and social behaviours within games is a widely studied area. As not all games involve others, these sub-scales were removed. Therefore, no

motivation to play influenced by social factors has been analysed, so there is no conclusion to be made of the structure of these concepts. However, as the focus of this thesis is on open world games, which are commonly single-player experiences, it was not as vital to include such sub-scales.

Thirdly, a number of research decisions were made to run such a study, including the rewording of certain items and and the standardisation of Likert points. Whilst this is common practice both in the field and in other comparison works (Denisova et al. (2016)), it does mean a typical comparison of reliability and validity cannot be gained from this analysis. Instead, this study explored the general structure of the questionnaires, as a prelude to exploring the underlying concepts they measure. Future work could replicate this work without taking such decisions, however the practicality of such a task would likely result in different decisions being taken that equally affects comparability.

5.4 Summary

Overall, there are many concerns for both construct and comparative validity in currently available motivation questionnaires. In terms of construct validity, the existence of sub-factors within sub-scales indicates not all sub-scale structures are apt to capture their proposed concept. For comparative validity, similarly named sub-scales do not always measure the same underlying concept, making it difficult to choose the best sub-scale of a concept from the selection currently available.

These findings highlight more questionnaires is not necessarily better. There is high overlap in sub-scales and the concepts they purport to measure, but no one current questionnaire is apt to measure them. The existence of sub-factors within sub-scales, and the unpredictability in statistical similarity between semantically similar sub-scales, raises the question of what sub-scales are actually measuring. Furthermore, if there are indeed upwards of 19 factors of motivation (and almost certainly more not covered in this analysis), this highlights a deeper problem with the use of such questionnaires for research. If all 19 factors are able to vary in each individual player, the common ternary split of players into high, indifferent and low on each factor would lead to 3^{19} (approximately 1.2bn) distinct partitions of players into 'types'. Even the simpler (and arguably naive) binary split would lead to approximately 0.5M distinct player categories. This would likely make any exploratory approach to individual player differences futile, and open to spurious significant findings. Certainly, an atheoretical approach seems likely either to fail or find false positives in a morass of disinterested significance tests. Therefore, no one questionnaire is conceptually sound enough to understand the experiences of open world game players in this thesis. Using any currently available motivation questionnaire would involve using an instrument that is either unreliable or has questionable conceptual validity.

5.4.1 Relation to Following Studies

Combining the findings of Study 3 and 4, it is not possible to use motivation as a framework for understanding the open world experience. Motivation as it is currently measured contains too many reliability and conceptual validity concerns that cannot be easily mitigated in this thesis. Therefore, this thesis will consider the use of goals to understand the open world experience.

Chapter 6

What Goals and Actions Exist in Open World Games?

"There is always choice. We say there is no choice only to comfort ourselves with the decision we have already made."
— Lady Morella, Babylon 5

In the previous chapter, motivation was found to be an inappropriate way to understand the open world experience, due to its conceptual confusion and lack of measurement rigour. Therefore, the feasibility of goals as a lens for action selection is now considered. As players can do almost anything in the open world, it is likely they have goals of play they bring to the game. It is consequently not enough to only consider the goal of play given by the game (i.e., to win), as open world games allow for more than one way to play and to experience them. By understanding what goals players bring to the game, it may be possible to understand what experiences they are likely to seek out and have in the game. Further, goals should (if open world players have them) guide players to select certain sequences of actions, which in turn lead to contextually-situated experiences. Differences both within and between open world players could therefore be explained by differing goals — for example, players with different goals may select different actions, and a player may change their goal between (or even within) play sessions.

If the experience of an open world game (both overall and contextually-situated) is driven by the goals of a player, and goals drive players to select actions, then goals provide the link between action selection and the open world experience. For example, players with a goal to explore may spend their time walking across the landscape (rather than utilising a fast travel function), leading them to contextually-situated experiences involving walking and discovering new content. If the player was successful in achieving this (e.g., the game did not prevent them from walking somewhere), or had a number of positive contextually-situated experiences in pursuit of their explore goal (e.g., the discovery of an interesting monument), then the player may rate the overall experience as immersive and fun. Therefore, players seek out contextually-situated experiences in the game, by selecting specific actions, related to specific player goals. Consequently, the pursuit of goals and the successfulness of this pursuit may be the metric players use to rate their open world experience — the higher the ease in goal pursuit, the better the experience. Viewing gameplay in this way opens up the possibility to understand how action selection enables the open world experience, as well as why (i.e., why players choose certain goals and by extension certain actions to fulfil said goals).

However, it is currently unclear what the mapping between player action selection and goals looks like, making it unclear how both relate to the experiences players have. Players could choose similar actions for different goals (such as collecting fruit for potion making vs for selling), or have similar goals with vastly different associated actions (such as wanting to defeat a boss by retrieving a powerful weapon vs collecting potions/supplies to increase health). It is also likely that players have more than one goal for a play session, which may even be active at the same time. Consequently, it is unclear how goals relate to one another, as they may not be mutually exclusive but instead influence each other.

As discussed in the literature review Section 2.5.1, the Goals-Means-Actions framework indicates a hierarchical nature of goals and their influence of actions taken. It is therefore expected that players will describe their behaviour within this hierarchy; the reason for selecting an action should relate to a means, a sub-goal, and an associated overall goal. If true, applying this framework to how players report their open world gaming behaviours may help to illuminate the connections both within goals and between goals and actions. From here, it may be possible to connect action selection and player goals to the open world experience.

The current chapter discusses the results of Study 5, which used secondary data of players describing how they played open world games in online forum posts. As it is unclear the extent to which players discuss goal-directed behaviour in relation to the open world experience, it was important to observe if this is true in a naturalistic setting. For this reason, similarly to Study 1, secondary data is used to explore how players discuss their choice of actions within open world games. Unlike Study 1 however, the place where players are likely to discuss their behaviours and reasons behind them are forum posts, such as on *Reddit*. On such forums, players can pose questions and learn how other players play open world games. Such posts may consequently reveal what kinds of goals players have, and the actions they take to accomplish them. However, because these discussions happen between players rather than directed at a researcher, results should reflect more natural discussions on how players describe their own behaviours. Study 5 therefore uses *Reddit* forum posts of players discussing behaviours in open world games as a way to explore if players talk in terms of goals and actions, as expected from the literature discussed in Section 2.5.

However, found data means it is not possible to truly know ahead of time what can be learnt, as it relies solely on what players decide to mention amongst themselves. Unlike previous chapters, save for investigating the presence of goals in how players communicate their intentions to other players, it was not possible to create specific research questions before data analysis had begun. Instead, exploratory questions were conceived based on the literature review and previous studies in this thesis centred on understanding how action selection relates to player goals. These built on top of one another and were refined during data analysis itself, and are as follows:

1. Do players discuss goals in relation to their choices (i.e, their actions?)
2. If so, what goals do players have within the open world experiences?
3. How do goals relate to one another?
4. How do goals and actions relate to one another?

Overall, it was found players do use goals to describe their behaviour, of which there are numerous types a player may have. These goals are frequently mentioned in combination, indicating players do not always have a 'singular' goal of play, but instead are driven by an interconnected collection of goals that influence one another. Players also relate these goals to their actions in numerous ways, where it is possible to identify sequences of actions completed in pursuit of specific goals. Consequently, it is possible to conclude that goals are an appropriate lens to understand actions taken in open world experiences, where action sequences can be related both to goals and the subsequent experiences players have.

6.1 Method

To find appropriate forum posts discussing behaviours taken in open world experiences, the forum website *Reddit* was searched. *Reddit* was chosen as it is a website known for discussing games and player's opinions of them, as well as having been used in previous research (such as Zendle & Cairns (2018)). The search term 'title:"open world" AND (game OR games) AND (play OR playing)' was initially used to find discussion posts. Due to Reddit's limits on post retrieval, this produced 220 results, many of which were not related to the research questions (such as players discussing new game releases, or talking about a specific gaming experience). To aid in data collection, the search term

'AND ("how to" OR "how do")' was added, to collect further results (adding a further 226 threads to the search). 13 threads were duplicated across the searches and so were removed, leaving 433. Data exclusion steps for these 433 threads are shown in Table 6.1.

Table 6.1: Data exclusion steps to select the Reddit threads for data analysis.

Step	Thread Count
Initial	433
No Specific Games (Title)	249
No Game Ideas	143
No Developer Questions	109
No 'Optimal' Play	101
No Dungeons & Dragons	77
No Wider Impacts	38
No Specific Games (Forums)	14
More Than 10 Comments	7
Final Count	**7**

Commonly, threads existed to discuss specific gaming experiences, and to share opinions on their designs. Such discussions were excluded, though making a reference to an example was permitted (e.g., 'games like Skyrim'), leaving 249 threads. Next, threads that suggested game ideas or were seeking new games to play were removed, leaving 143 threads. After, threads asking questions on how open world games are designed/developed were removed (leaving 109), as well as threads discussing what is the most 'optimal' way to play or how to engage with the open world game type generally (leaving 101). Threads relating to story prompts and playing *Dungeons & Dragons* (1974) were removed (leaving 77 threads), followed by threads asking how playing open world games effected their wider lives, such as relating to burnout (leaving 38). These 38 threads were then inspected to see what types of comments players were leaving within them. Many were found to be discussing specific gaming experiences that was not indicated in the title itself, such as when the thread was located within a forum like r/Witcher, where players may not have felt the need to specify. Removing such threads left 14 threads, with a varying amount of comments contained within them. As each thread asked similar yet distinct questions of players, only threads with more than 10 comments were selected for analysis, to provide more cohesion in the comments made. Therefore, 7 threads were selected for a total of 148 comments. However, not all comments provided useful data for analysis, such as unrelated responses (i.e., 'with a controller') or replies from the original poster. On removal of these comments, 106 remained (72% of comments).

As Study 5 consists of multiple exploratory research questions, a different analytic approach was needed for each. Due to the exploratory nature of the analyses, it is not always possible to have a clear separation between the methods and results. The following subsections describe how the analyses were conducted, whilst the results focus on what was learnt from this exploration of the data.

6.1.1 Frequency of Goals

To explore what goals (if any) players mention when describing how they play open world games, a conceptual content analysis was performed (Krippendorff, 2018) using open coding, with each comment treated as an utterance that could have multiple goals present (similarly to Study 1). Any mention of why a player performed an activity (for example, denoted with 'because') was counted as a goal. Players frequently mentioned more than one goal per comment, and so these were also coded as long as the second goal was different than the first. For example, if the player mentioned a desire to complete side quests twice in the same comment, this was only counted as one goal. To assess the frequency of goal mentions, the number of comments that contained at least one goal was analysed.

6.1.2 Types of Goals

To answer the second research aim, goals needed to be assigned a type. After a first pass through the identified goals, 146 goal type codes were generated. To reduce the number of goal types, they were initially grouped into 29 categories then reapplied to the data to assess their fit. When applied in the second coding round, categories were further merged together to reduce the number whilst remaining conceptually different, resulting in 13 goal types. Applying these 13 goals back to the data as a third pass indicated no new changes needed making to the categories.

At this stage, it became clear the 13 goal types reflected differing levels of abstraction as to why a player would pursue a certain activity, and as such were not always directly comparable to one another. If goals are not comparable to one another, it becomes difficult to understand how they individually would influence the actions a player may take to achieve them. To resolve this, the 13 goal types were categorised into a 3 meta-goal type hierarchy, based on their level of specificity (e.g., the more vague and encompassing the goal, the higher in the hierarchy). The hierarchy followed the literature on the Goals-Means-Actions framework discussed in Section 2.5.1, where player goals were discussed as Overarching goals, the Means to pursue these goals, and the Actionable goals they pursed to accomplish them. Following this, Goals would flow into the specific Tasks a players could do to achieve them (which, in turn, could have Means and Actions), such as walking to a town. Each goal and meta-goal was then counted to assess their relative frequency.

6.1.3 How Goals Relate to One Another

As goals were found to be hierarchical, and also frequently mentioned together within comments, it became apparent there were relationships between goals worth exploring (research aim 3; how do goals relate to one another). If goals influence one another, this may in turn change how they relate to the actions players take in games to achieve them, and make it more difficult to map goals to actions overall. To explore the relationships between goals, a hierarchical task analysis approach (HTA; French et al. (2019)) was combined with the Goals-Means-Actions framework. HTA reveals the sequence of how people perform tasks, whilst accounting for the different levels of abstraction involved (Goals, Sub-Goals, Plans, and Operations). In doing so, it is possible to display how different users perform a task within the same system, as they may have different Goals which explain why they perform specific actions. For open world games, there may be numerous goals to pursue as well as numerous plans and operations to accomplish them, even though it is the 'same' system. The HTA approach also shows similarities to the Goals-Means-Actions framework discussed in the Literature Review Section 2.5.1, where there are different levels of reasoning for why a person would pursue a specific action/operation.

Therefore, to answer research aim 3 a modified, exploratory HTA approach was used, which relied on the terminology of the Goals-Means-Actions framework. Table 6.2 illustrates the terminology used in this study. Goals share the same meaning within both frameworks, Plans refer to Means, and Operations are Actions. Sub-Goals were considered Actionable Goals, as players frequently discussed their sub-goals in terms of the types of activities they pursued (e.g., prioritising Side Quests). To distinguish Sub-Goals from Goals, this study refers to them as Overarching Goals. The level of Actions/Operations were not analysed at this stage, as research aim 3 explored how goals influence one another (as opposed to aim 4 which explores how goals relate to actions, described below). Goals, Actionable Goals, and Means were labelled according to the 3 Meta-Goal categories identified in the analysis for research aim 2.

When comments made reference to more than one Goal, these were linked together with an arrow to indicate influence. For example, one comment (T7, C7) stated the following; "take as many side tasks as possible [Actionable Goal; Side Quest Priority], to make the main story easier [Overarching Goal; Overpowered Goal]" (square brackets added to highlight the associated meta-goal and goal codes). Therefore, the flow of influence was described as Overarching Goal –> Actionable Goal for how Meta-Goals related to one another, and Overpowered Goal –> Side Quest Priority Goal for how goals related to one another. This analysis allowed for the linking of goals to one another (i.e.,

Table 6.2: Terminology used in Study 5, compared to those used in HTA and Kruglanski et al. (2018).

Terminology Used	HTA Equivalent	Goals-Means-Actions Equivalent
Overarching Goals	Goals	Goals
Actionable Goals	Sub-Goals	Sub-Goals
Means	Plans	Means
Actions	Operations	Actions

Overarching Goals fed into Means Goals, which in turn fed into Actionable Goals), and highlighted common patterns within goals in terms of how they influenced each other.

6.1.4 How Goals Relate to Actions

Up to this point, only what goals were present in comments and how they influenced each other was analysed. The analyses were therefore agnostic to goal sequences (how they change over time) as well as sequences of actions. It is therefore important to consider how players implement goals via their gameplay, to understand what actions a player may take to accomplish these goals, or how much this may differ between players. The aim of the final analysis was to explore what sequences of actions players selected in pursuit of their goals. In doing so, how action selection relates to player goals, and the experiences they had because of this, can be explored.

When players explained how they play open world games generally, and specifically distributing their time between the main quest and other activities, commenters would frequently explain the actions they engaged with. Of the original 106 comments, 72 provided a train of thought that linked actions together. As players sometimes mentioned action patterns in absence of goals, and goals in absence of actions, comments included in this analysis vary slightly to those in the above Sections. For example, the comment "I usually do side quests when I'm the area of the main story and don't progress the story till I've done all the mop up I can" (T3, C1) follows a specific pattern; when following a main quest (state 1, main quest), the player assesses the surrounding area for side quests (state 2, assess map). If there are side quests nearby they change task (state 3, side quests), before continuing after a condition is met (all side quests in the area are complete). An action sequence such as this provides insight into the relationship between actions and goals, as both *when* and *why* the goal shifts can be seen — *if* there are side quests nearby, the player would change goals; *else* they would remain on their original goal.

To understand gameplay discussed in comments such as the above example, there are two interrelated questions: why players select a new action, and why players change goals. To answer the former, a player may change actions in pursuit of the same goal, or switch to pursue a new one. To answer the latter, it is possible, and likely common, for players to switch goals during a play session, even at the Overarching Goal level. What actions lead to goal switches, and what this looks like in their action sequences, is therefore worth exploring to understand what experiences players have had.

To explore how sequences of actions relate to goals and goal switching behaviour, a diagram was designed inspired by Unified Modelling Language (UML) State diagrams. UML State diagrams are typically used in software engineering to model complex systems and user interactions, where boxes represent states and lines represent transitions (Samuel et al. (2008)). In the context of the current data, Tasks can be treated as 'states', as they are actions that do not change without an outside influence. Each transition arrow is accompanied by text that explains the condition needed in order for movement to occur. Highlighted boxes around certain task pathways indicates loops of behaviour, where a state is continuously pursued until a certain point (in this data, usually burnout/boredom). Such boxes would be considered the Goals of a player in the current dataset.

A UML State Diagram therefore extends the Hierarchical Task Analysis approach (HTA) discussed in research aim 3, where the components identified by HTA can be placed in a time-ordered sequence to identify the relationships between actions and goals. The creation of the diagram consequently became the method for describing what action sequences were present, and how they related

to the goals of players. To achieve such a diagram with the current data, the 72 comments were broken down into states — what actions the player currently pursues, and when they change. States did not contain a time component, as they are variable; some players may spend hours in a single state without moving (e.g., following the main quest), whilst others may spend only minutes (e.g., if on a break). Identified actions were then linked together into a flow diagram, as in a UML State diagram. To compare these across players, an abstraction was introduced; instead of labelling states as 'story mission' or 'explore', these were changed to 'current task'. Any time a change in action occurred, this state was linked to the state 'new task', along with the reason for change written along the arrow. This allowed comments to combine together, producing a state diagram that captured the actions trajectories of the players in the sample. However, whilst abstracting most actions was useful and aided cohesion, this was not always true; in some instances, undertaking the main quest was for a specific purpose (e.g., collecting more side quests). Therefore, abstracting to 'new task' would not be useful.

At this point, the diagram showed that players fairly frequently switch actions, and laid out there planned/past behaviours. However, it was unclear how this related back to their goals, and also could not account for action switches that were to change goals. Therefore two questions needed clarifying in the diagram; how to account for goals surrounding action sequences, as well as goal switches. To answer the first, it is possible to highlight certain loops of behaviour that relate to the comments about Goals. By analysing these loops, it was found these relate to the Goals identified in the content analysis. To answer the second, lines from the highlighted Goals to a state called 'mood assessment' were drawn. This reflected comments made in the data; for example, players changed goal because they were bored or frustrated, and in doing so could either leave the game or pursue a different goal. This was seen only on certain goals (typically the location-based do everything goal), though feasibly a player could perform this assessment from any goal, and so these lines were added to the state diagram. Figure 6.1 illustrates an example of how comments were iterated to create the final goal patterns, where the final diagram is presented in Section 6.2.4.

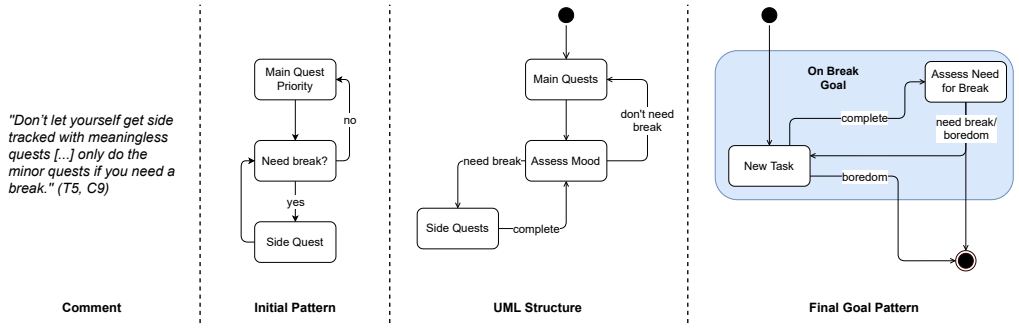


Figure 6.1: A diagram illustrating the iteration of creating an UML state diagram from comments.

6.2 Results

6.2.1 Frequency of Goals

When asked to explain how they play open world games generally, and specifically distributing their time between the main quest and other activities, players frequently explained the tasks they chose to engage with. In doing so, many players would also indicate a goal they had in mind whilst performing these actions. Of the 106 comments in the original dataset, 89 contained explicit references to goals (84%), where the average number of goals mentioned per comment was 1.93 (SD = 1.03) for a total of 172 goals. The 17 comments that did not include a reference to a goal instead described their opinions for a specific gaming experience they had had. For example, 10 comments disapproved of a quest structure/design they had encountered, 5 comments reflected on the structure

of open world games (such as offering advice to players on how to engage with the game style), and 2 comments only provided an action they performed in isolation (such as 'kill NPCs'). Many of these 17 comments did provide tasks they had pursued, but in absence of a stated goal (and so are analysed in Section 6.2.4).

In summary, it can be concluded that players frequently discuss goals in relation to their gameplay in open world experiences. Therefore, the next question to answer is what types of goals exist.

6.2.2 Types of Goals

In total, the 172 goals identified were categorised into 13 types of goals, where the top 3 most common accounted for 50% of the data (and the top 5 accounted for 75%). These 13 types were then sorted into 3 Meta Goals. How Meta Goals interact is discussed in Section 6.2.3.1. Figure 6.2 shows the distribution of goals and their associated Meta Goal.

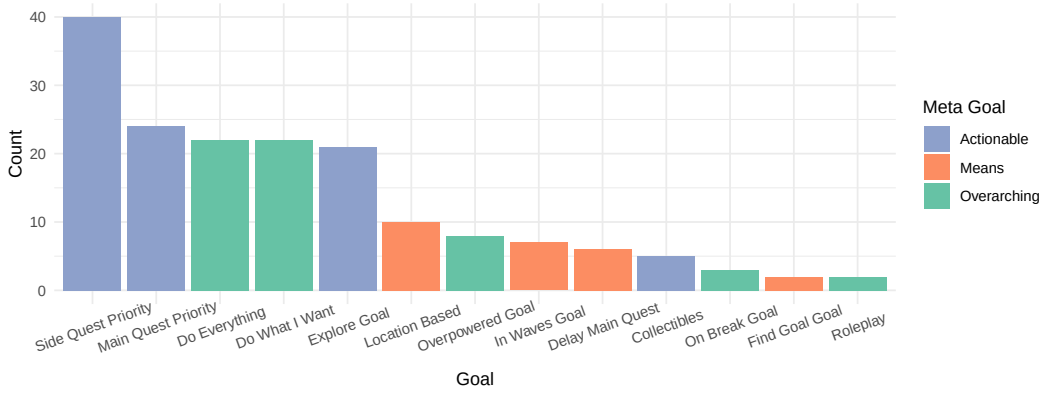


Figure 6.2: A histogram showing the types of goals players reported having, coloured by the meta goal they fall under.

Overall, many players made reference to Actionable Goals, most notably the prioritisation of main or side quests. This is potentially because many threads discussed the differences between side and main quests. It was also common for players to discuss Overarching Goals such as Do Everything and Do What I Want. Therefore, players mostly talk at the Actionable or Overarching goal level, with far fewer mentions of the Means by which to pursue them. The following sections describe the types of Goals found within these Meta Goals.

6.2.2.1 Overarching Goals

Of the 172 goals identified, 57 related to one of the 5 identified Overarching goals, accounting for 33% of utterances. Overarching Goals, as described in the Goals-Means-Actions framework, represent the highest level goals that are also the most vague in how they are executed whilst playing. The largest of these was tied between 'Do What I Want' and 'Do Everything', with 22 utterances each.

1. Do What I Want

The first category refers to players who wished to engage only with activities they found interesting/appealing in the moment (22 utterances, 13% of all utterances). Players with this goal would not typically plan in advance what to pursue, instead opting to engage with what they came across that seemed interesting; "decide what I want to do at the moment from there" (T7, C11). Interestingly, many comments mentioning this goal did so to highlight tasks players wished to *avoid*. Because players were given the freedom to choose activities, they would use this freedom to ignore content that did not interest them; "I just play through the main game and only do extra stuff if it's interesting" (T5, C3). Consequently, it was rare for players to state what they *did* engage with — if they did not

state things they avoided, responses were typically vague; "I usually just wing it and go with the flow" (T1, C6).

In summary, players with the Do What I Want Goal gave little explicit reasons for doing particular activities, and instead allowed themselves to be guided on interest. What they considered interesting and why was rarely discussed, other than to highlight tasks that were not of interest. As this goal is at the highest level in the hierarchy, it is naturally the vaguest, making the lack of specificity unsurprising.

2. Do Everything

The second category described a markedly different goal type. Players here were driven by the desire to complete every activity available, usually in relation to the side quests; "OCD style. I have to do every quest" (T3, C14). In contrast to the first category, the Do Everything Goal is specific and directed, rather than driving players to what interests them at the time. Sometimes this was due to the desire to avoid 'missing' content, as players feared completing the main quest would lock them out of side quests; "Do ALL side quests first because a lot of times they can get deactivated" (T2, C9).

Interestingly, a common downside to pursuing the Do Everything Goal was finding the approach tiring or leading players to 'burning out' of the activity, as it was a cognitively costly behaviour to pursue — "I always HAVE to do every side quest i find [...] to the point I get bored and stop playing" (T6, C4). Potentially, this pattern of play was so intensive (i.e., cognitively), or perhaps even too boring, that players would tire themselves out, leaving them more likely to leave the game. Therefore it is interesting that players willingly pursue this behaviour, if it has a tendency to leave them feeling drained and no longer enjoying the experience. The structure of the open world means the player has no need to choose this play pattern, and yet they do, even when they know it leads to negative affects. This highlights that sometimes a players desire (e.g., to complete all the side quests) can be so overbearing that it detracts from the experience, even when they themselves know they could stop at any time, as T6 C4 went on to explain; "even though I could literally just continue the [main quest]."

Overall, players with the Do Everything Goal were driven by the need to complete all aspects of the game/specific tasks, sometimes to the detriment of their own enjoyment. Of all the Goals found in this analysis, those with the desire to Do Everything would mention boredom/burnout most frequently.

3. Gain Power

The third largest overarching goal, Gain Power, described players who sought to increase their in-game abilities (8 utterances, 5%). Typically this was because they found the main quest too hard or did not wish to be challenged by it, and so wished to level themselves beyond what the main quest expected; "[complete multiple side quests] to make the main story easier" (T4, C5). Other reasons included a desire to unlock items that would enhance the player's abilities; "[complete side quests] which gets me the best gear first" (T4, C2). Therefore, players seek out items/experience points that will allow them to become more powerful, usually in a way that goes above and beyond the 'intended' experience the game provides; "I also like to go into the final boss fight [...] and be so OP I smear the boss against a wall" (T6, C6).

Overall, the Gain Power Goal relates to players who have the desire to amass experience points, weapons, and more. In doing so, players felt overpowered in some way, which could be achieved through picking up as many activities as possible in a 'grinding' fashion, or seeking out activities they knew would give them powerful gear.

4. On Break

The fourth Overarching goal was the 'On Break' Goal, where players actively choose activities separate from their previous goal (3 utterances, 2%). This led to the feeling of 'pausing' the original gameplay, without needing to leave the game entirely — a unique ability of the open world experience made possible by the flexibility of task engagement. Interestingly, players typically pursued this goal when they found the current task (usually the main quest) either too stimulating — "only do the minor quests if you need a break" (T5, C9) — or too boring; "if I start getting tired of the plot I wander off and look for something else" (T1, C7). Consequently, a goal can be pursued for a multitude of reasons,

even reasons that are directly opposing (e.g., to provide a rest vs to provide excitement). Further, the On Break Goal naturally implies players intend to return to their original goal at some point, suggesting a transitional nature.

Overall, the On Break Goal is a small category, but indicates how certain goals allow players to pause their current actions without leaving the game entirely. This is a typically unique feature of the open world experience, due to the vast variety of tasks available for players to choose from. Players are keen to achieve certain objectives, but also mindful that sometimes they need a change of pace in order to pursue them for extended periods of time.

5. Roleplay

The final Overarching Goal was Roleplay, where players were creating a narrative for their characters and acting in accordance to this self-made lore. This was one of the smallest categories found, with only 2 units of data (1%). These comments referred to the concept of immersion, as a way to increase enjoyment of the game; "immerse yourself and role play a little" (T5, C2). In doing so, the types of tasks and activities engaged with are selected as a reflection of the character being played — "invent the character you'd like to play, and pick up quests [they] would do" (T7, C8). Therefore, whilst a small category, this Goal indicates sometimes players have specific ways of selecting the tasks and activities, providing a way to evaluate anything they encounter against an intended model of play.

Summary

Overall, 5 Overarching Goals were identified from the comments. The Do What I Want vs Do Everything Goals were equally common, despite their opposing nature. This indicates players can have a multitude of Overarching Goals for their gameplay, which can vary substantially. Whilst presented individually, it is possible for the same player to have multiple Overarching Goals, even within the same gaming session. Some comments contained more than one Overarching Goal type (10 comments), with the most common combination jointly being Gain Power with Do What I Want (3 comments) and Do Everything (3 comments). A particularly interesting example was players who switch between the Do What I Want approach to Do Everything (2 comments); "I float between going to whatever draws my interest and completing literally everything in a given area before moving on" (T3, C10). This implies that, whilst these Goals are overarching in nature, they are not always static, and can fluctuate even in opposing directions. Further, this would also indicate Overarching Goals are unlikely to be an indication of a player 'type' due to their variability within players and their gameplay. The next section explores the Means Goals players deployed in pursuit of these Overarching Goals.

6.2.2.2 Means Goals

4 categories captured the ways in which players attempted to carry out a goal, accounting for 24 goals (15%). Consequently, Means Goals are typically active in players when they have simultaneous other Goals in mind (such as Overarching Goals). It is the smallest Meta Goal identified, which may reflect the Means to achieve higher, more abstract Goals is not readily discussed amongst players.

1. Location Based

The largest Means category refers to a pattern of play where players completed objectives in specific locations (10 goals, 6%). These objectives could be side quests, finding collectables, or simply exploring in a given area; "I always just try [...] and do the missions that are closest to me" (T1, C16). This typically meant players pursued tasks closest to the current position — "I sort quests by distance and always do whats closest" (T5, C4) — or pursuing tasks along the way they were already heading — "I will [...] see where the collectables are or where the quests and side missions go, then I'll go taking them following the map" (T1, C21). Another common technique was an attempt to 'clear' an area of all the objectives — "[...] completing literally everything in a given area before moving on" (T3, C10). This allowed players to complete a large quantity of side quests in a directed and systematic

fashion. Overall, the location of tasks was the deciding factor for this Means Goal, though how location was used varied between players. Whilst some players were guided by proximity (to themselves or to locations), others used location as a way to ensure no task was missed.

2. In Waves

The second largest Means was In Waves with 7 mentions (4%), where players explained how they spent their time between different types of quest. The Waves approach allowed players to pursue one task, and upon completion find a different type of task to pursue, in a repeating cycle. Usually this was in relation to completing side vs main quests. However, it could also refer to alternating between any type of activity, such as exploring vs questing; "It kinda goes in waves. I'll do a few story missions, then go out and explore [...] Rinse, repeat" (T6, C5). Players commented how this approach felt efficient and kept the experience engaging; "I do a little bit of both so that I feel like I'm killing two birds with one stone" (T1, C14). In Waves also helped protect against 'burnout'; "I used to play like [Location Based Goal] but I found it caused burnout and I wouldn't finish games. Now I alternate, main quest, side quest, main quest etc" (T3, C2). Overall, players who pursued differing goals In Waves frequently alternated between several Goals, as a way to keep the gameplay engaging and avoid burning out of the experience.

3. Delay Main Quest

The third largest Means was Delay Main Quest with 6 mentions (3%), referring to players who actively avoided the main quest in favour of pursuing other tasks; "I do everything asap and ignore the main quest" (T3, C5). It was not common for players to elaborate on what they chose to do besides the main quest, but they would mention the main quest to demonstrate they were not spending their time pursuing it; "I think I have around 200ish hours on Skyrim and I haven't started the main story on it" (T1, C5). In some ways, Delay Main Quest is an anti-goal, where players actively avoid an aspect of a game to allow them to experience other aspects of their choosing. The ability to do so is specific to the open world experience, where players must frequently choose between content, which would naturally lead to the avoidance of certain activities.

4. Find Goal

The final Means identified was Find Goal with 2 mentions (1%), a small category where players spent their time actively seeking out something to do; "If you ever run out of quests [...] go to a new town and talk around" (T7, C8). It is possible this Means is small as it is an uncommon goal to have — conversely, it may be that players do not feel it is important to share with others. It may also highlight that players are typically not at a loss for things to pursue in open world games, and so will rarely have a need to actively spend time finding a goal. Similarly to the On Break goal, Find Goal is somewhat transitional, and acts as a temporary goal before another more long-lasting goal is found.

Summary

Overall, the 4 Means highlight ways in which players attempt to achieve other goals. 2 of the categories (Location Based and In Waves) refer to how players set out to complete certain objectives, typically in reference to the main and side quests, whilst the other 2 are ways for players to achieve something else (Delay Main Quest and Find Goal). Unlike the Overarching Goals, it was uncommon for players to mention multiple Means in one comment; only one comment did so, which related the Location Based Goal to Find Goal. Therefore, players appear to select a specific Means Goal for achieving a given Overarching Goal, with little instances of changing between them. The following section explores the Actionable Goals players described.

6.2.2.3 Actionable Goals

The Actionable Goal level contains the highest number of goals (90, 52% of total goals). These goals closely tied to specific tasks players could take within the game, and so represent the most 'con-

crete' of behaviours (with Overarching Goals being the most abstract).

1. Side Quest

The largest Actionable Goal, and indeed largest category overall, was players prioritising Side Quests (40 goals, 23%). Players showed a strong preference for pursuing side quests, and spent a lot of their gameplay focused on them; "I literally do every single side quest" (T1, C9). There were a multitude of ways players engaged with side quests, ranging from a pure focus on completing them to finding them 'distracting'. The most commonly mentioned of these are explained below.

Some players preferred side quests to engaging with the main quest, and so prioritised them over the main story; "I usually do every side missions available before the main mission" (T1, C17). However, sometimes side quests could feel repetitive which led to boredom, as the same player added; "[...] unless I get bored of the side quests." Sometimes players enjoyed 'ticking off' side quests to complete everything in the game; "finish all the sides before continuing" (T4, C1). This completionism included the desire for XP/rewards — "side missions first in order of which gets me the best gear" (T4, C2) — or because they didn't want to 'miss' any of the story; "I've played too many rpg's where if you continue the main story you can sometimes make side quests inaccessible" (T2, C5).

Players rarely only completed side quests (9 out of 40), instead preferring to pursue them alongside other types of actions and goals; "I alternate, main quest, side quest, main quest etc" (T3, C2). Doing so helped alleviate the boredom/frustration of pursuing only one task; "I prefer to do a little of both [side and main quests], keeps things surprisingly fresh in my experience" (T4, C7). Other times players discussed how pursuing side quests were in fact a distraction, that they would not realise until some time after starting them; "I always start off a with the plan to do the story mode first. Then I get side tracked with a side mission and never stop doing side missions" (T2, C10). This is interesting, as some players completed side quests but would not realise until afterwards that it had not been their original intention.

Whilst side quests distracting players could be viewed negatively, the wording of players could also be neutral/accepting of the gameplay: "I got distracted by 1 or 2(or 40) side quests that took me all around the map, one of them actually brought back in path for the main one, played that for a bit, than got sidetracked again" (T7, C4). Therefore, the use of 'distraction,' despite a negative connotation, does not necessarily mean being distracted led to a negative play experience.

Overall, players engage with side quests in various ways, and show large variance in why players pursue them. Consequently there were various feelings around side quests, where some players enjoyed 'ticking them off', whilst others became annoyed at their repetitive nature, and others still saw them as a distraction (viewed both positively and negatively). The same Actionable Goals can therefore lead to vastly different evaluations, depending on how they are viewed and relate to a players' other goals. Furthermore, this also suggests players sometimes pursue side quests intentionally (i.e., they align with their current goals), whilst other times players become distracted by them. How tasks are pursued and their relation to goals is therefore complex, as players can sometimes be unaware of their actions.

2. Main Quest

The second largest Actionable Goal (and second largest overall category), refers to players pursuing the Main Quest (24 goals, 14%). Players prioritised the main quest for a number of reasons. For example, the most obvious reason was that some players preferred main quests over other aspects; "I always start off a with the plan to do the story mode first" (T2, C10). Sometimes players wanted to complete the game so they could 'move on' to another;"at some point you just have to [...] concentrate on finishing it and moving on" (T5, C10). In some cases, players would pursue the main quest to (somewhat ironically) *not* pursue the main quest — players were aware at times they needed to complete some of the main quest to unlock more content, usually side quests; "I have to progress further in the main story to get more side quests" (T2, C7). This highlights that, even when players are actively pursuing a goal or task, the reason for doing so varies wildly, even in contradictory ways.

3. Explore

The third Actionable Goal was Explore, where players wished to move across the gamespace to discover new content (21 goals, 12%). Typically this was goal-directed, in that players were not aimlessly exploring but rather driven towards discovering new content. Sometimes they were looking for new side quests or collectables — "I got intrigued towards [side quests] that I would stumbled upon when I'm exploring" — whereas other times exploration was itself the goal; "I then start exploring every inch of the map" (T4, C11). Sometimes a player's attention was captured by something interesting, which shifted their goal to investigate; "[I'll] wander off to have a look at interesting stuff on the way" (T6, C10). In other cases exploration was pursued simultaneously to others goals, such as when travelling to a specific location and purposefully going a way previously unexplored; "I maybe going to Town A [...] so I'll take a slightly longer route to see what's there" (T6, C3). Overall, players with an Explore Goal tend to be looking for something specific, such as a new landmark that has captured their attention, or they simply enjoy the act of exploring.

4. Collectables

The final Actionable Goal was Collectables, which referred to players seeking out items in the game usually associated with rewards for finding a certain amount of them (5 goals, 3%). Sometimes these were collected to increase the power of the player — "I also like to go into the final boss fight with all the collectibles and be so OP" (T2, C6) — whilst other times players enjoyed the process of collecting; "For me I will collect collectibles if it's an enjoyable process" (T5, C5). Therefore, players with the Collectables Goal wish to seek out items the game has hidden in the game world, both for the fun of collecting as well as the in-game benefits they provide.

Summary

Overall, the 4 Actionable Goals identified from players captured the most concrete goals (i.e., closest to the selected in-game actions) they engaged with. These indicate that players show a strong preference for pursuing side quests, with lesser preferences for main quests and exploring. The reasons for their engagement was again widely varied, highlighting that even within a highly specific goal, the reasoning behind them can be vast.

6.2.2.4 Summary

In total, players indicated a vast variety of goals when playing open world games. These goals were varied in their level of abstraction from their in-game actions, as well as the reasons for why they chose to pursue them. Some Goals were 'transitional' in nature (On Break and Find Goal), where they were pursued whilst waiting on other Goals to become apparent. It is interesting that even small and temporary Goals are considered important aspects of play, enough to be mentioned by multiple players. However their existence provides further complexity when relating Goals to behaviour, as some players may pursue an activity for a break whereas some players pursue the activity because it is their primary goal. Distinguishing between these Goals will be difficult without further context from players. Therefore, knowing the Goals players have in isolation is not always enough to understand their actions.

Whilst Goals in this section have been described in sequence, the co-occurrences between both Goals and Meta Goals more generally provided interesting insights into player behaviour. Therefore, these relations are explored in the following section.

6.2.3 How Do Goals Relate to One Another?

When analysing the goals mentioned by players, some comments included how Goals interacted together. Sometimes the interactions indicated how goals influence one another (e.g., players pursuing Collectables to Gain Power), whilst others were sequences of goals (e.g., players who started with a goal to Explore, then switched to Side Quests). This Section explores the former, both in terms of influences between Meta Goals and Goals. The subsequent Section explores the latter by understanding the types of goal-directed actions players generally selected.

6.2.3.1 Meta Goals

As mentioned in Section 6.2.2, Goals were sorted into Meta Goals based on the Goals-Means-Action framework outlined in the literature review Section 2.5.1, where Goals higher in the hierarchy influence those lower down. Figure 6.3 demonstrates the hierarchy found in the data, along with the frequency of each goal within each level. The arrows indicate the direction in which Meta Goals influenced one another; for example, some players mentioned wishing to Do Everything (Overarching Goal), where to do this they would search systematically through locations for quests to complete (Location Based; Means Goal), which would involve them doing Side Quests (Actionable Goal). From Actionable Goal, players could then relate this to the Tasks they took to pursue this (e.g., walking to a location). Consequently, the actions players take in game become more specific the closer to Task they become.

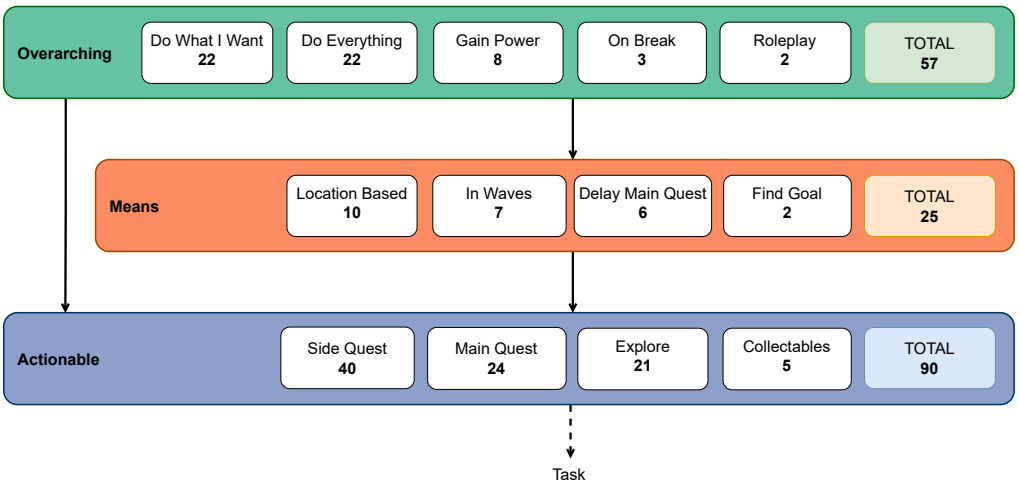


Figure 6.3: The categories identified by the content analysis, organised via the corresponding Goal type they fall under. Arrows indicate direction of influence.

Overall, players most commonly discussed Actionable Goals (90 goals), followed by Overarching Goals (57 goals). Players did not always refer to Means, and instead related Overarching Goals straight to Actionable ones (21 instances, 24% of comments that mentioned goals), hence the presence of the left-hand arrow. Further, whilst the Meta Goals are hierarchical in nature, this does not mean players would frequently mention all of them — in fact, only 7 comments out of 89 mentioned all 3. It was most common for players to only mention Actionable Goals (29 comments), or mention both Actionable and Overarching Goals (21 comments), followed by only Overarching Goals (15 comments). For example, it was possible for players to never 'leave' the Actionable Goal level for their play; they may wish to focus on side quests for their own merit and no other stated reason (9 comments). Therefore, whilst the Meta Goals are frequently discussed in a hierarchical nature, it was also common for players to only discuss one type of Meta Goal. Consequently, whilst there are 5 Overarching Goals representing the highest level of goals, it is not as simple to say these alone aptly capture the behaviour of players.

6.2.3.2 Connections Between Goals

To understand how Goals influenced one another, comments which mentioned more than one Goal, and explicitly causally linked them together (e.g., "I do X because Y"), were collected (33 comments, 19%). By drawing these causal links as arrows, Figure 6.4 was created. Note that, due to the nature of Do What I Want feasibly relating to any other Overarching Goal, these lines are not shown for clarity. Further, the presence or lack of lines does not indicate that no such connection exists/the

frequency of the connection overall. Figure 6.4 highlights what was found within the specific data used in Study 5, and so is not representative of all possible connections. For example, players could easily connect In Waves to Exploring, or Roleplay to Main Quest; the fact they did not reflects the interests of the players in this data, rather than all possible connections. Line frequency is therefore only shown to indicate prevalence within this specific data, rather than make inferences about goal influences generally.

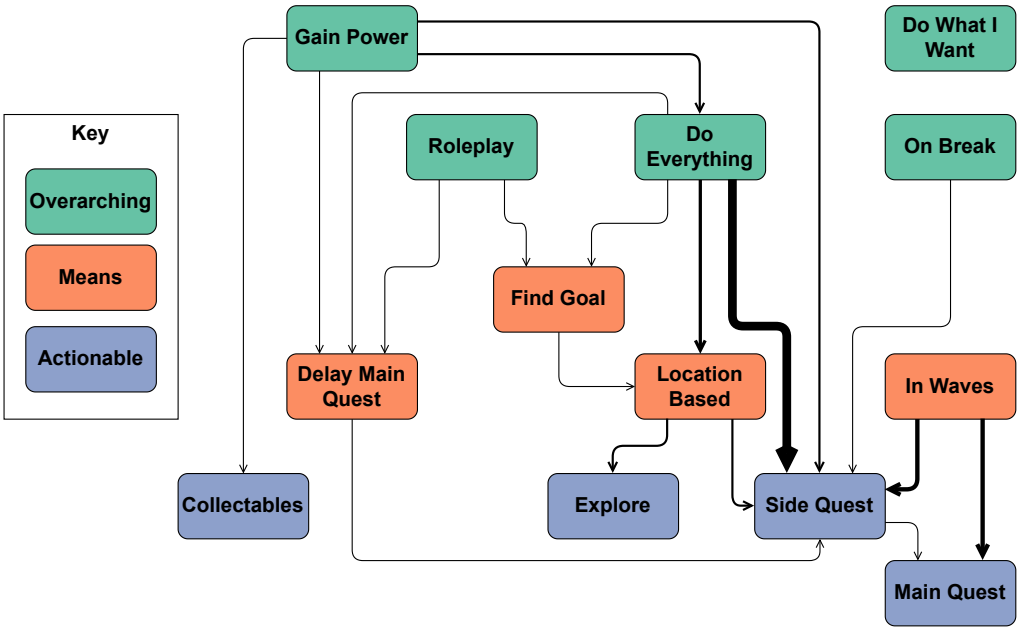


Figure 6.4: A diagram illustrating how Goals causally relate together, as identified by players. Arrows indicate directions of influence, where thickness indicates number of instances.

From this diagram, a number of observations can be made. Firstly, it is clear that Side Quests relate strongly to many other Overarching Goals and Means. This demonstrates certain Actionable Goals can be pursued for a multitude of higher order reasons. Further, the most common Goal influence was Do Everything to Side Quests, with 8 mentions. The extent to which this is the most common Goal in all players is unknowable, as this could be specific to the players commenting on *Reddit* threads.

Other interesting findings include the ability for Goals to exist in hierarchies *within* Meta Goal levels. Gain Power goal sat atop the Do Everything goal, in that players would do everything in a game *to gain power*; "I'm such an XP junkie I'll do anything mundane enough if the yield is worth it [...] I never want to feel underpowered in a story mission" (T5, C12). Similarly, Main Quests could be pursued *in order to* unlock more Side Quests;"I have to progress further in the main story to get more side quests" (T2, C7). Therefore, the structure of Goals can have further complexity depending on the player.

Due to the nature of Means describing ways for people to achieve their objectives, it is unsurprising that Goals and Means related in numerous ways. For example,'Do Everything' Goal was mentioned alongside the 'Location Based' Means (3 comments). However, not all Means were associated with Overarching Goals; sometimes they were stated only with the actions they related to (e.g., In Waves co-occurred with the Actionable Goals alternated between). This may have happened because an Overarching goal is not needed for some players, needing only Actionable Goals and the Means to achieve them. It is also possible that due to the nature of the data, players did not elaborate fully on their goals and so this was missed.

Overall, Figure 6.4 illustrates the complex nature of goals; the diagram only shows the Goals of players, and does not include the lower level of Tasks that are pursued to achieve them. Actionable

Goals, the closest level to Tasks, refers to the types of tasks players can pursue rather than any specifics of how this is done, therefore remaining still abstracted. Without the higher levels of understanding of Means and Overarching Goal, it is difficult to understand why Actionable Goals are selected. It also highlights how even the categories of Overarching Goals and Means are fluid, as sometimes Actionable Goals act as Means; 'to pursue Side Quests I will pursue the Main Quest to unlock them'. Certain Overarching Goals also act as Means; 'I Do Everything to Gain Power'. Therefore, players can have several Goals of play, from various levels within the hierarchy. Most commonly, players reported pursuing Side Quests because they wanted to Do Everything in the game.

6.2.3.3 Summary

Overall, players can have several Goals and Meta Goals to guide play, and sometimes more than one at once. Players were most likely to talk at the Actionable Goal level, and showed a strong preference for completing Side Quests. Whilst diagrams 6.3 and 6.4 provide insights into how Goals are connected, there are a number of issues present if trying to use them to understand player behaviours. Specifically, each level of analysis has limitations in understanding action selection for different reasons.

Overarching Goal typically captures the highest level of desire a player has to pursue an action, but is also the most vague; if players wish to 'Do What They Want' or 'Gain Power,' it can be difficult to predict the actions they will select, as they are so many that could aid this goal. Actionable Goals offer the highest specificity as they sit just above the individual Task level, but because of this granularity it is difficult to understand why players would choose them without referring to a higher Goal. It is common at the Actionable level for players to pursue goals for multiple reasons; the Side Quest goal could give players access to Gaining powerful items, it could provide a Break from pursuing the Main Quest, or it could be what the player actively wants to spend time doing. This makes it difficult to predict a player's intended reasoning behind pursuing Actionable Goals.

In sum, Overarching Goals are all-encompassing but vague, meaning players on the same goal could pursue a multitude of actions for the same reason. Actionable Goal is specific but could be deployed for a multitude of reasons, making it difficult to assign reason to it. In other words, whilst offering different strengths, they suffer the similar problem that they do not inherently relate to one another. Goals can relate to many Actions, and Actions can relate to many Goals.

The Means level, as the middle-ground, attempts to connect the two Meta Goal levels, by demonstrating how players put Goals into Action. For example, because a player wishes to Do Everything, they may deploy the strategy of completing Actionable Goals In Waves to alleviate boredom of any one Task. This leads them to the Actionable Goals of pursuing Side and Main Quests in an alternating fashion. Focusing at the Means level does however still have drawbacks; without considering what the Goals or Actions surrounding the Means are, the analysis is empty. To know that players wish to pursue Tasks 'In Waves' does not highlight what actions were originally selected or why. This information is typically contained within the Overarching Goal (Do Everything), and what the actual behaviour looks like is found within the Actionable Goal (Side and Main Quests). Therefore it would seem that, without careful consideration of all three levels and the interconnections between them, reasons for action selection remain unclear.

This analysis has revealed some of the complexities of goal-driven actions. The interactions between Goals, Means, Actions, and Tasks are highly entwined, with co-occurrences happening both between and within levels. To understand goal-directed actions, an appreciation for all aspects of the diagram is needed, as only the entire system view reveals lines of influence. However, even knowing all three level of Meta Goals does not tell the whole story. There is no relation to specific actions or how players implement Actionable Goals from this analysis. How actions relate to Goals is therefore the focus of the final analysis of Study 5.

6.2.4 How Do Goals Relate to Actions?

In the previous analyses, the focus was on understanding the goals players have when playing open world games, and how they relate to one another. To understand gameplay discussed in the comments, there are two interrelated questions; what causes players to change actions, and what causes players to change goals. To answer the former, a player may change actions in pursuit of the same goal, or switch to pursue a new goal. It is possible the series of tasks looks the same in both scenarios — walking to a location and talking to an NPC could be for the same goal (handing in a Side Quest) or switching to another (Exploring the location then choosing to pick up a new Side Quest). Therefore, understanding the difference between an on-goal vs off-goal switch is required. To answer the latter, it is possible (and likely common) for players to switch goals during a play session, even at the Overarching Goal level. As discussed previously, some players switch between Do What I Want and Do Everything, and in pursuit of a goal a player may pursue multiple actions to achieve it. What actions lead to these goal switches, and what this looks like in their sequences of actions, is therefore explored in the current dataset.

6.2.4.1 Task Patterns & Related Goals

A task state analysis diagram was created that shows how players switched between actions, and how these pathways related to the goals identified in the previous analyses.

Nine of the 13 goals identified earlier could be identified from these pathways, as they naturally require action switching (e.g., Location Based). The 4 missing goals were either too abstract (Roleplay and Do Everything) or players did not mention action switching components to them (Collectables and Gain Power). Therefore, the missing goals mostly originated from the highly abstract Overarching Goal category, with the final goal Collectables also missing due to its nature typically lending itself to being a one-task focused behaviour.

Figure 6.5 illustrates not only how players move between actions, but also how this relates to their goals. For example, within the yellow box that indicates the 'Do What I Want Goal', players will not move from the state of Original Task *unless* a New Task appears. The coloured boxes surrounding specific action patterns therefore capture the player goals, as these loops form the actions players undertake to achieve them.

To illustrate how to read the diagram, a specific goal is chosen to highlight how action selection relates to it. The goal chosen is Explore Goal, highlighted in orange. The player begins the play session with the goal of exploring the game world, in a typically 'random' fashion (i.e., they are not actively seeking a specific object or location). This state may continue for a long amount of time, and at some point this exploration may lead them to 'stumble' on the Original Task; this may be from a previous play session, or before they began the goal earlier. The Original Task is likely to be the Main Quest, as this is a task the player always has active to some extent, unless they have completed the game. However, it could be a different task they had previously engaged with, accounted for by the line from Original Task found within the yellow goal 'Do What I Want', that points to Explore (randomly), such as a specific Side Quest they once found interesting. If the player stumbles on the Original Task, they enter a new state, 'Assess Original Task'. This state involves the player scoping out the requirements of the task, typically assessing it based on difficulty. If the task appears too difficult, they may return to the Original State, 'Explore (randomly)'. However, if the task does not appear too difficult they may re-engage with it, and so change goal. In this case, the goal has moved from 'Explore' to 'Do What I Want', as the task in engaged with on the players' terms.

Continuing following this flow, it is possible to return to the Explore Goal; a player that is in a state of the Original Task may encounter a New Task (for example, a new mission to locate a valuable item), in which case they change to a state of Assessing the New Task. If the New Task is interesting to the player, or generally distracts them, their state will change again to this New Task. Whilst pursuing this task, the player may change locations as they follow the steps of the task. In doing so, they move into a state of Explore Map, which accompanies their actions of the New Task. Because of this movement, it is possible they will once again stumble onto the Original Task, leading them again to a state of Assess Original Task. In contrast to the first time this state was encountered, the player now has 3 options;

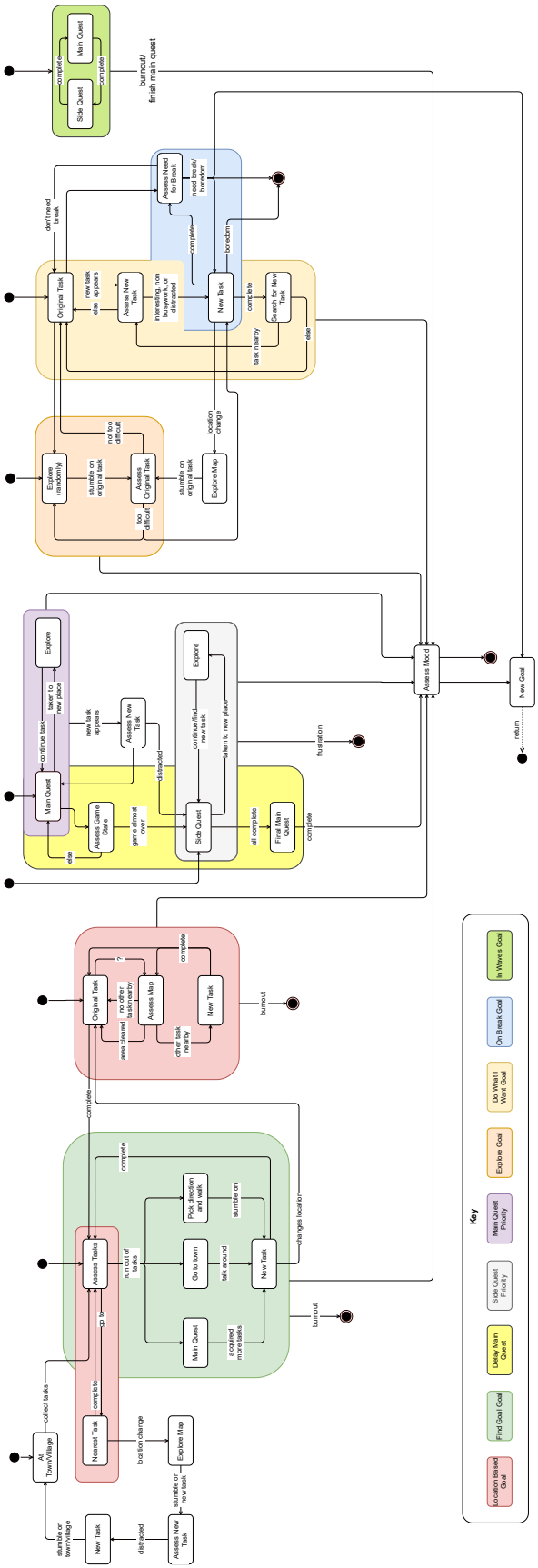


Figure 6.5: A diagram illustrating how players switched actions, the reasons for for doing so, and how these relate to the goals identified earlier.

deem the task of capable difficulty and return to the Original Task, deem it too difficult and decide to Explore (randomly), or deem it too difficult and continue on with the New Task.

The behaviours that fall within the orange box therefore represent the goal of prioritising Exploration above other goals. The looped nature implies players return to the act of Exploration, and if they do not, they have explicitly changed goal. At any point, the player may decide the goal of Exploring is no longer appealing, or indeed any goal they are pursuing. If true, the player assesses their current mood and decides either to find a new goal, in which case the player returns to the start of any goal, or decide they no longer wish to play, and so exit the game.

This example illustrates one pathway through the state diagram. By following the flow of states, the diagram reveals patterns of behaviour that were observed from the data. The same technique can be applied to the rest of the diagram, to showcase different action selection trajectories. This is however not an exhaustive list of goals players may have, or transitions between states; the nature of the open world experience is so flexible and inclusive of what players want to spend their time doing that it is possible for a player to theoretically move between most states at any time. This diagram therefore captures only a slice of the possibility of the action space, and as such only a subset of the possible goals available to players. Furthermore, this diagram does not indicate *why* players have these goals.

The diagram also does not include all of the goals identified within the Goals section, as some did not involve changing between action/states. For example, players who wish to gain experience points and level up their character typically did not elaborate on how this was achieved, other than by partaking in side quests. Therefore it is important to consider all of the analyses in Study 5 together to understand the behaviours of players.

6.2.4.2 Summary

Overall, the final analysis of Study 5 aimed to explore how sequences of actions performed by players could be understood and related to a player's goals. By laying out action sequences, it is possible to circle patterns and assign them to the goals players have, in various levels of the goal hierarchy (Overarching, Means, and Actionable).

It is important to acknowledge that the usefulness of this diagram is contextually-specific to the sample that created it; the action sequences and associated goals are unique to this sample, and likely does not reflect all options available to a player in open world games. For example, it is possible to learn that for some players, pursuing a mixture of side and main quests involves opportunistically waiting for new quests to appear enroute to the next main quests. For other players, pursuing a mixture is more structured, where they alternate between side and main quests depending on which has been most recently completed. For the former group, the lack of specificity allows them to more easily switch onto different goals, such as exploring or delaying the completion of the main quest. However, there are likely other action patterns that exist, associated to different goals. For example, roleplaying was a goal mentioned by participants but could not be mapped into this diagram due to a lack of actions associated with it. Further, a player could delay the main quest by choosing to explore the area, despite no link between these two goals currently existing.

Whilst the diagram therefore does not illustrate the 'true' action selection of all open world gameplay, it does reflect what was true for *this* sample, in an informative and condensed fashion. It is possible to summarise and combine multiple player's actions and goals, despite the large variety in what can be pursued. Therefore this analysis has shown how the goals and actions of players can be related to one another, and a way to illustrate these connections in a new way.

6.3 Discussion

Study 5 investigated if players discuss goals, the types of goals they may have, how goals influence one another, and what actions they select when following such goals. This is because the goals of a player may lead them to have specific contextually-situated experiences, as they select actions likely to fulfil their desired goals. Action selection is therefore the way players implement goals, to enable

contextually-situated experiences, which form the open world experience. The analyses here highlighted the inherent complexity of goals and their relation to action sequences and the contextually-situated experiences players have.

6.3.1 Aim 1: Do players relate goals to their actions?

It was found that players frequently discuss goals in relation to their gaming habits, even when the original question posed in the thread related to 'how' they played. This indicates players naturally use goals as a way to explain their behaviours to other players, suggesting players use goals to direct their actions and action selection. Therefore, goals have the potential to explain how players' experiences of an open world game can differ despite playing the same game. Players have specific, individuated goals in mind for their play, which they use to select actions, which lead them to interact with the game in specific ways. Therefore, the contextually-situated experiences players encounter during their play are influenced by the pursuit of their goals.

6.3.2 Aim 2: What goals exist in the open world experience?

Overall, players were found to have a variety of goals, sorted into 3 meta-categories based on how abstract the goal was. The most abstract and high level goals formed the Overarching Goal category, containing 5 types of goal (Gain Power, Roleplay, Do Everything, On Break, and Do What I Want). Overarching goals were frequently mentioned by players, with Do What I Want and Do Everything equally the most common.

The next goal in the hierarchy was Means, or the ways in which players can achieve their Overarching goals, which contained 4 goal types (Delay Main Quest, Find Quest, Location Based, and In Waves). Means were not frequently mentioned by players, suggesting players may not be interested in discussing their behaviour at this level. This is interesting, as many threads asked players to discuss the 'how' of their gameplay, which would imply Means Goals are the most appropriate to mention.

Within this dataset, players were in fact most likely to discuss goals at the Actionable Goal level, which are most closely related to the actions a player can take within a game (and consequently the most concrete in application). This consisted of 4 types of goal — Collectables, Explore, Side Quest, and Main Quest — and implies players are most likely to explain their behaviour at the lowest level of abstraction. Actionable Goals are a way for players to group behaviours together without losing detail of why they are being pursued. For example, it would make sense to group side quests together, which could consist of a multitude of different quests that are all unique, as the reason for pursuing them is similar (i.e., because they are in a quest log that designates them as side quests). Therefore, players may use the Actionable Goal level to explain their behaviours as it is the easiest to map to their actions, whilst remaining abstract enough to not provide too much detail. If they did not use Actionable Goals, they were likely to mention a goal from the Overarching category, implying that players can also explain their behaviour in terms of general statements (such as 'doing what I want'). In summary, players have a number of goals they pursue in open world games, that vary in their level of abstraction.

6.3.3 Aim 3: How do goals relate to one another?

It was common for players to mention more than one goal, indicating players regularly considered their gameplay driven by numerous factors. Whilst some players may have only one goal of their gameplay (e.g., complete Side Quests simply for the sake of completing Side Quests), players can, and regularly do, have multiple goals active at once, even within the same hierarchy level. They are also capable of changing from one goal to another unrelated one, such as Exploring and then completing the Main Quest. This indicates the relationship between goals is both structural and temporal. Structurally, players were found to have sub-goals within other goals, which reveals how one goal leads to the pursuit of another. For example, a player who wants to Do Everything may search in a Location Based manner for Side Quests to complete, which descends through the goal hierarchy.

In contrast, other players may move across the hierachy, such as wishing to Gain Power by Doing Everything in the game (two Overarching Goals), or Find a Goal by searching in a Location Based manner (two Means Goals), or complete the Main Quest to unlock more Side Quests (two Actionable Goals). The temporality of goals adds further complexity to the relationship between goals, as players can also switch between *unrelated* goals at will during gameplay, such as pursuing Side Quests and then Exploring. This highlights the inherent fluidity in goal pursuit over time.

Because of the highly interconnected nature of the goals identified, it is consequently unlikely that knowing only one of them in isolation is enough to understand what players are wishing to achieve in a given gaming session. If only the Actionable Goal is known, *why* this is being pursued is unknown. For example, some players pursue Side Quests because that is simply what they want to do. Others may wish to Do Everything and treat side quests as something to be systematically ticked off from a list. Yet another player may be completing them In Waves with the Main Quest to break up the repetitive nature of play. This is true of any level of the hierarchy; knowing a player's Overarching Goal, such as wishing to Roleplay, does not inform on *how* they will implement this. Furthermore, even if all three levels of the hierarchy are known, this is only relevant for a specific moment of gameplay; players are able to abandon their current goal entirely in favour of another at any time. Therefore, to understand action selection in open world games, it is not enough to only know what goals a player has; the connection between goals is equally important.

In summary, Goals are found to be highly interconnected, both within and across hierarchy levels. It would therefore be inaccurate to assign one goal to a player and use this to explain their action selection and experiences encountered in the game.

6.3.4 Aim 4: How do goals relate to the actions players take?

The final aim related Goals to the actions players can take in the game, as many players mentioned action sequences in their comments. By plotting these sequences and combining them across players, it was possible to circle specific patterns as being in pursuit of specific goals. In doing so, 9 of the 13 identified goals had identifiable action sequences assigned to them, indicating player goals are used to describe specific actions in open world gameplay. Further, it was found that players could switch between actions for three main reasons: to continue the current Goal (e.g., assessing the map then walking towards a new task, which relates to the Location Based Goal), to switch to a different Goal (e.g., exploring an area, stumbling onto the main quest and deciding to pursue it; Explore to Main Quest Goal), or because the player was distracted (e.g., pursuing the main quest and stumbling on a new side quest which they switch onto).

In summary, disengaging from an action or a goal does not mean a player has to disengage from the game; a unique behaviour available in an open world experience. Because of this, predicting what goals a player has at any one time is complex, even if the actions are known. The relationship between goals and actions is not straightforward, as many actions could be pursued for many goals, and vice versa. However, the sequences of actions were typically unique to a stated goal, and the transitions between actions indicated what players were experiencing. For example, being distracted from a current task implies the game has suggested a new goal for a player to follow, whilst changing locations may be a desire of the player to find new tasks. Therefore, understanding action sequences and their relationships to goals can illustrate what players experience in games.

6.3.5 Relation to Previous Studies

In Studies 1 & 2, players reflected on what the open world experience meant to them, and what enabled it. In Study 5, players described what they chose to do, and what goals they pursued. In doing so, many players discussed a 'Do What I Want' goal, showing overlap to the definition created in Chapter 3. However, in Study 5 not all players pursued this goal (found to be Overarching in nature), and instead were more directed and purposeful in their play (such as Do Everything). Whilst it could be argued players having the *choice* to Do Everything still reflects the Do What I Want experience described, there are clear caveats to how this should be interpreted between players.

Further, players also frequently mentioned changing goals and actions, splitting their time between activities as the players in Study 2 also mentioned. Sometimes this was due to being distracted by the content available to them, providing further explanation for why players change actions in their gameplay. In sum, Study 5 has extended Studies 1 & 2 to provide more context for what 'Do What I Want' means to players, and how they enact it within gameplay (such as via goals).

6.3.6 Relation to the Literature

The analysis was inspired by the Goals-Means-Actions frameworks of Kruglanski et al. (2002), and consequently shows many similarities in structure. For example, the hierarchical nature of the three aspects was observed, and that they influence one another. However, the structure was also found *within* Goals, in that there are hierarchies that follow the same structure even when only considering what a player wishes to do in the game. Therefore, whilst the original model considered Goals-Means-Actions, the current analysis found Goals (Overarching, Means, Actionable)-Means-Actions, extending the concept. Whilst Overarching Goals and Means are directly comparable to the model of goal systems, Actionable Goal is an extra level that groups together the types of actions players engage with. This added grouping accounts for the ability of players to continue the same *type* of quest without it being considered a different goal, as completing side quests can require multiple separate instances of side quests.

However, there are notable differences between the model created in Figure 6.3 and the theory of goal systems by Kruglanski et al. (2002), an example of which is illustrated in Figure 2.2. Firstly, the Figure is not representative of one person, but of the collective experiences of players. Whilst it is possible for players to have any of these combinations, it is unlikely they have all of these active at any one time. Secondly, the double-headed lines between goals in the Goals-Means-Actions framework indicate influence, and so are bidirectional. Whilst the arrows in Figure 6.3 also indicate influence, these only go one way (down from abstract goals to concrete actions). It is unclear from the data whether Means and Actionable Goals influence their higher-levelled counterparts, as players did not discuss their goals in this way. Lastly, whilst the lines of influence of the goal systems theory can be both facilitative and inhibitory, only facilitative influences are present in 6.3. This was because players did not discuss how concepts interfered with one another, outside of feelings of burnout or frustration with pursuing some goals for extended periods of time. Whilst goals were sometimes discussed as being in conflict, this was not framed as an inhibitory phenomena. Players typically resolved this conflict by pursuing the goals in smaller, integrated steps, such as via the In Waves Goal. Therefore, whilst there is considerable overlap in the structure of goals found in this analysis to the goal systems in Kruglanski et al. (2002), this analysis has adapted the system to reflect aggregated goal pursuit across players.

In terms of previous work on goal pursuit specifically in games, Study 5 shows notable dissimilarities. Goal research in games is typically from an AI focus, where goals can be extracted from the gameplay (such as Ha et al. (2011)) or utilising the goals given to players (such as the completion of side quests, M. Aung et al. (2019)). However, open world players indicated they used such in-game goals to achieve *other*, higher-level goals. For example, whilst previous research has considered the goal of completing the main quest, players stated reasons for engaging with the main quest for many other reasons beyond this (e.g., completing everything, gaining power). Further, some players followed goals that were entirely abstract from the in-game goals; players discussed roleplaying and being on a break, both of which are not goals given by the game but are an artefact of the interaction *between* players and the game. Therefore, previous research on goal pursuit in games lacks inclusion of goals brought into the game by players, as the open world experience allows far greater freedom of goal and action selection. Consequently, previous work linking goals to actions does not account for the full nature of how players navigate the open world experience. Excluding the types of goals found here obscures the 'full' reason why players engage with what they do, which in turn limits the usefulness of such approaches and the findings they generate.

Along with relating to the literature on goals, Study 5 shows overlap with the engagement literature, notably the engagement model suggested by O'Brien & Toms (2008). Players frequently

discussed the same four repeatable steps of the model: the point of engagement, engagement, disengagement, and re-engagement. However, unlike the model proposed by O'Brien & Toms (2008), players did not always re-engage with the *same* action/goal after disengaging — they could re-engage with a different one, without needing to leave the game. Usually if a player disengages with an action/goal in a game, they are forced to disengage with the entire game, as there is nothing else to do. However, the open world experience is unique in that it allows players to choose to re-engage with new actions/goals from within the *same game*. Re-engagement is consequently more flexible in its scope in open world games than other applications. Therefore, Study 5 extends the work of O'Brien & Toms (2008) by integrating the engagement model into the more complex setting of open world gameplay, where disengagement and re-engagement stages are more flexible.

6.3.7 Limitations

Data were collected opportunistically from *Reddit* forum posts, where the sample of participants was small and the explanations extracted were not intended to answer the research aims. Players communicated amongst themselves, and so responded in varying ways to answer questions left by other players. This meant findings were limited to what players discussed, with no ability to follow up on any insightful comments for further information. Consequently, it was sometimes difficult to understand why players have certain goals and why they associate specific actions to them, and it is also not possible to conclude the overall frequency of these goals within the general open world gamer population. However, rich insights were still gained from this dataset in terms of what types of goals players pursued and the actions they associated to them, which was not known before this study. As the aim of the study was to understand if players naturally discuss goals in regards to their gameplay, and indicate what types of goals may exist, the size of the dataset was still sufficient to perform this important first exploration into the topic. The work here can therefore be taken forward in further work using primary data, where more players can be asked for explanations for their answers.

A further limitation that comes from using online data is that there will be biases in what players discuss with one another. They may overemphasise certain goals/actions than they typically perform in order to impress/fit in with their peers. For example, players may have overemphasised their desires to Do Everything in these games, to be seen as a 'serious gamer,' and so their answers many not reflect their true gaming behaviour and goal pursuits. This may introduce noise into understand which goals players have in open world games. However, such social desirability bias can be present in any research involving participants describing their behaviours, where it can only be reduced depending on how questions are asked. Further, the findings of Study 5 show similarities to what players indicated as their behaviour in Study 2 (the open world experience interview), as players similarly discussed similar goals such as Do What I Want. The publicly openness of responses in Study 5 may therefore have not influenced what players chose to disclose, or if it did, this was to a similar level to Study 2.

A final limitation of this study is that players reflected on their general gaming preferences and behaviour, rather than discussing a specific gameplay session. This leads to natural abstraction in what is mentioned, which in turn meant the analysis was also limited to understanding open world behaviours at an abstracted level. For example, knowing that players pursue side quests in a location-based manner by travelling to towns may be an apt description of a player's overall experience of a gaming session. The game is however capable of creating semi-unpredictable events for the player to come across whilst they pursue this goal, meaning there may be further actions and goals that occur during play. These are also a part of the gaming experience, but players are unlikely to discuss them when reflecting generally, unless they provided a very specific, contextually-situated example of gameplay. Therefore, these potential extra actions and goals are currently unknown, limiting the ability to understand what goals and actions occur during a specific gaming experience. However, this study has explored the general goal structure of open world games, which could then be applied to specific gaming experiences to analyse any differences that occur.

6.4 Summary

Study 5 has shown that players talk in terms of goals, of which many can be pursued simultaneously in gameplay. Goals can influence one another, and are also shown to relate to the actions players select. At any point, the player can change their actions or goals, potentially explaining why players can have highly variable behaviours within the 'same' experience.

Whilst many goals show a high degree of overlap in the types of actions undertaken to pursue them, the *sequence* of actions is typically unique to a specific goal. By plotting action sequences, it is possible to circle specific patterns as being in pursuit of specific goals. Furthermore, plotting such sequences highlighted that players are routinely pulled away from their original/intended goal by the game via distractions or boredom. In turn, this led them to new actions which led to them having/seeking out new experiences. This highlights the inherent interactive nature of gameplay, where both game and player influence what actions are selected and what is experienced. It is not enough to only know what the player intended to do (i.e., their goals) to understand their experience, as the game may also influence why players chose different actions.

Overall, the experience players have in an open world is shaped by the goals a player possesses, by guiding their actions and what they engage with. Players enact their goals (of various degrees of abstraction) into effect through pursuing certain actions in sequences, to seek out and enable specific experiences. To only consider the player's goal would however obscure the influence of the game itself; the game can also provide goals and options for a player to choose, which may or may not align with their original goals. In combination, these lead to the contextually-situated experiences players have, meaning the open world experience is how a player navigates both their own goals and those presented by the game, within the context of what they encounter.

6.4.1 Relation to Following Study

Study 5 has indicated that certain goals and actions selected to pursue them relate to specific experiences within the game, such as burnout and boredom. It is however unclear how goals and selected actions form the experience identified in Studies 1 and 2 more generally (the ability to self-pace gameplay by engaging and disengaging with tasks at will). For example, how does goal pursuit relate to frequently reported summative experiences such as immersion? Does it matter what actions are chosen and in what order, or is it simply the ability to choose? Are relations between goals and actions observable in a specific gaming session? Due to the limitations addressed above, Study 5 does not have the ability to answer such questions. As comments do not reflect the actual gameplay behaviour of players, it is not possible to know how the relation between goals and actions plays out during a specific play session. Consequently, what experiences are encountered over a specific gaming session are unknown.

Overall, knowing the action sequences a player takes, and why transitions between actions occur, enables an understanding of what experiences a player has encountered. Typically, these transitions occurred because it was their intended goal, or because a new goal became relevant. Recreating a similar analysis in a specific gaming experience, rather than asking players to reflect generally, may indicate how action sequences enable contextually-situated experiences, via player goals and game-imposed events. For these reasons, the following study explores how action selection observed from gameplay relates to the goals players identify and their overall experience. By replicating the approach in a specific gaming experience, combined with the ability to gain more granular data, it may be possible to explain what experiences players have in open world games and why.

Chapter 7

What Goals and Actions Exist in a Specific Gaming Experience?

"Leaving without a trace, Don't know when I'll be back again.
Images of unfamiliar faces, Making maps of non-existent places."
— Thank You Scientist

Up to now, this thesis has explored what players experience in open world games using general reflections, such as interviews and online comments. Therefore, it is now important to apply these findings to understand what players experience during specific gaming experiences. In other words, what do players actually *do* during an open world gaming session, and by extension what experiences do they have from the actions they select? For example, it is now known what the concept of 'the open world experience' is from the perspective of players, which reflects a process of engaging with game content depending on what currently is of interest. The previous chapter expanded these findings, as players consider what they choose to engage with (i.e., their action selection) to be goal-directed. Therefore, during a specific gaming session players are expected to pursue goals that lead them to the experiences they have. Differences in desired goals consequently would explain how players have different experiences within the same game, as what they wish to achieve guides them towards specific types of content and in turn specific actions. Therefore, there is a need to explore how player goals relate to the experiences they have, via the actions players select.

Study 6, the final study in this thesis, aims to explore what players do in terms of goals and actions during a specific gaming session, and how these enable the overarching experience they have. The research aims are therefore as follows:

1. What goals and actions do players pursue in a specific open world gaming experience?
2. What affects a player's choice of goals and actions?

However, to understand gaming experiences at this level of specificity is complex, as collecting the necessary data could be affected by numerous extraneous variables. These fall into two complications that first must be overcome. Firstly, what does goal pursuit look like in gameplay? What actions are players selecting in pursuit of what goals? Due to the abstract nature of goals it may not be an easy task to map them onto raw gameplay footage as they are unlikely to be observable from gameplay alone. It is therefore important to explore a method for combining different data types surrounding a specific gaming experience. Secondly, how do players articulate their goals? It is important to understand how players describe their experiences in terms of their goals, in order know how to map these onto gameplay. Study 5, discussed in the previous chapter, found that goals are hierarchical and interconnected. However, it is also known that how people describe their experiences can be influenced by a number of factors. These factors are therefore explored in a literature review section located within this chapter (Section 7.1), to inform what the best way to ask participants to describe their experience in this context would be.

Therefore, Study 6 accounts for these complications when collecting data from players during a specific gaming session. To do so, an exploratory analysis approach is used to answer the research questions, as at the start of the study it is not known what is potentially relevant to goal choice in open world games. This exploration is guided from the findings of Study 5, now applied to a specific gaming session; for example, what goals and actions do players pursue? How do they relate together? When and why do players switch goals?

Data collection for study 6 consisted of 15 players who were observed playing 30 minutes of the open world game *Skyrim* (2011), followed by a post-game interview where they recalled every action they chose, and an immersion questionnaire. Participants were randomly assigned into three conditions: warmup (where players were asked to describe their general open world gaming preferences and goals before the gaming session), no warmup (where they played the game with no pre-interview), and think aloud (where participants were asked to describe what they were doing as they played). Doing so allowed an exploration of how the context of the question being asked may change what players describe and the level of detail they provide. Alongside this, gameplay was recorded during observation, to compare what players describe their actions to be versus what they actually did.

Whilst the condition affected the amount of information recalled, it did change what types of information players provided. Therefore, data across conditions was analysed together. The majority of player actions involved moving around, attending to objects of interest, and interacting with objects. In terms of goals, players frequently followed side quests, explored, and had their attention grabbed. In terms of recall, unlike the time they spent on actions and goals, players most frequently recalled dying, entering a location, and combat, and in terms of goals recalled reloading after death, following side quests, and being interrupted by the game. This suggests frequency alone does not predict what players will choose to share about their experience. Furthermore, players frequently switched between goals, and usually a switch occurred when the game provided a new/different situation for the player to engage in. The relationship between goals and actions was therefore complex; in the majority of cases, knowing what goal a player was currently pursuing would not help predict what actions they would take, or vice versa. Finally, players rated the overall experience as highly immersive, but those who spent more time having their attention grabbed were more immersed.

Taken together, these findings suggest players select actions and goals to enable the experiences they have. However, a player's intentions are not the only factor affecting what is experienced. The open world gaming experience in fact involves the game providing unintended goals/events to the player (in the form of interruptions or attention-grabbing), which results in frequent goal switching as players must decide what to pursue. This goal negotiation is consequently what helps make the experience immersive. Therefore, similarly to Study 5, players can be considered goal-directed in their actions, but what they end up doing in a gaming session is also dependent on what the game offers the player in the moment. Consequently, only understanding a player's intent/goals when playing an open world game does not explain the full gaming experience; it is important to also consider the contextually-situated experiences that occur because of interactions arising from the game.

7.1 Literature Review

To understand how players describe their experiences for a specific gaming session, there is a need to understand known factors that influence how people talk about their experiences, to aid in interpreting their answers. This is not to say asking players for their experiences is an un-useful or unreliable approach — indeed, the only way to understand a person's experience is to ask them. However, knowing what may influence the answers given can help avoid being misled by noise in the data resulting from the mere act of asking. The known factors covered in this section are memory, novelty, socio-linguistics, and situated actions.

7.1.1 Memory

When asking players to recall an experience, especially when asked to recall what actions they have taken, there is an inherent reliance on their memory ability. This is true no matter how small the difference in time between experience and recall, as information begins to decay as soon as the experience is over (see Ricker, Vergauwe, & Cowan (2016) for an overview of Decay Theory for immediate memories). Memory ability can refer to a number of skills, such as working memory, long term memory recall, and speed of recall. It is also known to vary widely between people, such as due to age (Hertzog, Dixon, Hultsch, & MacDonald, 2003) or training (Ericsson & Kintsch, 1995). Indeed, *how* memories are encoded also varies between individuals. Ewell, Hamilton, & Guadagno (2018) for example found experienced players view their in-game behaviours more abstractly, which also helped them to perform better. When talking to experienced players, it is therefore likely they will not talk in terms of concrete actions, but instead in terms of strategies and goals.

As many methods used to assess player experiences rely on the memory of players, it is likely that information about what actions were taken and why is already lost, with some aspects lost quicker than others. For example, personally positive memories are known to decay slower over time than negative memories (Walker, Vogl, & Thompson, 1997). However, when recalling directly after specific events there is evidence to suggest negative emotion relates to higher memory accuracy and number of aspects recalled (Kensinger, 2007). It is possible then that players are overall more likely to report positive experiences when asked, but if asked to recall a specific event may be more accurate and detailed if the event was viewed negatively. Therefore, what players recall is likely influenced both by their memory ability, and the type of experience they are reflecting on.

For open world experiences, it is possible the game is so complex and cognitively demanding that players forget much of the granular details of the experience, such as every action they selected and why. However, that is not to suggest that asking players about their experience does not yield useful insights. Actions that have been recalled could arguably be those that were most important to the player, and by extension may constitute what the player believes to be the 'core' actions taken within the experience. If recalled actions were to be compared against what actions were actually selected, insight can be gained into what actions players believe to be important to the experience. Therefore, the memory ability of players is not necessarily a limitation of the approach, but instead requires a reframing of what information is being collected.

7.1.2 Novelty

As noted in the previous section, not all memories are equally salient and recalled by participants. One specific factor is the novelty of the events that transpired, where people are more likely to remember something if it 'stuck out' in some way. Examples of this can be seen in psychology research, such as how the novelty of an item can direct more focused attention towards it and away from other information. Erickson, Lampinen, & Leding (2014) showed that when participants saw an image of someone holding a rubber chicken, they were less able to correctly identify the person holding it in a police lineup than when the object was non-novel (in this case, a drinking glass). It is consequently likely that open world players who experience a novel event in game are likely to pay attention to it and recall it afterwards, but this may happen at the expense of remembering other details.

Novelty of events and stimuli aids in learning and adapting to new environments (see Schomaker (2019) for a review), and its role in drawing attention is so pronounced that some researchers (such as González-Cutre, Romero-Elías, Jiménez-Loaisa, Beltrán-Carrillo, & Hagger (2020)) argue it could even be considered a basic psychological need (like autonomy, competence and relatedness described in Ryan, Rigby, & Przybylski (2006)). Therefore, contextually-situated experiences that occur in open world games may be recalled more easily if they were novel to the player. Novelty here would vary between players, as inexperienced players may consider events to be novel that experienced players do not, due to their differing familiarity with what the game is capable of doing and how it can respond to them. Furthermore, it is possible that experienced players may be more susceptible to novelty bias. Their gaming may become so habitual and practised (a process known as automaticity; Bargh

& Chartrand (1999)) that they no longer pay close attention to their general gaming actions, leaving novel events more readily available for recall instead. Consequently, what players mention at a post-game interview may not be everything they experienced or did, but rather what stood out most to them. This would limit the ability to map what players say they do to the experiences they have.

However, novelty in itself still provides interesting insights into what players do and experience — the novelty highlights aspects they felt were unexpected, and so most likely required more active thinking. They may also suggests interesting interactions that occurred with the game, which would signal the presence of a memorable contextually-situated experience. Therefore, whilst recall may be biased towards events that are novel, using this as a lens to understand when unique player-game interactions have occurred may help to locate important contextually-situated experiences within the overall gaming experience.

7.1.3 Socio-Linguistics

When asking players to explain an experience, their answer will be dependent on how people generally use language to communicate. In this section, what influences how people engage in conversation is explored. This focuses on how players prioritise what to communicate to a researcher about an experience, as there are inherent social practices and rules of conversation likely followed.

The ways in which people communicate are likely to influence what players report in open world experiences. For example, the goal of communication is to exchange not only information but the meaning behind the information, and so both speakers must work together to allow for meaning to be shared. This is known as the cooperative principle (Grice, 1975), where there are four maxims (i.e., rules) to follow:

- **Quantity**: what is said provides sufficient information
- **Quality**: what is said is genuine and relevant
- **Relation**: what is said is contextually relevant to the conversation and the current topic
- **Manner**: what is said must be understandable

A player communicating with a researcher about their experience will engage in these four maxims to share their opinions and the meaning behind them. Consequently, how players communicate will change depending on the conversation itself and those involved. As a worked example, consider a skilled player of the open world game, *Breath of the Wild* (2017), is discussing their experiences with a researcher. The player, to communicate effectively, needs an understanding of how much the researcher knows about the game. If the researcher indicates they have also played the game extensively, this will alter how much information they need to give, and the types of information to share. For example, the player may not feel the need to elaborate on the details of a specific quest they are following (the maxim of quantity), because it is assumed the researcher knows what they are referring to. Similarly, the player may choose to not describe certain actions in favour of others, as they believe the researcher is interested in actions they deem to be of most interest (e.g., not discussing moving around as that is 'a given,' but instead discussing what quests they were following at the time; the maxim of quality). The player may also use shorthand language that is more precise but specific to those who play games regularly (such as nicknames for enemies or specific questlines), and so can only be used if the researcher understands this way of speaking (the maxim of manner). It is likely that players will provide information relevant to the conversation when asked about their experiences (the maxim of relation), but this also involves assuming what the researcher wants an answer to — to talk about 'the experience' may be inferred to also mean what the player felt, thought, did, and planned to do.

Therefore, it is important to understand the four Gricean maxims of conversation to understand what information a player is likely to provide to a researcher. The experiences of the researcher will likely change what information is discussed, and the detail that is provided. That is not to say that asking players for their opinions is inherently biased or provides unreliable information; it is simply

a bi-product of existing in a social system. Players will prioritise what is important to share based both on what they believe is important to share, and what they believe the researcher wants to hear. Consequently, what players do mention is the aspects of an experience they believe to be important, which highlights what they value and prioritise to share. Therefore, such utterances can be revealing as to what the experience meant to the player, which can then be used to understand what experience they have had.

7.1.4 The non-truth of plans

As discussed in the previous Section 2.3.2.2, it is known that people reconstruct their goals, associated actions, and plans for a task *after* it has occurred. Relatedly, any plan for action they give before a task is necessarily vague, as the contextually-situated experiences they will have to navigate cannot be fully known ahead of time. Similarly, Section 2.3.3.1 describes Moral Foundation Theory, where people can make choices without fully knowing what led to that decision, as the reasons are somewhat subconscious and driven by their underlying values. Therefore, it is entirely possible when asking players to recall their experiences and what actions they took within them is a narrative reconstruction of events, rather than what drove them in the moment. It will be difficult to understand what actions players select, and what they have experienced in the moment of gameplay, if relying on their recall of events. Any plan a player reports at the beginning, and any explanation given afterwards, are unlikely to directly map to what actually happened.

7.1.5 Summary

Based on the above literature review, the following factors may affect how players discuss a specific gaming experience:

- **Memory** effects may make players more likely to report positive experiences overall, but provide more accurate and detailed recall of negative experiences. Therefore, it is unlikely that players will recall all of a gaming experience to the same level of detail.
  - *Proposed Mitigation*: accessing what players objectively did in terms of their actions from gameplay footage will indicate if certain experiences are more likely to be recalled than others, depending on their valency.
- **Experienced** players are unlikely to recall the same types of information about behaviours as novices, as experts think in more abstract terms in order to perform better. Further, because their behaviour has become habituated with practice, it is possible experienced players are more susceptible to **novelty** bias. Players may recall events that are novel moreso than those that are part of the 'everyday' actions and goals of gameplay (such as walking or clicking on objects).
  - *Proposed Mitigation*: Ensuring the sample has a similar level of experience is important to keep comparisons across participants fair. Further, accessing gameplay will reveal if certain types of experiences are more likely to be discussed than others, depending on their novelty.
- Theories of **Social Communication** suggests how players communicate will change depending on the conversation itself and those involved. Players will respond differently to a researcher they believe does or does not have relevant experience with the game in question, and will alter their responses accordingly. This may lead them to leave out important details for the analysis.
  - *Proposed Mitigation*: It is important to choose a game for players that the researcher/interviewer is similarly experienced in, so they feel comfortable explaining themselves in detail.

- The theory of **Situated Actions** suggests when asking players to recall their experiences and what actions they took within them is likely a narrative reconstruction of events, rather than what drove them in the moment.
  - *Proposed Mitigation*: Comparing what players report doing to their gameplay will reveal differences between what players say they did, and what took place in their gameplay.

Taken together, these factors suggest actions and goals that are recalled may differ from what actually takes place. They may however indicate actions and goals that are highly valued by the player, as they have been chosen to share with the researcher. As such, these actions and goals may be core to the experience. However, they still require situating within the overall experience the player had to understand their true relevance and importance to the gaming session. Therefore, to minimise the impact of the above factors on the results of Study 6, and contextualise what players do report, it is necessary to compare what players say they do to what they actually do. This can be done by comparing what players recall to their gameplay. This comparison may inform what players experience in the moment, versus how they report their experiences on reflection.

7.2 Method

7.2.1 Study Design

As Study 6 explored a specific gaming experience, there are a number of considerations in designing a study to collect such data. These involve what gaming experience to analyse, how to collect and assign actions to gameplay data, how to collect and assign player goals to gameplay actions, and how to relate player actions and goals to the overall player experience.

The first consideration is which specific open world gaming experience to ask players to engage with, and for how long they should do so. To explore what players do in an open world game in terms of actions and goals, it was important to choose a game that a) was prototypical of an open world experience, b) has a player-base of experienced players, and c) could be easily recorded for analysis via an online video call. These are explained in detail below.

A 30-minute session of *Skyrim* (2011) was consequently selected for this study. Skyrim is a single-player open world role-playing game where the player tries to save the world from a threat of dragons, however players can also choose to pursue a variety of other objectives. These include joining different guilds, completing quests for powerful entities known as Daedras, and building houses. Thirty minutes was chosen as it was considered long enough for players to get into the experience, but not long enough for players to grow tired from being in an experimental setting. Skyrim was chosen for this study for several reasons. Firstly, it is a prototypical example of an open world game, using the themes outlined in Study 2; players are situated to scale, the game world is accessible to them from the beginning of the game, the main goal does not stop them from pursuing other activities, and therefore they can self-pace what they choose to do. It is therefore likely to provide a 'typical' open world player experience. Secondly, the game was released in 2011 and has been highly popular amongst open world players for several years, meaning the potential sample population is both large and likely experienced in playing the game. The latter is particularly important as players experienced both with open world games generally and with this specific game are likely to play the game differently to novice players. Sampling from experienced players reduces the chance of learning/novelty affecting what players do and experience, as discussed in the literature review Section 7.1.

Finally, Skyrim was chosen as it is originally and popularly played on the PC, which allows for gameplay to be easily screen-recorded for analysis. This subsequently allowed players to play Skyrim from their own homes, with their own save files, increasing the ecological validity of the recorded open world experience. Furthermore, gameplay recordings allow what players do in terms of actions to be analysed second-by-second, allowing for granular exploration of what players are doing over time.

Once the game, duration, and how to record second-by-second players actions was decided on, it was important to decide how to assign goals to these player actions. Before describing how goals were assigned, it is first important to clarify what 'goal' means in the context of this study. The previous study considered how Overarching Goals relates to Means Goals and Actionable Goals, based on the framework described by Kruglanski et al. (2018). However, there are further levels below Actionable Goals with their own hierarchy; the Means to pursue an Actionable Goal, and the Action itself. Consequently, Action is the smallest unit of specificity achievable. Figure 7.1 illustrates these further levels. The given example is as follows: a player has the Do Everything Goal (Overarching), where

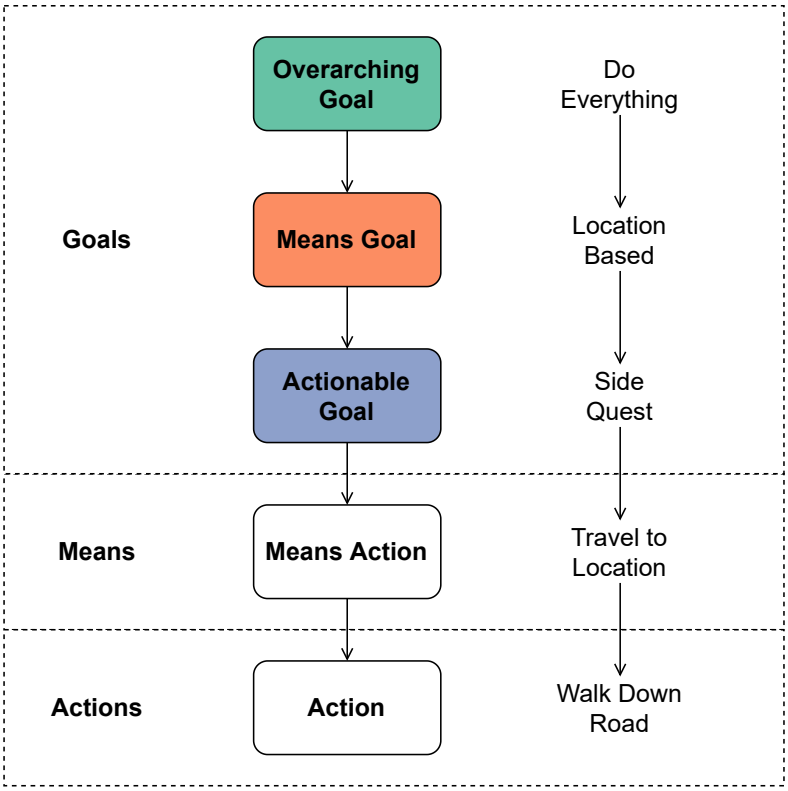


Figure 7.1: A diagram illustrating the relationship between Goals, Means, and Actions.

they want to complete all the Side Quests (Actionable). To achieve this, the use a Location Based strategy (Means Goal). There are many gameplay actions players could do to achieve these Goals. In this example, they may travel to a specific location (Means Action), which if a second snapshot of gameplay is taken, this may show the player walking down a road (Action). Therefore, Figure 7.1 demonstrates how second-by-second gameplay can be linked to abstract concepts such as Means and Goals.

To code and assign each of these goals to second-by-second gameplay data would not be feasible. To simplify analysis, Study 6 only assigned Actionable Goals (e.g., Side Questing, Exploring) and gameplay Actions to each gameplay second. During analysis, players were found to typically discuss their goals exclusively at the Actionable Goal and Action levels, with little mention of Means. Therefore, a simplified version of the Goals-Means-Actions framework is the basis of Study 6's analytical approach.

Actionable Goals therefore were required to be collected to compare to the gameplay data. Study 5 showed player goals, even those only at the Actionable Goal level, are numerous, interlinked, and frequently switched between. Similarly, the actions players take in pursuit of these goals is equally

complex and dependent on the current context of the game. This means it is likely not enough to ask a player at one time point for their goal to explain their actions. There could be multiple active goals at once, and the most relevant goal will likely change over time. Therefore, it is important to understand how player goals evolve over time, and how they are specifically tied to their gameplay. This requires a way to label data for what actions and goals are being performed at each moment of gameplay.

Whilst actions can be labelled from observing gameplay alone, assigning a goal to an action is more complex, as these exist in the minds of the players. One way to access goals is to ask players to describe their goals during or after the play experience. From here, a description of their experience could then be used to label the gameplay actions. However, as shown in the literature covered in Section 7.1, it is clear that asking players to reflect on their experiences may be affected by a number of factors. How players are asked to recall what they did can affect what they say; for example, asking a player to describe their motivations and goals for gaming beforehand may predispose them to reporting more goals, leading to more data for analysis. Conversely, asking players to talk throughout their play session may also increase what they mention, which would also lead to more data for analysis. Therefore, the ease of mapping goals to actions could be affected by how participants are asked to explain their gaming experience, and it is currently unclear which is the best approach. To explore this, Study 6 comprised of three conditions which manipulated the context of how players were asked to recall what they did: warmup, no warmup, and think aloud. These are explained further in the Procedure section.

Finally, how to relate actions and goals to the overall open world experience is important to consider. For example, open world games are described as highly immersive (as seen in Study 2), which is a summative overarching experience with a reliable way of being measured (Jennett et al., 2008). It is therefore interesting to explore how the actions and goals players pursue relate to immersion; in other words, does the type of action or type of goal affect how players view the overall experience? Therefore, a measure of immersion was also collected.

Accounting for the above factors, the design for Study 6 is summarised as follows. An online interview where participlants played 30 minutes of *Skyrim* (2011) was chosen, where each second of gameplay was recorded so they could be assigned an action (from observation) and goal (from observation and using what players say about their actions). As players might be affected by how they are asked to recall what they did, three conditions were explored that manipulated the context of how they were asked to recall. Findings from the second-by-second gameplay analysis were then related to the overarching experience of the game, measured via immersion, to relate player actions and goals to the summative gaming experience. Taken together, this design allows Study 6 to explore what players do in open world games in terms of actions and goals, how this relates to the experience they have, and how best to ask for goal descriptors of gameplay.

7.2.2 Participants

Online advertisements on the forum posting website *Reddit* and on *Twitter* were distributed to find experienced *Skyrim* (2011) players. Recruiting experienced players avoided the potential of novice/learning effects influencing recall, as novices report their behaviours in less abstract ways than experts (Rosen et al. (2008)). What constituted an experienced player was kept intentionally flexible, however most players had been playing since the game originally came out in 2011, and considered themselves experienced. Inclusion criteria was kept brief to sample from as wide a player base as possible: players needed only to be over 18, have an installed save file of Skyrim they wished to play for 30 minutes, and consider themselves experienced. In total, 15 players were recruited.

7.2.3 Procedure

Ethical clearance was obtained from the University of York prior to beginning the study. Participants completed a signup form on *Qualtrics*, where they could read the information sheet and leave contact details to arrange a time for the experiment. At the agreed time, participants were invited to a *Zoom* call, where they first read the information sheet again and signed a consent form.

The consent form explained what participants would be asked to do, that they would be audio and screen-recorded, and how their data would be used. Participants were randomly assigned into three conditions: Warmup, No Warmup, and Think Aloud. In the Warmup condition, players took part in a short pre-game interview where they described their general Skyrim experiences, what they did/-didn't like to do, and their typical goals. In the Think Aloud, players were briefed on what a think aloud is, and what they were going to be asked to do. This involved a series of warm-up exercises as described in Eccles & Arsal (2017), where participants spoke their thoughts as they solved a simple mathematical problem, unscrambled a word, and found a character in a picture scene. In the No Warmup condition, players went straight to the playing phase.

All participants were then asked to load their chosen save file. No restrictions were placed on what players could do, to collect as much naturalistic play data as possible — the only requirement was that the save was further than the tutorial area. Screen recording was activated and the researcher's camera and microphone were switched off, allowing participants to play as they normally would for 30 minutes. During gameplay, the researcher took notes on what players were doing, to use as prompts for the post-game interview. The Think Aloud spoke throughout the 30 minutes, whilst Warmup and No Warmup were told they could speak as much or as little as they usually would. At the end of the 30 minutes players were asked to stop, and invited to a post-game interview and asked the following question:

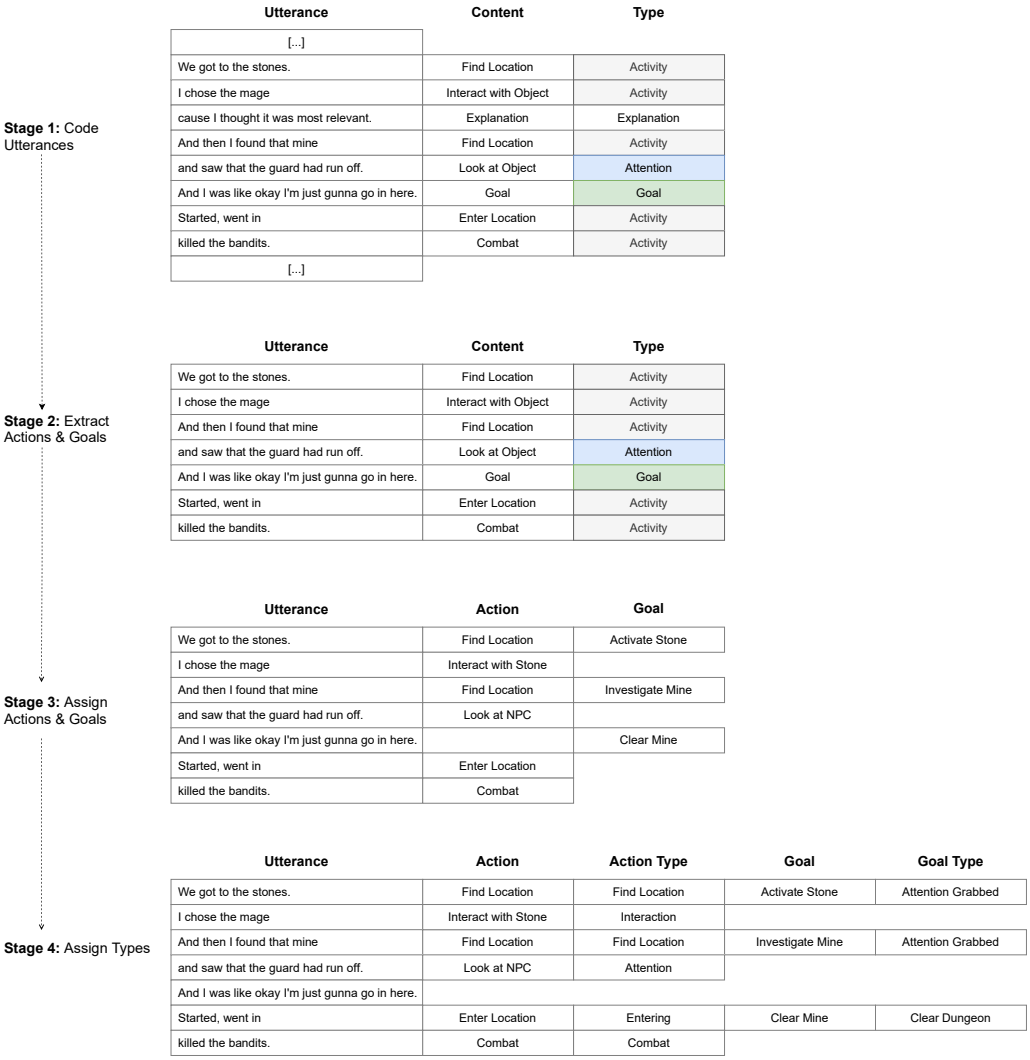
> "When I stopped you, the last thing you were doing was [action]. At the start of the session, you were doing [action]. What I'm going to ask you to do is walk me through everything you did between those two points — preferably chronologically, but it's okay if things are out of place. No detail is too small."

Participants were then given time to recall as much as they remembered. Afterwards, players were probed for any further context that may help with data analysis (such as specific reasons for certain goals), followed by the Immersive Experience Questionnaire Short Form (IEQ-SF; M. T. Aung (2022)). The IEQ-SF was chosen as it is a recently validated, updated version of the original IEQ Jennett et al. (2008), comprising of 11 questions in three sub-scales (Real World Disassociation, Challenge, and Involvement). Items were rated on a scale of 1-5 from 'Disagree Strongly' to 'Agree Strongly,' with an example item from Involvement as follows: 'The game was something that I was experiencing, rather than just doing.' The full item list and post-interview questions can be found in Appendix D. Finally, participants were debriefed on the goals of the study, and thanked for their time.

7.2.4 Data Preparation

What players were doing was extracted from the gameplay footage (to find their actions) and compared with what they reported doing in the post-game interviews (to find their goals). The *post-game interviews* were analysed via a content analysis (Krippendorff, 2018) to assess what goals players recalled and what actions they related to. However, participants frequently provided extra details surrounding what they did. For example, Participant 1 stated; "I had to lockpick to get into his house, which was smooth, I did a really good job, and it was a novice lock it's not hard but like I found the sweet spot pretty quick." The stated Action was lockpicking a door with the Goal of entering the house, followed by a Reflection on how the player Felt, and an Explanation of why it was easy. Therefore, 4 types of utterance are present: Action (I had to lockpick), Goal (to get into his house), Emotion (I did a really good job), and Explanation (which was smooth; it was a novice lock it's not hard but like I found the sweet spot pretty quick). Utterances coded as either Activity or Goal were then analysed by assigning them an Action, a Means, and a Goal that reflected what was taking place. These codes were then assigned a type to allow for easier comparison across utterances. Figure 7.2 provides an overview of how comments were transformed from utterances to coded data, using an example from Participant 2.

In total, each second of gameplay was assigned an action and type, and a goal and type (1801 seconds per participant, multiplied by total number of participants, for a total of 27015 seconds). Actions were coded by analysing gameplay for what participants were doing in each second (e.g.,



Utterance	Content	Type
[...]		
We got to the stones.	Find Location	Activity
I chose the mage	Interact with Object	Activity
cause I thought it was most relevant.	Explanation	Explanation
And then I found that mine	Find Location	Activity
and saw that the guard had run off.	Look at Object	Attention
And I was like okay I'm just gunna go in here.	Goal	Goal
Started, went in	Enter Location	Activity
killed the bandits.	Combat	Activity
[...]		

Utterance	Content	Type
We got to the stones.	Find Location	Activity
I chose the mage	Interact with Object	Activity
And then I found that mine	Find Location	Activity
and saw that the guard had run off.	Look at Object	Attention
And I was like okay I'm just gunna go in here.	Goal	Goal
Started, went in	Enter Location	Activity
killed the bandits.	Combat	Activity

Utterance	Action	Goal
We got to the stones.	Find Location	Activate Stone
I chose the mage	Interact with Stone	
And then I found that mine	Find Location	Investigate Mine
and saw that the guard had run off.	Look at NPC	
And I was like okay I'm just gunna go in here.		Clear Mine
Started, went in	Enter Location	
killed the bandits.	Combat	

Utterance	Action	Action Type	Goal	Goal Type
We got to the stones.	Find Location	Find Location	Activate Stone	Attention Grabbed
I chose the mage	Interact with Stone	Interaction		
And then I found that mine	Find Location	Find Location	Investigate Mine	Attention Grabbed
and saw that the guard had run off.	Look at NPC	Attention		
And I was like okay I'm just gunna go in here.				
Started, went in	Enter Location	Entering	Clear Mine	Clear Dungeon
killed the bandits.	Combat	Combat		

Figure 7.2: An illustration of how interview data was coded into utterances, then assigned actions & goals.

walking down a road, drinking a potion, looking at a sign), and assigned a type (e.g., movement, combat). To ensure coding was at an appropriately abstract level (i.e., similar to how players described their behaviour), codes were compared against what participants mentioned in the post-interview. Some actions were not discussed by players in the interview. These gaps were analysed and assigned a similar abstraction based on the previous analysis (e.g., if a participant explored a location whilst following a quest but did not recall the exploration, the encounter was labelled as Explore). This allowed each second of gameplay to be assigned an action and type, which were then overlaid with the player goals collected from the post-game interview (e.g., following the Dark Brotherhood questline). Table 7.1 provides an example of what the coded data looked liked, using the same example from Participant 2 shown in Figure 7.2.

After overlaying player goals to the actions extracted from gameplay, the next step was to combine this data with what players recalled doing in the post-game interview. Recall indicates what actions could be assigned a goal by the player (vs researcher interpretation), but also what players were generally able to recall about their experience. The latter consequently indicates how viable it is to ask players to recall their goals, and if there are any notable gaps. Recall was considered in two ways: the time spent on a type, and the total number of instances. However, this process required a number

Table 7.1: An example of coded gameplay data after combining both the actions pursued (observed from gameplay) and the player goals (described in the post-game interview).

Timestamp	Action	Action Type	Goal	Goal Type
00:17:10	Finds Guardian Stones	Find Location	Activate Stone	Attention Grabbed
00:17:11	Finds Guardian Stones	Find Location	Activate Stone	Attention Grabbed
00:17:12	Looks at Stones	Attention	Activate Stone	Attention Grabbed
00:17:13	Looks at Stones	Attention	Activate Stone	Attention Grabbed
00:17:14	Looks at Stones	Attention	Activate Stone	Attention Grabbed
00:17:15	Looks at Stones	Attention	Activate Stone	Attention Grabbed
00:17:16	Looks at Stones	Attention	Activate Stone	Attention Grabbed
00:17:17	Activates Mage Stone	Interaction	Activate Stone	Attention Grabbed
00:17:18	Activates Mage Stone	Interaction	Activate Stone	Attention Grabbed

of considerations. Firstly, not all goal types were equal in length, which could negatively affect recall. For example, reloading a game after dying was a small goal, but following a quest was markedly longer. Remembering a large volume of short goals would consequently receive lower recall scores than remembering a small volume of long goals, and so the recall of number of goal instances was also calculated.

Another complexity was sometimes players would partially recall goals. For example, a player could be following a quest (side quest type), veer from their path to explore a house (explore type), then continue to their quest (side quest type). However, players sometimes only recalled questing — should the second quest be counted as recalled or not? To overcome this, two numbers were calculated: one where only the first instance was counted as recalled, and another when the second instance was also counted. The two numbers were then averaged to provide final seconds recalled, and final total number of goals recalled, for each type. If a player described a goal that related to the actions identified in the gameplay data, this was counted as a recalled goal and assigned a 1. If actions were not discussed/related to a goal, this was counted as a 0. Doing so allowed recall to be counted as a binary did/did not recall, and showed what goals players discussed and identified gaps in recall. Gaps were similarly assigned a goal type in the same way as missing actions.

7.2.5 Data Analysis

After the data were prepared, a number of exploratory analyses were conducted using the findings from Study 5 as a starting point. It was important to consider if the condition affected what players did and reported doing. If the condition changed what players did or reported doing, this would mean data across conditions would not be comparable. Differences between responses to the IEQ questionnaire, what goal and action types players pursued, and what was recalled, were explored. Whilst there were differences in immersion and the quantity of recall, what players did and reported doing were comparable across conditions. Therefore, data across conditions were combined for subsequent analysis. Specific differences between conditions is reported in the relevant results sections where appropriate.

The first analysis involved what types of Goal existed. In total, 11 goal types were identified. However, many types were closely related or represented sub-types of other codes. For example, the goals of pursuing Side Quests or Main Quests are similar, but are distinct in what gameplay is involved and the motivation for pursuing it. Therefore, the 11 goal types were sorted into 5 overarching categories, to provide a broader summary of the data.

Next, the average recall (total seconds and total number) of each goal type was compared against the percentage of time spent and percentage of total number of each type. This compared what players recalled doing versus what they spent time doing. To further explore differences between the two values, the percentage recall of each type was subtracted from the percentage of time spent pursuing the type, displayed in the following equation:

$$\%\ of\ time\ spent\ pursuing\ the\ type\ -\ \%\ recall\ of\ the\ type$$

This indicated types recalled above and beyond the amount of time spent/number of instances pursuing them, with positive numbers suggesting a higher priority for recall (and vice versa for negative numbers). Following this, the same analysis were repeated for action types and the recall of action types. In total there were 15 action types, which similarly to goal types sometimes contained sub-types of other codes. For example, the action of Looting is a form of Interacting with in-game objects, but has a unique purpose (i.e., rather than interacting to open a door). Therefore, the 15 action types were sorted into 6 overarching categories.

After goal and action types were analysed, the next analysis involved how goals and actions related to one another. This explores how the actions players take in the game relate to what they want to pursue and experience. As action and goal types were highly interconnected, a visualisation was required to explore the data. To do so, Alluvial diagrams were created that visualised each time an action type was selected in pursuit of a specific goal type, created with the R package ggaluvial (Brunson, 2020). Alluvial plots are useful for visually plotting how complex groups change over time, as they indicate the directions in how data moves from one time point to another. In this case, it can indicate the common actions players enact in pursuit of a goal, and vice versa.

After considering how goals and actions were related to one another, the next analysis explored how players switched between goals. This is because the data collected allows for analyses that relate to the timing of goals, to explore what influences a player to change from their current goal. To assess goal switching, a series of visualisations were created. Firstly, from the data it was possible to see how players switched between goals both collectively and individually. To do so, the number of times a goal type was pursued for each player were extracted. This revealed a list of goal types pursued for each player, which allowed the exploration of what types players started on, to what they switched to. Similar to the relations between actions and goals, Alluvial diagrams were created to identify the common goal switches.

At this point in the analysis, only aggregate data across participants had been explored. However, goal switching is inherently a process that occurs over time, and highly dependent on what occurs in the specific game a player is in. Therefore, individual traces of players switching goals was explored. To visualise individual goal switching, each second of each goal type pursued by an individual player was plotted in a bar chart. A similar process was repeated for the number of times an instance of a goal type was pursued, to account for differences in average length of goal types. As action switching is similarly dependent on time, and highly individualised to a play session, this process was then also repeated with action type data to visualise action switching.

Whilst maintaining the time component of the experience revealed interesting insights into how the experience unfolded over time, goal switching could also be summarised more succinctly to allow easier comparison across participants. To do so, goals were presented as boxes and any time a player switched from one goal type to another, this was represented as an arrow. This also allowed arrow thickness to indicate the number of times a player moved from one goal to another. Doing so revealed loops of behaviour, which may reflect the core gameplay loop of participants. In this chapter, two participants are selected to illustrate what these visualisations look like, to explore how goal switching changes over time.

Finally, to assess if what players pursued in terms of actions and goals effected their overall experience, responses to the IEQ were correlated with the time spent and number of instances of action and goal types using Spearman correlations. As this analysis is purely exploratory, no p-values are reported, and only general trends are discussed.

7.3 Results

7.3.1 Goal Types

Whilst not explicitly asked to talk about their goals in the free recall, all players made reference to a goal at least once. Players in the post-game interview mentioned 95 different goals in total, such as pursuing the main quest or trying to find a bed, for an average of 6.33 goals per player. Across the 30 minute play session, players pursued an average of 49 separate goals instances (range = 24 - 73), indicating frequent goal switching (1.6 goals per minute). Goals were analysed and collected into 11 types, ordered below by the overall percentage of time spent on each overarching type:

- **Questing (58%):** completing a *Side Quest* (35%), the *Main Quest* (17%), or *Clearing a Dungeon* (7%)
- **Explore (15%):** looking around in search of something in an area
- **Attention Grabbed (11%):** choosing to pay attention to a specific in-game event/object
- **Interruption: (9%)** unplanned in-game events that require immediate attention; *Interrupting* events such as being attacked by bandits (9%) and *Loading Game* after dying (1%)
- **Misc. Quests: (6%)** *Sleep* to pass in-game time (1%), *Shop* to buy/sell items (1%), *Revenge* by returning to a place to kill an enemy that killed them (1%), and *Individual Quests* (e.g., only undertaken by one player, such as Collecting Flowers; 2%)

Figure 7.3 shows both the percentage of time spent on each goal type and percentage of each number of goal type, where colour indicates the overarching categories. Overall, players spent most of their time pursuing side quests, the main quest, and exploring. In terms of the number of goal instances, players most frequently pursued side quests, attended to points of interest, and explored.

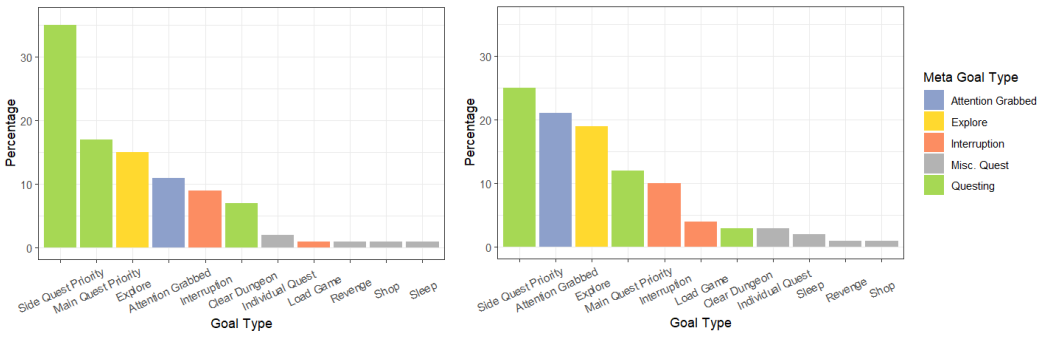


Figure 7.3: Time spent on each Goal Type (left) and the percentage of total Goals spent (right) on each Goal type, colour coded by their overarching categories.

Players spent the most time pursuing either the main or side quest (around 50% of their time on average). Each goal is described in turn, grouped under their respective overarching category.

All players pursued at least one type of **Questing**. Eleven players pursued a Side Quest, 4 players pursued a Main Quest, and 4 players pursued Clear Dungeon. It was uncommon for players to pursue multiple types of Questing during the session; 8 players pursued Side Quests, and 3 pursued the Main Quest. There were no examples of players switching between the Main Quest and Side Quests, though 3 players did pursue both Side Quests and Clear Dungeon, and one player pursued the Main Quest and Clear Dungeon. Side Quests were therefore the most frequent Questing goal type pursued.

Similarly, all players pursued the **Explore** goal, either in terms of looking around an area or searching for something specific, typically loot. This was commonly pursued as part of Clearing Dungeons

or following other Questing goals, where players would temporarily pause Questing in order to collect loot/search a room so as to not miss finding loot.

All participants experienced multiple instances of having their **Attention Grabbed**. Events that grabbed players included noticing a landmark such as a cave entrance, organising the character's inventory, levelling the character, fixing controls/settings, and funny occurrences usually caused by glitches. Sometimes players would return to their previous goal after having their attention grabbed; this was typical for events such as fixing a setting or observing a glitch. However, sometimes players would change to a new goal, such as when they noticed a landmark. In a sense Attention Grabbed is an anti-goal that implies players do not *choose* to pursue it; rather, it chooses them. However, players discussed Attention Grabbed in a goal-oriented way (e.g., choosing to investigate what is happening in front of them), and so it was recorded alongside the other goal types. In summary, Attention Grabbed reflects the state a player enters when an event in the game has temporarily caught their attention, and represents players spending time deciding what to do with this new information.

All players also encountered events that were an **Interruption** from their current goal. Typically interruptions were random encounters created by the game, involving either combat (9 players) or talking to NPCs (5 players). These could however also be forced interactions from the game, where the player must stop and partake in a dialogue with the NPC (4 players). Players sometimes reported annoyance at experiencing interruptions, especially if they occurred frequently within the same goal. For example, Player 1 was forced into multiple dialogues with NPCs whilst attempting to reach a building in a town; "people stopped me from getting in 'cause I had to pay a guard a bribe. Then another person stopped me from getting in, wanting me to stay out of the [Blackbriar's] business, which annoyed me." Of note is that combat was not always an interruption, as it depends on the current active goal. A player Clearing a Dungeon will likely encounter enemies to kill, but that is encompassed *within* the goal of clearing the dungeon. Conversely, a player walking to a dungeon and being attacked disrupts the current goal of reaching a destination. Whilst most times players returned to their original goal, sometimes interruptions caused players to choose a different goal. For example, players who were killed by an enemy would sometimes seek out the same enemy in order to get revenge, before continuing onto their original goal. Interruption is therefore different to the Attention Grabbed goal. Attention Grabbed events were interesting to the player and therefore unique to them, rather than unavoidable to all players — some players may be intrigued by the presence of a dungeon marker enough to pause their current goal, but all players will be disrupted from their goal if an enemy attacks them on the road.

Finally, 9 players mentioned having at least one of their own **Miscellaneous Quests**. Some were unique to one player (e.g., Individual Quests such as to Collect Flowers to make potions) but some were shared across players (e.g., Sleep and getting Revenge after dying). Miscellaneous Quests are therefore similar to Questing, but the difference is that goals here are conceived by the player rather than existing within a quest log (like Main Quest) or designed by the game to be completed (like Clear Dungeon). It is therefore difficult to identify such goals from gameplay data alone, as the player has created other goals to follow.

7.3.1.1 Effect of Condition

Overall, players in the Think Aloud condition pursued an average of 61 goals (with a range of 48 to 76), Warmup pursued 62 (51 - 87), and No Warmup pursued 46 (27 - 73). The percentage of time spent and number of each goal did not markedly vary between conditions, as shown in Table 7.2. All three conditions spent most of the time pursuing Side Quests, and within the top 5 all pursued Attention Grabbed and Explore. The main difference is that the Warmup had more Interruptions and pursued more Individual Quests. In terms of the frequency of goals, all conditions pursued Side Quests, Explored, had their Attention Grabbed, and were Interrupted the most. The main difference was Warmup participants had a larger number of Individual Quest goals than pursuing the Main Quest. Therefore, the condition type did not influence what participants did, though Warmup did pursue more Individual Quests.

Table 7.2: The types of Goals players spent time on (both seconds and instances), ordered by their frequency. Bold text indicates the top 5 most frequent overall for comparison.

Seconds Spent		
Think Aloud	Warmup	No Warmup
Side Quest	**Side Quest**	**Side Quest**
Main Quest	**Explore**	**Explore**
Attention Grabbed	**Interruption**	**Main Quest**
Explore	**Attention Grabbed**	Clear Dungeon
Clear Dungeon	Individual Quest	**Attention Grabbed**
Interruption	**Main Quest**	**Interruption**
Sleep	Clear Dungeon	Sleep
Load Game	Revenge	Load Game
Revenge	Shop	Shop
Shop	Load Game	Individual Quest
Individual Quest	Sleep	Revenge

Number of Goals		
Think Aloud	Warmup	No Warmup
Attention Grabbed	**Side Quest**	**Side Quest**
Side Quest	**Explore**	**Explore**
Main Quest	**Attention Grabbed**	**Attention Grabbed**
Explore	**Interruption**	**Interruption**
Interruption	Individual Quest	**Main Quest**
Clear Dungeon	**Main Quest**	Load Game
Sleep	Load Game	Shop
Load Game	Clear Dungeon	Sleep
Revenge	Revenge	Clear Dungeon
Shop	Shop	Individual Quest
Individual Quest	Sleep	Revenge

7.3.2 Recall of Goals

Participants on average recalled 71% of seconds spent on goals (with a range of 46% - 88%), and 53% of the total number of goals (35% - 68%), indicating a large variety in recall volume between participants. This section describes the differences in what goal types were recalled, as this indicates what goals players believe are valuable to share. As not all goal types were pursued for equal amounts of time or an equal number of times (as shown in Figure 7.3), analysing the raw recall of seconds and number of each type would not be a fair comparison. Instead, the average recall of time spent on each type was divided by the total time spent on the type:

$$percentage\ of\ time\ on\ goal\ type\ recalled\ = \frac{average\ recall\ of\ time\ spent\ on\ the\ type}{total\ time\ spent\ on\ the\ type}$$

Next, the average recall of each type was divided by the total number of times the type was pursued:

$$percentage\ of\ goal\ type\ recalled\ = \frac{average\ recall\ of\ instances\ of\ the\ type}{total\ number\ of\ times\ the\ type\ was\ pursued}$$

Doing so created percentages of time recalled per goal type, and percentage of recalled goal types, shown in Figure 7.4.

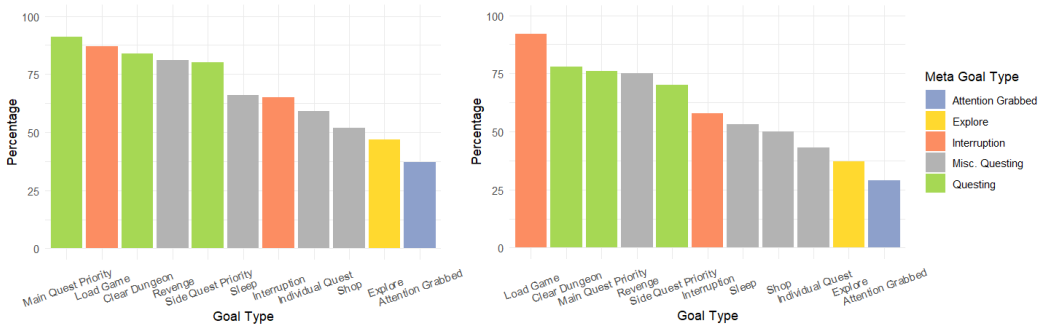


Figure 7.4: The average percentage of time recall of each Goal type (left) and average percentage number of each Goal type (right) recalled across all participants. Colour represents the overarching categories.

In summary, players recalled the most seconds of time spent and total number of goals pursuing the Main Quest, followed by Loading the Game (i.e., dying) and Clearing Dungeons. In contrast, players recalled the least seconds of time spent having their Attention Grabbed, Exploring, and pursuing Individual Quests/Shopping. This is markedly different to the distribution of time spent on

each goal type, indicating some goal types are more likely to be recalled than others, regardless of total time spent.

The above analysis indicates neither the time spent on a goal or the number of times a goal occurs relates to the likelihood of recall. This suggests players treat some goal types as inherently more worthwhile recalling than others. To further highlight the discrepancy between actual time spent and percentage of time recalled, the difference between the two values was calculated by subtracting percentage of time recalled from actual time spent, shown in Figure 7.5. Load Game and Sleeping showed the highest recall above and beyond the time spent pursuing it. In contrast, having their Attention Grabbed and pursuing the Main Quest showed the lowest recall. In terms of the difference between the total goals and number of goals recalled, Load Game and Revenge had the highest recall, whilst having their Attention Grabbed and Exploring were the lowest. Consequently, goal recall does not relate to the time spent on the goal — some goal types are inherently more memorable than others.

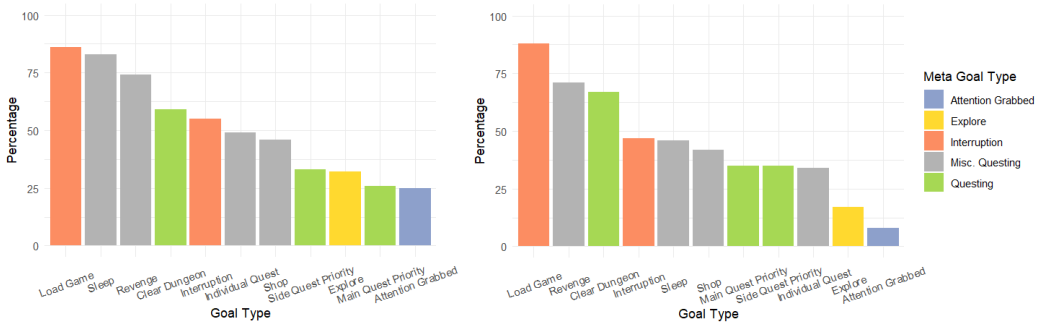


Figure 7.5: The difference between the percentage of recalled Goal type minus the percentage of time spent on the Goal type, for seconds (left) and number (right). Colour represents the overarching categories.

Overall, whilst players were most likely to pursue Quests (either Main or Side Quests), they were most likely to recall the Main Quest and Loading the Game (i.e., dying). Having their Attention Grabbed was especially de-prioritised to recall, whilst Loading the Game was especially prioritised.

7.3.2.1 Effect of Condition

The average recall of time spent on goals was 71% and 53% for total number of goal instances. Differences between conditions is shown in Table 7.3:

Table 7.3: Average recall of time spent on goals, and number of goals recalled, by condition.

Condition	Average Recall of Time Spent on Goals	Average Number of Goals Recalled
Think Aloud	75% (51 - 88)	55% (42 - 65)
Warmup	65% (46 - 80)	51% (42 - 60)
No Warmup	73% (54 - 87)	51% (35 - 68)

The Think Aloud condition recalled more time on goals and number of goals, and there was little difference between the number of goals recalled between Warmup and No Warmup, though No Warmup did recall more time spent on goals than Warmup. As shown in Table 7.4, there was also little difference in the percentage of types of goals players recalled between conditions. The only notable difference is that No Warmup were more likely to recall Individual Quests than the other conditions. Overall, all conditions frequently recalled Clearing Dungeons, pursuing Side Quests, and Loading the Game. Therefore, the condition did not affect what types of goals participants were most likely to recall.

Overall, the three conditions engaged in many of the same goals. The Think Aloud recalled more goals than the other conditions, however there was no marked differences between the types of goals

Table 7.4: The types of Goals recalled (both seconds and instances), ordered by their frequency. Bold text indicates the top 5 most frequent overall for comparison.

% of Goal Time Recalled		
Think Aloud	Warmup	No Warmup
Main Quest	Sleep	Individual Quest
Sleep	**Load Game**	**Clear Dungeon**
Clear Dungeon	**Clear Dungeon**	**Main Quest**
Load Game	**Revenge**	**Side Quest**
Side Quest	**Side Quest**	**Load Game**
Interruption	**Main Quest**	Interruption
Explore	Explore	Shop
Attention Grabbed	Interruption	Explore
Revenge	Shop	Sleep
Shop	Attention Grabbed	Attention Grabbed
Individual Quest	Individual Quest	**Revenge**

% of Total Number of Goals Recalled		
Think Aloud	Warmup	No Warmup
Main Quest	**Load Game**	Individual Quest
Load Game	Sleep	**Load Game**
Clear Dungeon	**Clear Dungeon**	**Side Quest**
Side Quest	Revenge	Interruption
Interruption	**Side Quest**	**Clear Dungeon**
Sleep	**Main Quest**	**Main Quest**
Explore	Shop	Shop
Attention Grabbed	Interruption	Attention Grabbed
Revenge	Explore	Explore
Shop	Attention Grabbed	Sleep
Individual Quest	Individual Quest	Revenge

recalled. This indicates the condition may affect total recall, but not what is specifically recalled.

7.3.3 Action Types

Across the 30 minute play session, players pursued an average of 286 separate action instances (range = 193 - 363), indicating frequent action switching (9.53 actions per minute). Actions were analysed and collected into 15 types, ordered below by the overall percentage of time spent on each overarching type:

- **Moving (38%):** moving around the world. This mostly involved walking/running, but also includes jumping and sneaking.
- **Attending (22%):** choosing to *Attend* to something specific in the world. This mostly involved attending to events/objects such as looking at an animal or a signpost (15%), but also included *Checking* the map/quest log for information (3%), looking at items in the *Inventory* (3%), using an online play *Guide* to help progress a quest (1%), or *Finding a Location* which occurs when the players enters a new area for the first time (0.2%).
- **Interacting (15%):** interacting with in-game objects such as doors (10%) or specifically interacting to *Loot* items with the goal of putting them into the inventory (5%).
- **Combat: (12%)** fighting enemies using a variety of attacks, both ranged and melee.
- **Dialogue: (8%)** talking to Non-Player Characters (NPCs).
- **Loading: 5%** anytime gameplay was paused for the game to advance in some way. This included *Entering* a new location via a loading screen (3%), *Loading* after dying (1%), *Save* the game file (1%), *Idle* whilst waiting for an in-game event to take place (0.4%), or performing the *Wait* action to progress the in-game time (0.1%).

Figure 7.6 shows both the percentage of time spent on each action type and percentage of each number of action type, where colour indicates the overarching categories. Overall, players spent most of their time moving around, attending to things, and engaging in combat. In terms of the number of action instances, players most frequently moved around, attended to objects of interest, and interacted with/looted items. Overall, players spent the most time moving around and attending to objects of interest (accounting for 60% of their time on average).

7.3.3.1 Effect of Condition

Overall, players in the Think Aloud condition pursued an average of 277 actions (with a range of 229 to 309), Warmup pursued 303 (193 - 363), and No Warmup pursued 278 (239 - 313). The

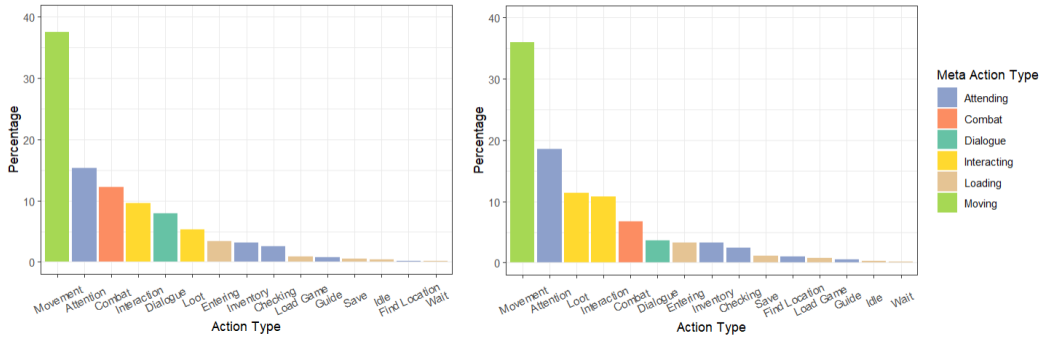


Figure 7.6: Time spent on each Action Type (left) and the percentage of total Action spent (right) on each Goal type, colour coded by their overarching categories.

percentage of time spent and number of each action type did not markedly vary between conditions, as shown in Table 7.5. All three conditions spent most of the time Moving and Attending to objects of

Table 7.5: The types of Actions players spent time on (both seconds and instances), ordered by their frequency. Bold text indicates the top 5 most frequent overall for comparison.

Seconds Spent		
Think Aloud	Warmup	No Warmup
Movement	**Movement**	**Movement**
Attention	**Attention**	**Attention**
Combat	**Combat**	Guide
Interaction	**Interaction**	**Dialogue**
Dialogue	Loot	**Interaction**
Loot	**Dialogue**	**Combat**
Inventory	Inventory	Entering
Entering	Entering	Inventory
Idle	Checking	Loot
Checking	Idle	Checking
Save	Load Game	Load Game
Load Game	Wait	Wait
Find Location	Find Location	Save
Wait	Save	Find Location
Guide	Guide	Idle

Number of Actions		
Think Aloud	Warmup	No Warmup
Movement	**Movement**	**Movement**
Attention	**Attention**	**Attention**
Interaction	**Loot**	**Interaction**
Loot	**Interaction**	Guide
Combat	**Combat**	**Loot**
Dialogue	Inventory	**Combat**
Entering	Dialogue	Entering
Inventory	Entering	Dialogue
Save	Checking	Inventory
Checking	Find Location	Checking
Idle	Save	Find Location
Find Location	Load Game	Save
Load Game	Idle	Load Game
Wait	Wait	Wait
Guide	Guide	Idle

interest, and within the top 5 all pursued Combat and Interactions. The main difference is that the No Warmup used a Guide the most and Warmup pursued more Looting. A similar pattern was observed for the frequency of actions. Therefore, the condition type did not influence what participants did, though No Warmup did use a Guide the most.

7.3.4 Recall of Actions

Participants on average recalled 31% of seconds on actions (with a range of 14% to 49%), and 21% of the total number of actions (9% - 38%), indicating a low overall recall, and a large variety in recall volume between participants. Similarly to the previous section, not all action types were pursued for equal amounts of time or an equal number of times (as shown in Figure 7.6). Therefore, the average recall of time spent on each type was divided by the total time spent on the type, along with the average recall of each type divided by the total number of times the type was pursued. Doing

so created percentages of time recalled per action type, and percentage of recalled action types, shown in Figure 7.7.

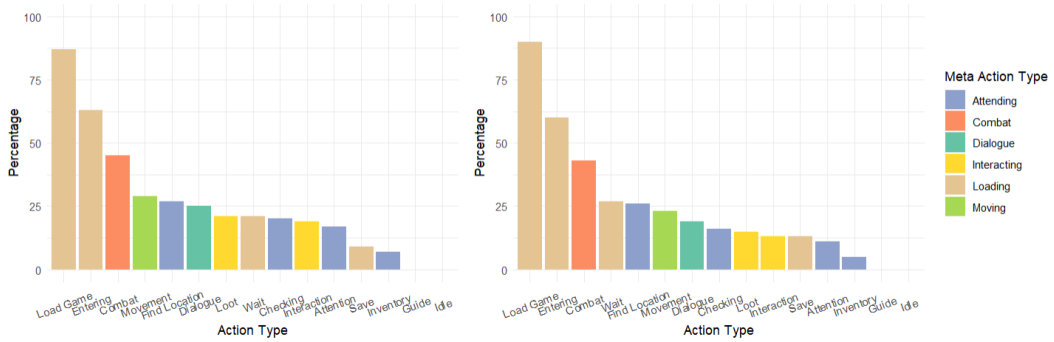


Figure 7.7: The average percentage of time recall of each Action type (left) and average percentage number of each Action type (right) recalled across all participants. Colour represents the overarching categories.

In summary, players recalled the most seconds of time spent and total number of goals Loading the Game (i.e., dying), Entering locations, and Combat. In contrast, players recalled the least seconds of time spent Idling, using a Guide, and looking through the Inventory. This is markedly different to the distribution of time spent on each action type, indicating some action types are more likely to be recalled than others, regardless of total time spent.

The above analysis indicates neither the time spent on an action or the number of times an action occurs relates to the likelihood of recall. This suggests, similarly to goals, players treat some action-types as inherently more worthwhile recalling than others. To further highlight the discrepancy between actual time spent and percentage of time recalled, the difference between the two values was calculated by subtracting percentage of time recalled from actual time spent, shown in Figure 7.8.

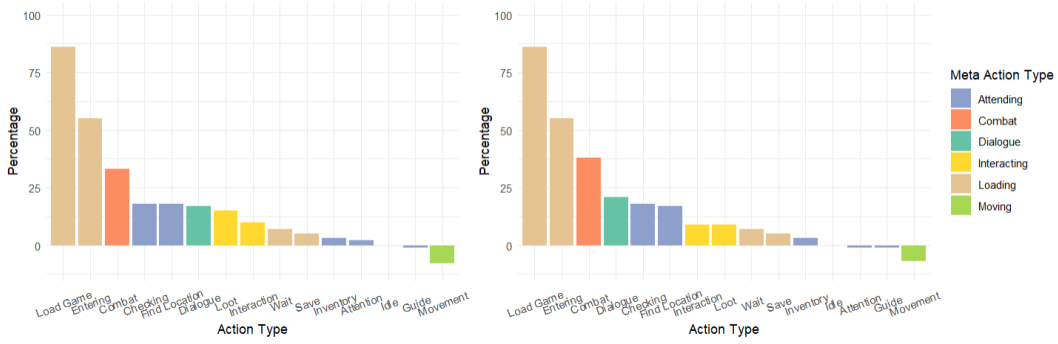


Figure 7.8: The difference between the percentage of recalled Action type minus the percentage of time spent on the Action type, for seconds (left) and number (right). Colour represents the overarching categories.

Load Game and Entering showed the highest recall above and beyond the time spent pursuing them, and above the total number of times the action type occurred. In contrast, Movement and using a Guide showed the lowest recall. Consequently, action recall similarly does not relate to the time spent on the action — some action types are inherently more memorable than others. Overall, whilst players were most likely to spend time Moving around, they were most likely to recall Loading the Game (i.e., dying). Movement was especially de-prioritised to recall, whilst Loading the Game was especially prioritised.

7.3.4.1 Effect of Condition

The average recall of time spent on actions was 31% and 21% for total number of action instances. Differences between conditions is shown in Table 7.6:

Table 7.6: Average recall of time spent on actions, and number of actions recalled, by condition.

Condition	Average Recall of Time Spent on Actions	Average Number of Actions Recalled
Think Aloud	39% (33 - 49)	29% (19 - 38)
Warmup	28% (22 - 37)	19% (14 - 23)
No Warmup	26% (14 - 49)	16% (9 - 32)

The Think Aloud condition recalled more time on actions and number of actions, with little difference between Warmup and No Warmup. Similarly, as shown in Table 7.7, there was a high degree of overlap in the percentage of types of actions players recalled between conditions. Notable differences include Think Aloud recalled more seconds and instances of Dialogue, and No Warmup recalled more seconds and instances of Waiting. Overall, all conditions frequently recalled Loading the Game, Entering locations, and Combat. Therefore, the condition did not substantially affect what types of actions participants were most likely to recall. Overall, the three conditions engaged in many of the

Table 7.7: The types of Actions recalled (both seconds and instances), ordered by their frequency. Bold text indicates the top 5 most frequent overall for comparison.

% of Action Time Recalled			% of Total Number of Actions Recalled		
Think Aloud	Warmup	No Warmup	Think Aloud	Warmup	No Warmup
Load Game	**Load Game**	**Load Game**	**Load Game**	**Load Game**	**Load Game**
Entering	**Entering**	Wait	**Entering**	**Entering**	**Wait**
Combat	**Combat**	**Entering**	**Combat**	**Combat**	**Entering**
Movement	**Find Location**	**Combat**	Dialogue	**Find Location**	**Combat**
Dialogue	**Movement**	Checking	Movement	Checking	Checking
Find Location	Attention	**Movement**	**Find Location**	Movement	Movement
Interaction	Dialogue	Loot	Interaction	Loot	**Find Location**
Loot	Checking	**Find Location**	Save	Dialogue	Loot
Attention	Loot	Dialogue	Loot	Attention	Attention
Inventory	Interaction	Attention	Inventory	Interaction	Save
Save	Guide	Interaction	Attention	Guide	Interaction
Checking	Idle	Save	Checking	Idle	Dialogue
Guide	Inventory	Guide	Guide	Inventory	Guide
Idle	Save	Idle	Idle	Save	Idle
Wait	Wait	Inventory	**Wait**	**Wait**	Inventory

same actions. The Think Aloud recalled more actions than the other conditions, however there was little difference on the types of actions recalled. This indicates the condition may affect total recall, but not what is specifically recalled.

7.3.5 How Goals Relate to Actions

To explore how actions related to goals, alluvium were plotted that counted each time an action type was completed in pursuit of a specific goal type. Figure 7.9 shows these connections. These figures highlight the inherent complexity in mapping actions (the bottom stratum) to goals (the top stratum). The simplest mappings are the relationship between the Movement action type to Questing, Combat to either Interruption or Questing, Attention to Attention Grabbed, and Dialogue to Questing. However, even within these connections there is no way to conclude what goal a player is pursuing based on the action type alone, and vice versa. For example, Movement was associated with

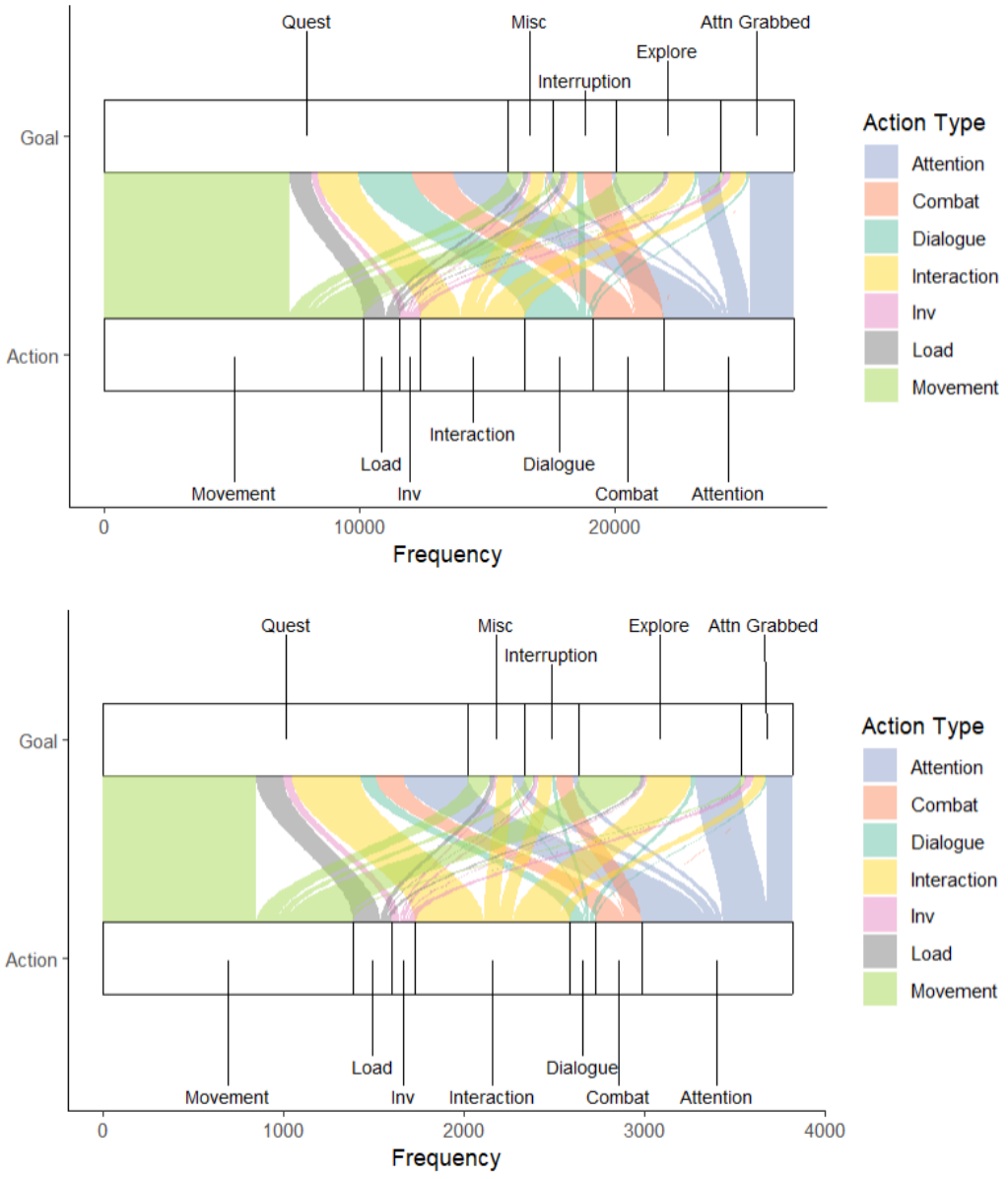


Figure 7.9: Alluvium showing how action types relate to goal types, in terms of seconds (top) and instances (bottom). Line thickness indicates number of occurrences.

every other goal type to varying degrees, with Explore as the second most common. Further, Questing was also associated to every action type. Therefore, an action type can lead to many different goal types, and a goal type can lead to many action types.

7.3.6 Goal Switching

Goal switching across all players is shown via an Alluvial in Figure 7.10. There is inherent com-

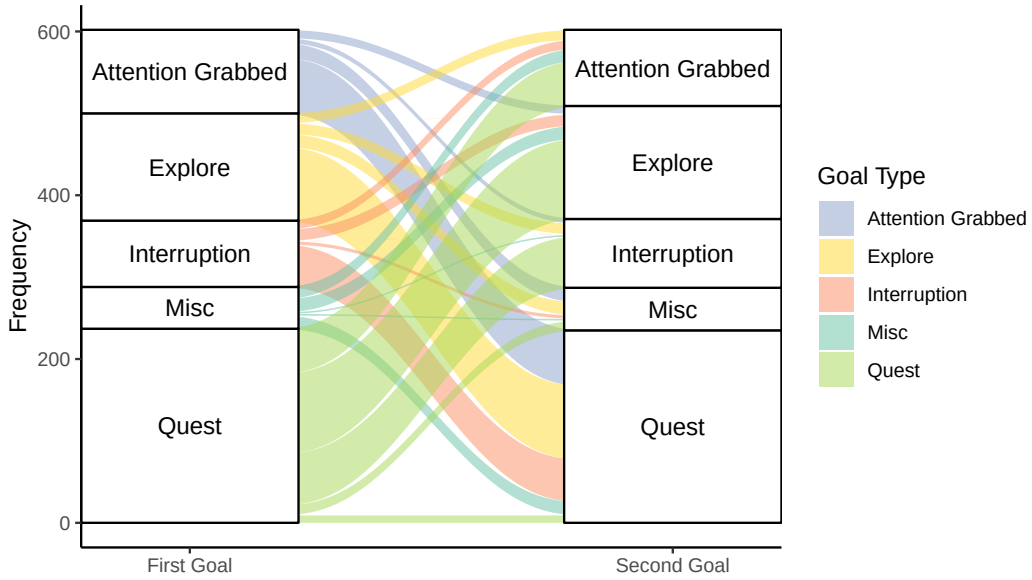


Figure 7.10: An alluvium showing how players changed between goals during play. Line thickness indicates number of occurrences.

plexity in goal switching displayed in this figure. For example, if a player was initially on a Questing goal, they equally could switch to an Attention Grabbed, Explore, or Interruption goal. Conversely, players currently on an Attention Grabbed goal were most likely to switch onto a Questing goal. Therefore, players frequently switched between a different type of goal than the one they were currently on, as it was uncommon for players to switch to a different goal of the same type (e.g., players who were pursuing an Explore goal like searching a room were unlikely to switch to another Explore goal like searching a different location). Players were particularly unlikely to spontaneously switch from one Questing goal to another (indicated by the small green connection at the bottom of the diagram). Instead, players were likely to switch to an Attention Grabbed, Explore, or Interruption goal. Conversely, it was common for players in all three of these goals to return to a Quest goal. There were exceptions however; for example, some players would move from an Attention Grabbed into a Miscellaneous Quest, some players moved from Explore to Attention Grabbed, and others moved from Interruption to Explore. Therefore, players frequently switched goals and goal types during play sessions, and so it would be inaccurate to consider gameplay to consist of players seeking out a singular goal.

By plotting each second of each goal type pursued by an individual player in a bar chart, it is also possible to see how goals change over the course of a play session. A similar process was repeated for the number of times a goal type was pursued. Figure 7.11 shows the goals pursued by Participant 1, selected as they had the highest overall goal recall.

The player pursued 70 separate goals, and spent the majority of time pursuing side quests (indicated in green), but occasionally experienced interruptions (in red) and having their attention grabbed (in blue) or exploring (in yellow). Interruptions typically involved forced dialogue with NPCs and being attacked whilst walking down the road, whilst attention grabbed ranged from listening to NPC conversations to looking at in-game objects (such as the moon, animals, or gifted items).

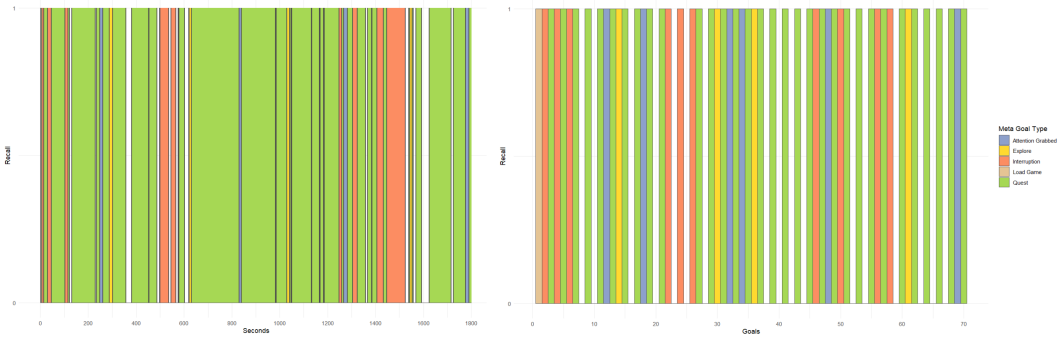


Figure 7.11: The types of goals pursued across 30 minutes for Participant 1, in terms of seconds (left) and instances (right). Colour indicates type, where white indicates the goal was not recalled.

Whilst maintaining the time component of the experience reveals interesting insights into how the experience unfolded over time, goal switching can also be summarised more succinctly to allow easier comparison across participants. For example, Figure 7.12 shows the connections between goal types as arrows, where thickness indicates the number of times a player moved from one goal to another. Doing so reveals loops of behaviour, which may reflect the core gameplay loop of participants.

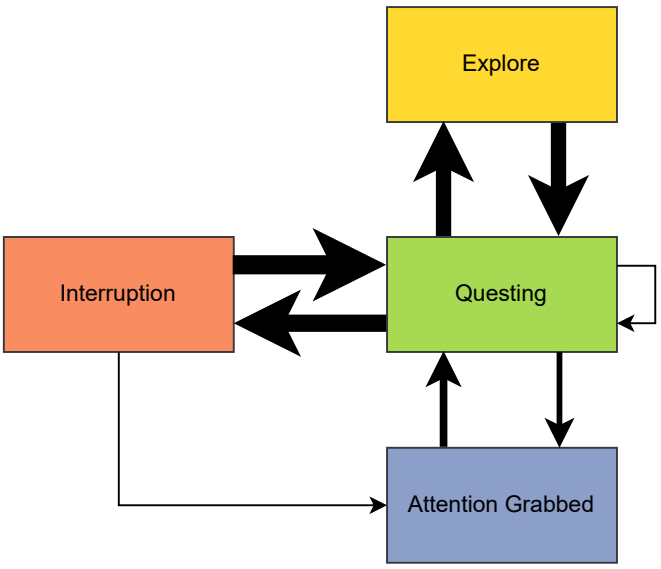


Figure 7.12: A diagram illustrating how Player 1 switched between goals during the play session.

For Participant 1, it can be concluded they spent their time pursuing quests, but would be frequently pulled from this by interruptions or new options (exploring or attention grabbed). The player maintained the same goal of pursuing side quests throughout the session despite these interactions with the game, though these interactions could have initiated switching to a different quest or goal if the player had wanted to.

To show the variety in player goals, Participant 15 is shown in Figure 7.13, as they had the lowest recall. This player had a total of 58 goal instances, but did not recall a large quantity of gameplay in the middle of the session (from gameplay, it was found they were performing inventory management in the players' house). Of the goals recalled, the player primarily pursued side quests, but also pursued revenge (grey) after dying, and was routinely interrupted by events such as dragon and bandit attacks.

Figure 7.14 presents the condensed summary of goal switching. Overall, this player had a more

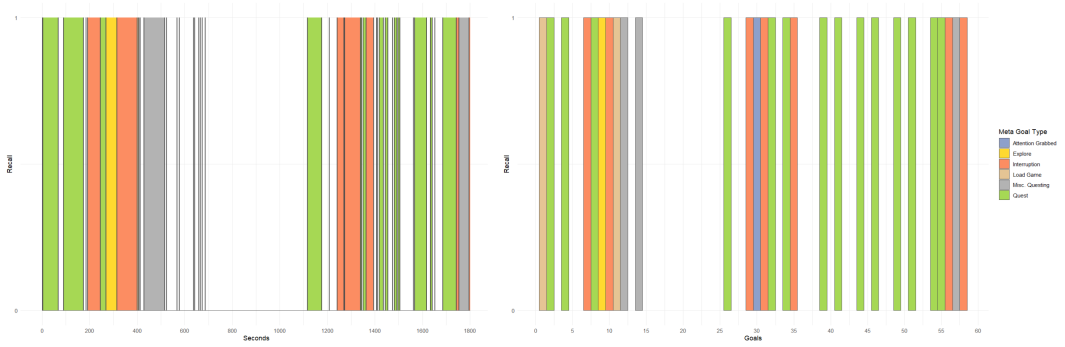


Figure 7.13: The types of goals pursued across 30 minutes for Participant 15, in terms of seconds (left) and instances (right). Colour indicates type, where white indicates the goal was not recalled.

complex goal switching behaviour, though was frequently Interrupted from their Questing and had their Attention Grabbed from their Miscellaneous Questing.

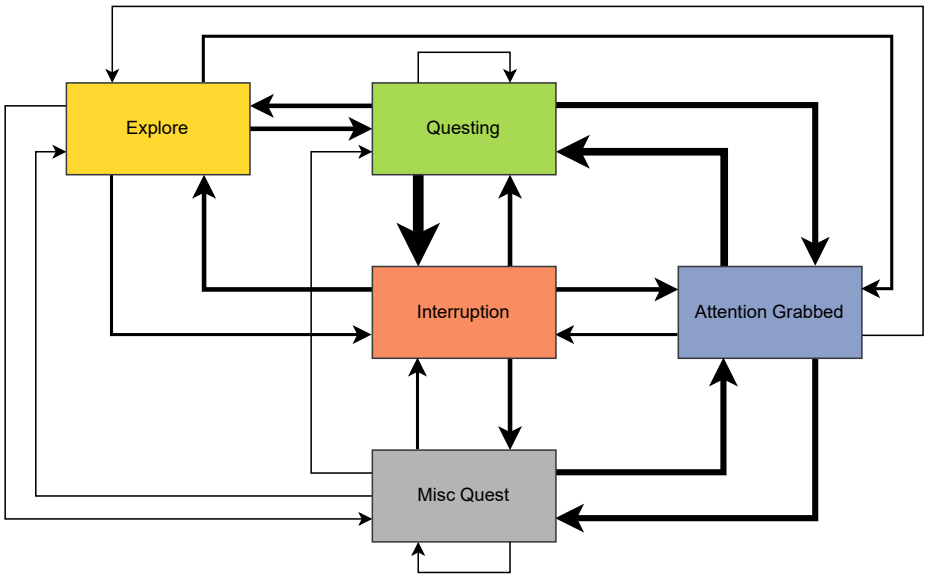


Figure 7.14: A diagram illustrating how Player 15 switched between goals during the play session.

Across all participants, players would typically have a primary quest in mind for the session (such as a side or main quest), but would be routinely presented with options for new goals (Attention Grabbed) including a desire to explore an area (Explore), or forcibly paused by an in-game event (Interruption). Consequently, these three goal types represent moments that cause players to switch goals, either temporarily or entirely.

7.3.7 Immersion

All three conditions rated the experience as equally immersive. Table 7.8 shows the breakdown in immersion sub-scales across the conditions.

Players in the No Warmup rated the experience as the most challenging compared to the other conditions, whilst the Think Aloud condition rated the experience as highest for real world disassociation and involvement.

Table 7.8: Mean immersion scores for each condition.

Condition	Real World Disassociation (out of 20)	Challenge (out of 15)	Involvement (out of 20)	Total (out of 55)
Think Aloud	14.60	7.00	17.80	39.40
Warmup	13.80	7.20	16.40	37.40
No Warmup	12.60	9.20	16.40	38.20

Overall, players were highly immersed (38.33 out of 55 for total immersion on the IEQ). To explore if what players experienced in terms of their goals affected their ratings, Spearman correlations were calculated between the time spent on goal types and number of instances of goal types, against ratings on the IEQ. These are shown in Table 7.9.

Table 7.9: Spearman correlations between time spent on meta goal types (left) and number of meta goal types (right), and responses to the IEQ. Correlations above 0.30 or below -0.30 are in bold.

Goal Type	Real World Dissociation	Challenge	Involvement	Total
Attention Grabbed	-0.02	**-0.35**	**0.38**	-0.02
Explore	0.17	-0.15	-0.08	-0.09
Interruption	-0.17	0.11	-0.13	0.01
Misc. Questing	-0.18	0.15	0.02	-0.06
Questing	0.13	-0.09	-0.15	-0.08

Goal Type	Real World Dissociation	Challenge	Involvement	Total
Attention Grabbed	0.19	0.04	**0.44**	0.26
Explore	0.20	0.01	0.07	0.07
Interruption	-0.12	0.20	-0.20	0.05
Misc. Questing	**-0.40**	-0.03	-0.17	**-0.38**
Questing	0.23	**-0.36**	-0.26	-0.06

In terms of time spent, players who had their Attention Grabbed more often reported higher levels of involvement, but conversely reported less challenge. Interestingly, there was little relation seen between time spent on Questing and involvement, or Interruptions and involvement. For number of goal instances, there was a similar relationship between Attention Grabbed and involvement, but no relationship to challenge. There were also a few more correlations observed; Miscellaneous Questing was negatively associated with real world disassociation (RWD) and total immersion. Further, Questing was negatively associated with challenge. Therefore, it is possible that what goals players pursued related to their experience of immersion, most notably in relation to Attention Grabbed.

To explore if there were any relationships between the actions players pursued and immersion, Spearman correlations were also calculated for the time spent on action types and number of instances of action types, against ratings on the IEQ. These are shown in Table 7.10.

Table 7.10: Spearman correlations between time spent on meta action types (left) and number of meta action types (right), and responses to the IEQ. Correlations above 0.30 or below -0.30 are in bold.

Action Type	Real World Dissociation	Challenge	Involvement	Total
Moving	**-0.43**	-0.28	**-0.34**	**-0.56**
Attending	0.28	**0.44**	**0.55**	**0.51**
Combat	-0.12	-0.23	**0.42**	0.08
Dialogue	-0.22	0.02	**-0.62**	-0.24
Interacting	**0.47**	0.05	0.15	0.16
Loading	**0.35**	**0.71**	-0.19	**0.51**

Action Type	Real World Dissociation	Challenge	Involvement	Total
Moving	**-0.37**	-0.22	-0.15	**-0.47**
Attending	**0.41**	**0.51**	0.12	**0.54**
Combat	-0.04	-0.21	**0.33**	0.11
Dialogue	**-0.36**	0.05	**-0.40**	-0.22
Interacting	0.07	**-0.43**	0.16	-0.21
Loading	0.18	**0.61**	-0.25	**0.37**

In terms of time spent, players who spent more time Moving reported lower immersion for every sub-scale, though most notably RWD. Players who Attended more often found the experience more challenging and involving, with a notably weaker relationship to RWD. Further, players who spent more time in Combat reported higher levels of involvement, but those who spent more time in Dialogue reported lower levels. Spending more time Interacting was associated with more RWD, and players who Loaded the game more often rated the experience as more challenging, slightly more RWD, and found the experience more immersive overall. For number of action instances, there were many similarities, but also a few notable differences. Moving showed a weaker relationship to in-

volvement, whilst Attending showed stronger relationships for all immersion sub-scales. Dialogue similarly showed a stronger negative association with RWD. For Interacting there was a stronger positive association between RWD, but a stronger negative association with challenge. Finally, Loading showed a stronger positive relationship to RWD. Therefore, the relationship between action types and immersion is less clear than between goal types. However, it can generally be concluded that players who spent more time Moving and in Dialogue were less immersed, whilst players who spent more time Attending and Loading were more immersed.

7.4 Discussion

Open world games allow players to pursue a variety of goals, and in turn select a variety of actions that will achieve such goals. Goal pursuit therefore may explain how players can have different experiences even within the same game. To investigate how goal pursuit and associated action selection relates to what players experience in a specific gaming session, Study 6 involved observing players whilst they played *Skyrim* (2011) followed by an interview. In doing so, what players pursued, what they reported doing, what they experienced overall, and what influenced their choices, were explored.

7.4.1 Aim 1: What goals and actions do players pursue and recall in a specific open world gaming experience?

Overall, players spent their time on several goals. Players pursued quests, explored areas, paid attention to points of interest, were interrupted by the game (such as a random encounter or dying), and pursued miscellaneous quests such as collecting flowers or shopping. As questing was one of the most popular goals followed, it can be concluded that players were more likely to choose a goal based from what the game had to offer than to devise their own unique goal to follow. Therefore, the literature surrounding goals devised from the game could help explain player behaviour (such as Debus, Zagal, & Cardona-Rivera (2020)), as players frequently pursued the Main Quest as well as various Side Quests dictated by the game via the quest log. However, many goals were not related to Questing, such as Exploring and the various Miscellaneous Quests. Therefore, it is important to understand how the players view their goals to understand if they originate from the game goals, or from themselves.

In terms of actions, players spent their time moving around, attending to points of interest, and interacting with objects. As playing a game is a series of interactions, this is not so surprising. To play, players must be aware of their surroundings (attending), interact with the environment (interacting), and move towards areas where they can perform actions (moving). Further, as open worlds typically involve large worlds to traverse, it is understandable that the majority of gameplay involves moving from one point to another.

Despite what players pursued in terms of goals and action types, what they were likely to discuss in the post-game interviews was notably different. In terms of goals, players most frequently discussed following the main quest and loading the game, and least discussed having their attention grabbed and exploring. When accounting for the time spent and number of instances of each type, players greatly prioritised recall of loading the game, and greatly de-prioritised recall of having their attention grabbed. For actions, players most frequently discussed loading the game and entering locations, and least discussed idling, using a guide, and searching the inventory. When accounting for time spent and number of instances of each type, players greatly prioritised recall of the loading and entering action types, whilst greatly de-prioritised moving and using a guide.

Therefore, the time spent on a goal and action, or the number of total instances of a goal and action, do not seem to relate to the likelihood that a player will discuss them. Certain goal and action types appear more intrinsically worth sharing by players, which mostly involve goals and actions that force the player to pause what they are currently doing. These could be seen as 'negative' experiences, as players are removed from their current flow, and so are more likely to be recalled because of the negative association (Walker, Vogl, & Thompson, 1997). When loading the game after dying,

or entering a new location, players must stop what they are doing momentarily while the game state changes. Consequently, and somewhat ironically, players were more likely to report goals and actions that involved a moment of *not* performing an action or goal. In contrast, players were least likely to recall goals and actions that required them to pay attention to something, or related to moving around. This implies players do not feel the need to describe their gameplay in terms of what they were paying attention to.

An alternative implication is that the frequency of some actions and goals could be so high that players felt they were too common and so not necessary to discuss. For example, the movement action alone accounted for 38% of all seconds, and the attending meta-actions accounted for a total of 22%. These actions may be so much 'a part of the game' that players did not feel the need to mention every time they occurred. Further, as they were experienced players who were habituated in their behaviours, they may not have been novel enough to be considered worthwhile mentioning (Erickson, Lampinen, & Leding, 2014). This also relates to the Grice (1975) maxim's of conversation, where players may have believed the researcher would take such actions as a given and therefore not worth discussing. In a similar manner, players did not discuss the specific buttons they pressed to enact their actions, even though this technically is also a valid response to what players were doing. Including low level information the player assumes the researcher is not interested in would consequently reduce the *quality* of the response, and affect the *relation* of the content to the context of the conversation, and so would be a violation of the maxims.

Therefore, what players say they do in a gaming session does appear to be influenced by socio-linguistical factors, which could only be observed by comparing the 'ground truth' of what players pursued in the game. Furthermore, not all action and goal types appear inherently interesting to share, which also leads to differences in what players recall about an experience.

Players in the post-game interviews frequently related their actions to goals, supporting the idea that gameplay is goal-directed. Consequently, what players choose to do in terms of their actions does indeed relate to the experiences they have, via the goals that drive them. However, the mapping of types of actions to types of goals was complex, as there was high overlap between what actions related to which goals. For example, it is possible for one type of action to strongly relate to one type of goal, such as the Combat action which primarily related to either Questing or Interruption. Some actions can be strongly related to one type of goal, such as the Movement action. However, other actions map on to multiple goals in even amounts, such as the Interaction action which frequently related to Questing, Exploring, and to a lesser extent Miscellaneous Questing and Interruption. Therefore, knowing the action type a player is following does not make it explicitly clear what goal they are currently pursuing.

To complicate matters further, the inverse for mapping goals to actions is also true. Whilst some goal types have strong associations to one action (like Attention Grabbed to Attending), some goals contain all types of actions, such as Questing. It is therefore also difficult to know what actions a player will take even if the goal is known. Furthermore, in this study the only goals were considered at the Actionable level, and it is highly likely that goals higher in the hierarchy are also interconnected and affecting the actions players select.

The existence of multiple mappings to actions and goals is similar to results found between Goals and Means discussed in the Theory of Goal Systems (Kruglanski et al., 2018) in Section 2.5.1. The association between Combat and Interruption is strong as the number of connections between these actions and goals is low, making the connection more unique. In contrast, the associations between the Questing goal and its actions are lower as there are a higher number of connections, meaning the goal has higher equifinality ("all roads lead to Rome"). Conversely, the Interaction action connects to multiple goals, and so has higher multifinality ("many birds one stone"). These connection patterns indicate different ways players associate actions to goals, which highlights that player behaviour and the experience that takes place because of it is complexly goal-orientated.

Overall, the complexity in how actions and goals highlights the importance in asking players to describe their behaviour. By knowing how players map actions to goals, it becomes possible to assign meaning to gameplay data that accounts for not only what is being observed, but what is driving these actions.

7.4.2 Aim 2: What affects a player's goal and action pursuit and recall?

Three factors were explored during the analysis that influenced what players pursued and recalled. This included the affect of the condition on actions and goals, when and why players switch goals, and how goals and actions affect the overall experience (immersion). The findings of each are discussed in turn.

Overall, players in the Think Aloud rated the experience as more immersive than the Warmup and No Warmup conditions. This was despite players pursuing similar goal types and action types in all three conditions. This indicates the condition did not influence what players chose to do in terms of goals and actions, but may have influenced how they viewed the experience. However, differences between scores were low as the majority of players rated the experience as high in immersion. Consequently, it is possible that condition differences in immersion scores are not meaningful.

In terms of recall, players recounted similar levels of the types of goals, however the Think Aloud condition recalled a larger percentage of time spent on goals overall (75%) and total number of goals (55%). The Warmup condition recalled the second highest total number of goals, followed by No Warmup, though No Warmup recalled more seconds on goals than Warmup. Whilst recall was on average far lower for actions, a similar trend in recall was observed; players in the Think Aloud recalled the most amount of time spent on actions (31%) and total number of actions (29%). Therefore, participants who were more involved before the post-game interview, either via a pre-interview or taking part in a think aloud, recalled more information.

When considering the Gricean's maxim's of conversation Grice (1975), these findings are understandable: players were asked to verbalise what they were doing in the Think Aloud, and then asked to recall everything that they did. Similarly, Warmup were asked to consider their general gaming habits before starting. Participants in these conditions may therefore have increased the **quantity** of information given in the conversation, as they felt more confident of what the researcher was interested in hearing. For the No Warmup participants, they had no way to know ahead of time what the researcher was interested in, and so could only report what they believed to be of interest. In contrast, as the question itself remained the same for all conditions, participants could not alter the **quality** of information provided between conditions — they could not know what types of actions and goals the researcher was interested in.

Therefore, involving participants before an interview may increase the quantity of information provided, but is unlikely to change the quality (i.e., what they discuss). This suggests play experiences can be affected by the context of the experiment, which should be taken into account in future studies. However, due to the small sample size the findings between conditions is only an exploratory analysis, and requires further research to validate on a larger representation of players.

As seen in previous research, players have a mixture of game goals (e.g., pursuing main quests) and personal goals (e.g., collecting flowers), which are flexibly and regularly switched between (Debus et al. (2020); Oswald et al. (2014)). Players chose to pursue specific actions in pursuit of specific goals, and frequently switched between them, as found in Study 2. However, the codes generated also show specific differences to how goals have previously been considered. Most notably, the goals of Attention Grabbed and Interruption are unique, in that they are unplanned. For example, a player spots a cave entrance and considers entering it, or the player is walking along a road and is suddenly attacked by wolves. Whilst these events were not planned ahead of time like the other goals (i.e., planning to walk to a location), players still discussed them as something that they did. The difference between these two goals however is that players could *choose* to attend to the cave entrance, but they could not avoid the wolves. Therefore, player agency is the important distinguishing factor. Along with the Explore goal, these three explain what would most likely cause a player to switch from their current goal. The player is pursuing a goal, but is presented with new options by the game, causing them to pause their current goal or switch to something else. Therefore, goal switching frequently occurs because of contextual events that happen within the game, that are usually not planned ahead of time. It was rare for players to spontaneously switch between goals of the same type (e.g., Questing), indicating they tend to stay on one goal until presented with a new option. Consequently, whilst open world

gameplay can be considered goal-directed, it is not accurate to say that players have a singular goal in mind for a specific play session.

Overall, players were highly immersed whilst playing the game. As open world games were reported as immersive in Study 2, this is understandable. However, despite players reporting immersion in terms of real world disassociation and involvement, players did not report high levels of challenge. This follows the findings from Study 2, where players did not feel a need to be challenged by the game, and instead preferred to self-pace their level of challenge. As players were experienced in Skyrim it is possible they did not find the game challenging due to their practical knowledge of how the game worked. Instead, their immersion may come from using the game to select what to do on their own volition. Therefore, the importance of challenge for immersion in open world games appears low for experienced players.

In terms of the effect on immersion for what goals players pursued, players who experienced more Attention Grabbed were more likely to be Involved, but less Challenged. Further, those who experienced Miscellaneous Questing were less likely to experience real world disassociation, and those who experienced more Questing were less challenged. In terms of actions, those who spent more time Moving and in Dialogue were less immersed, whilst those who spent more time Attending and Loading were more immersed. Therefore, what players choose to do in the game does appear to change how immersive they rate the experience. Notably, considering options presented by the game (via Attention Grabbed goals and Attending actions) experienced more immersion, which suggests players that are more fluid in what they want to pursue experience more immersion. This may relate to feelings of agency/autonomy, which can increase immersion (Ryan, Rigby, & Przybylski, 2006). Here, players may feel more involved because they are choosing between multiple options available, whilst also having the final say on what to pursue.

7.4.3 Relation to Previous Studies

There are many differences observed in this study on a specific gaming experience to the previous studies that assessed general gaming experiences. For example, in Study 2 which asked players to define the open world experience and what they do within it, they did mention some of the same goals, such as Exploring, and some of the same actions, such as Looting. However, players did not mention the goals of Attention Grabbed and Interruption. This suggests players may not readily discuss goals that originate from the interaction with the game when reflecting on general gameplay, and instead prioritise discussion of goals they have more sole ownership over (such as Questing). Therefore, combining gameplay with post-game interviews provided a richer understanding of what goals players have and what they experience in the game because of them.

When comparing to Study 5, which analysed player comments on what they do in open world games, players similarly were most likely to mention goals at the Actionable level. It is therefore likely that players conceptualise their experiences most commonly at this level when discussing their behaviour with other players and in research settings. However, dissimilarly to Study 5, there were little mentions of Means or Overarching Goals. Some players did discuss Overarching goals such as roleplaying and finding a goal in this study, but it was a rare occurrence. This is potentially because players were primarily attempting to describe their actions, and so only required their actions to be explained by the first level of abstraction for a Goal, and did not feel the need to elaborate further.

Furthermore, there are a number of new Actionable Goals found in Study 6 such as Sleep. Most interesting was the Goals of Attention Grabbed and Interruption which are unique categories in that they denote times where the player was momentarily pulled from their current goal. Typically this was because the player had noticed something (e.g., an interesting part of the terrain) or had been presented with a game event (e.g., a combat encounter on the road). In some sense they are anti-goal categories, and so could be viewed as separate to the other Goal types. However, players discussed Attention Grabbed in a goal-oriented way (such as *choosing* to investigate the event), indicating it is viewed similarly to goals by players. Similarly, Interruptions explained why some actions were imposed by the game but were still considered goal-orientated, as players were following the objective of overcoming the event. Therefore, Study 6 provides further nuance to what players do and experience

in open world games than the previous studies, as specific goal types such as Attention Grabbed and Interruptions were unlikely to be mentioned outside of a specific experience.

7.4.4 Relation to the Literature

Similar to previous work, players in this study enjoyed activities such as exploring (Wolf, 2021) and pursuing a number of different quests/goals (Tanenbaum, 2013), whilst finding the overall experience highly immersive (Elias, Almeida, Filgueiras, Rodrigues, & Alexandre, 2021). Doing so was sometimes in pursuit of a game goal as discussed in previous work (e.g., Debus, Zagal, & Cardona-Rivera (2020)), where players would use their quest log to direct their play. In other cases, players brought their own personal goals to the game, such as to collect flowers for potion making. These personal goals are similar to previous work on goals such as speedrunning (Sjöblom, Törhönen, Hamari, & Macey, 2017), where players decide ahead of time how they wanted to play the game in a specific session. However, personal goals could also be decided within the game in response to an in-game event, such as to seek revenge after dying. Therefore, players bring a variety of goals to their open world gameplay, but these can and do change within the session depending on what transpires. Crucially, it was only possible to observe personal goals by using how players themselves describe their behaviour to annotate gameplay footage. This is in contrast to previous work, which relies on variables the game can output, such as the number of missions completed (Melhart, Azadvar, Canossa, Liapis, & Yannakakis, 2019), the number of enemies killed (M. Aung et al., 2019), or what actions a player has completed (Ha, Rowe, Mott, & Lester, 2011). Therefore, it is important to consider how players describe their actions and goals to understand what they are pursuing, as gameplay alone is unlikely to reveal the meaning behind what players are doing.

Previous research has typically considered open world players to pursue in-game goals, or to bring in their own goals, such as speedrunning. However, this study also found the existence of goals specifically created because of the interactions between both what the player and the game are doing. Attention Grabbed and Interruption are such goals that exist because the player has a current goal, but the game is capable of providing the potential for other goals. Both of these goal types were commonly observed (20% of total seconds), but rely on knowledge of what players were currently attempting to do to understand if they are indeed considering alternate goals (attention grabbed) or are confronted with a new one (interruption). Therefore, it is important to consider goals provided by the game, and goals provided by the player, but it is also important to consider the goals provided from the *interaction* between the two parties in the moment of gameplay. Doing so reveals how goals are connected and unfold over time to form the basis of what players experience and reflect upon.

7.4.5 Limitations

There are a number of limitations to this study. Firstly, as the aim of the study was to collect a rich dataset where gameplay data was hand-coded, only 15 experienced players took part. Consequently, what participants did is unlikely to reflect all possible goals. Secondly, whilst care was taken to keep the play sessions as naturalistic as possible (players used their own save file, pursued any activity they wanted, and the researcher was not visible or spoke during play), players may have still chosen different actions and goals than normal. Potential reasons for doing so include wishing to present 'interesting' gameplay to the researcher, or feeling a desire to perform well. Thirdly, only one type of game was observed, and at one time. It is not known how recall would vary between gameplay sessions, even within the same game. Future work could ask a larger sample of players to take part in multiple gaming sessions to establish their general in-game behaviours and recall of players. Finally, differences in goals pursued and recalled across conditions was exploratory due to the small sample size. It is therefore unknown the true extent of changing the context of the post-game interview. Relatedly, individual differences in memory ability between participants was likely present but not controlled for. Some participants may recall more than others simply because they are more capable of remembering specific details, which could effect differences between conditions. Therefore, future work could replicate these conditions with more players, whilst controlling for memory abilities.

Nevertheless, this study provides an in-depth analysis using a rich and highly annotated dataset, to reveal what players actually pursue in a gaming session. This specificity reveals insights into goal switching which could not have been seen using more broad data collection methods.

7.5 Summary

This chapter explored what players do and experience in a specific open world play session via their actions and goals. Results indicate players spend a majority of time pursuing quests, but are routinely pulled from their current goals towards other in-game aspects. Goals could be mapped to player actions, revealing players typically switch goals because their current one is paused by an interaction with the game. However, players had moderate recall of goals overall, where there was little relation between time spent and likelihood of recall. Further, players who are asked to perform more tasks surrounding the gaming experience (i.e., a pre-game warmup or a think aloud) recall more information about their experience. This study therefore highlights that players frequently switch goals and actions during open world gameplay, sometimes on their own volition, but sometimes because the game has presented a new scenario. This interplay of goals between player and game consequently forms the crux of the experience.

Chapter 8

General Discussion

> **Simmons**: *"You ever wonder why we're here?"*
> **Grif**: *"It's one of life's great mysteries isn't it? Why are we here? I mean, are we the product of some cosmic coincidence, or is there really a God watching everything? You know, with a plan for us and stuff. I don't know, man, but it keeps me up at night."*
> **Simmons**: *"What? I mean why are we out here, in this canyon?"*
>
> — Red vs Blue

This thesis has looked at how to understand the experiences players have in open world games, which are simultaneously unique to each person and gaming session, but comparable across players. To do so, the concept of contextually-situated experiences was introduced, where moment-to-moment gameplay is viewed as a series of unique and contextual interactions between the player and the game. These contextually-situated experiences make up the overarching experiences players typically report, such as immersion or overall opinion of the game/gaming session. Therefore, to understand the open world experience is to understand the contextually-situated experiences that occur within the overarching experience of the game. This involves understanding how players choose and navigate interactions with the game during contextually-situated experiences. Therefore, to understand contextually-situated experiences and their relationship to the overall open world gaming experience, it is important to understand how players select actions to enable such experiences. Consequently, this thesis highlights the difference between what a game 'is' overall, versus what players experience within them via the actions they choose.

The overarching thesis question therefore was, 'what is the experience of playing an open world game?' To answer this question, a series of sub-research questions were also explored. This included how to define the open world experience as there was no consensus in the literature from a player's perspective, how to conceptualise the choices players make (in terms of goals or motivations), and how to relate choices made to gameplay, as what players report doing does not always align with what happens moment-to-moment. As the sub-questions are additive in understanding how to answer the thesis question, they are addressed first in this chapter, before concluding with what is the open world experience.

8.1 RQ1: What defines the open world experience?

When asked for their perspective on what enables the open world experience, players discussed an agreed set of requirements which involve giving the player freedom to self-pace what they engage with. This freedom allows player to encounter unique contextually-situated experiences, as they can direct their gameplay towards what they want to experience. For example, a player who wants to experience the narrative of the game, but is not interested in experiencing difficult combat, can choose to follow a quest that promises puzzle-based rather than combat-based mechanics. Doing so increases the

chance they will have desired contextually-situated experiences involving narrative but not combat. The game also has agency to provide content for the player to interact with outside of what the player explicitly wants to do, meaning player desires cannot fully explain the open world experience. Instead what content the game provides, and how it responds to the player, must be considered. Consequently, a specific moment of gameplay experienced by the player is both a product of the desires of the player, and how the game has responded.

Therefore, whilst the actions a player selects can share little to no overlap to another player, it is still possible to say they have had the 'same' experience — they have experienced a series of contextually-situated experiences they had a level of control over, by interacting with and navigating through the game. In other words, the overall open world experience involves feeling agency in what contextually-situated experiences will occur, which involves interactions between what actions the player selects and the reactions of the game to these actions.

However, knowing the overall open world experience involves agency to choose contextually-situated experiences, and that players attempt to encounter ones they desire, does not full explain *which* contextually-situated experiences will happen/are predicted to happen. This is because contextually-situated experiences map to overarching experiences the same way that individual statistics map to population statistics; they don't. Knowing that players 'on average' (a population metric) spend time enjoying exploring open world games does not tell us if a *specific* player will explore the gameworld in a given play session (an individual metric). Similarly, knowing players will engage with the game to have contextually-situated experiences does not tell us what contextually-situated experiences will occur. Therefore, only understanding how the overarching experience is enabled cannot explain what experiences players have within a specific gaming session. To understand the complexity of the open world experience beyond a general sense of agency over what events happens, it is therefore important to understand what events occur and how they are enabled within a specific gaming session. In other words, there is a need to look beyond the overarching gaming experience, and focus on the contextually-situated experiences that comprise it. These questions were explored in the remaining research questions.

8.2 RQ2: What framework is best for understanding action selection in open world games?

Understanding what drives players towards contextually-situated experiences requires a framework to understand why specific actions are selected that enable them. This is because it is not possible to assume what players in open world games are doing, why they are doing it, and what as a result they are experiencing — there are countless possible actions, which could be deployed in search of countless contextually-situated experiences. A framework that explains why actions are selected could illuminate the connection between what players do and what they experience because of their actions.

From the literature review, two potential frameworks were identified: player motivation and goals. If motivation is a coherent concept, then what players seek out in games should relate to what actions they choose, and consequently what contextually-situated experiences they gravitate towards. Alternatively, if players view their action selection as goal-directed, then understanding what goals they are working towards could provide similar insights. Therefore, the feasibility of both frameworks was explored.

8.2.1 RQ2.A: Can motivations by measured and related to experience?

Motivation, being an abstract concept that naturally varies between people, requires a reliable measurement technique. Questionnaires are one such way to achieve this, which ideally should turn abstract yet distinct motivational concepts into something concrete and measurable; a process known as reification. In gaming motivation research, there are at least 22 questionnaires available to choose

from that purport to reify a specific subset of motivations. Despite the large amount of measurement tools available, researchers do not frequently explain their justifications for choosing a specific questionnaire, making it difficult to understand what makes a 'good' motivation questionnaire for a given context. Researchers who did specify a reason mentioned the reliability and validity of the questionnaires.

However, in practice, and in this thesis, this claim was not empirically founded — numerous questionnaires currently in use were found to be unreliable, to have average structural loadings, and to have high degrees of conceptual overlap. This suggests the underlying concepts purporting to be measured with these questionnaires are ill-defined, meaning they cannot be reified. Therefore, whilst researchers may desire reliable, valid, and conceptually sound questionnaires that also cover the full range of motivations, the current selection available do not meet these requirements. Consequently, motivation cannot be measured or related to the open world experience, as there is no way to know if findings are genuine or based on unreliable measurement tools. It was therefore not used to understand the open world experience in this thesis.

It is important to note that the lack of reliable measurement of gaming motivation does not mean the *concept* of motivation as a driving factor of gaming experiences is incorrect. For example, the theory that a player who enjoys a game narrative is likely to seek out a story element in a specific gaming session is not an unrealistic assumption. However, if the concept of motivation cannot be reliably measured, it is not possible to assess the extent of these supposed relationships between motivation and behaviour. Furthermore, constructing a newer, 'more reliable' questionnaire to overcome the limitations in previous measurement tools is highly unlikely to solve this problem — 22 questionnaires already exist, it is unclear what the 23rd could do differently. Even if the next iteration of questionnaires could produce reliable findings, pulling across all the different sub-sets of motivation that exist would still leave at least 19 motivational factors to consider. Consequently, it would be very difficult to distinguish genuine correlations between behaviours and motivations, and not simply spurious false positive significant test results.

Therefore, a different approach to the measurement of motivation is required. However, as the aim of this thesis was to explore ways to understand the open world gaming experience, doing so was out of scope. Instead, the focus became if goals could be used as a way to understand player behaviours.

8.2.2 RQ2.B: Do players consider their actions goal-directed in open world games?

Players were found to spontaneously discuss goals in relation to their action selection, both when talking amongst themselves in forum posts, and when asked to detail *what* they were doing, as opposed to *why* they were doing it. As many goals originated from the player rather than the game, this makes goals especially important to understand action selection; open world players bring in their own desires and enact them via specific actions, which cannot be predicted from what the game says the player 'ought' to be doing (i.e., the main quest). Consequently, players also feel high agency over their actions because they have agency over their goals. They are able to 'do what they want when they want,' and in ways of their choosing.

Therefore, action selection can be viewed as goal-directed, making it a useful framework for understanding what contextually-situated experiences players have when pursuing their goals.

8.2.3 Summary

Player goals is the framework used to understand action selection in this thesis, as player motivation cannot be reliably measured and players do consider their actions to be goal-directed.

It is interesting that motivation was not easy to map to open world gameplay, despite their conceptual similarity to goals. Indeed, in psychological literature the two are commonly mentioned together, as to have a goal is to be motivated towards achieving something (Elliot & Fryer, 2008). Aside from the methodological concerns surrounding the use of questionnaires, it is also worth noting the con-

ception of gaming motivation is markedly different to other disciplines. In psychology, motivation refers to an internal or external desire to achieve something (Baumeister, 2016), which can be further broken into sub-sets. However, these sub-sets are typically activity-agnostic; they are different facets of motivation that do not specify what part of the activity is causing the motivation. For example, motivation can be be considered intrinsic, where people pursue something for the themselves and the enjoyment doing so brings, or extrinsic, where people pursue something for other reasons such as a fear of punishment or seeking approval from others (Ryan & Deci, 2000). In contrast, gaming motivation moves the focus to aspects of the *game* that are motivating; narrative, exploration, customisation, socialisation are all activities enabled by the game.

Consequently, this may explain why the theory of motivation underlying these questionnaires is difficult to apply to specific gameplay experiences, especially over time. It is easy to correlate general game type enjoyment and aggregate gameplay behaviour to motivation; for example, players who were high in a motivation for Narrative were more likely to enjoy role-playing games (Tondello, Arrambide, Ribeiro, Cen, & Nacke, 2019), whilst players high in Discovery were more likely to engage in exploratory behaviours in *World of Warcraft* (2004) (Billieux et al., 2013). However, it is not as easy to correlate moment-to-moment gameplay data to motivation. If a player is highly motivated to play the narrative of games, this may be difficult to correlate with open world gameplay data because they are unlikely to be engaging in a story element for every second; the game will naturally present other activities, and the player may also be drawn towards other content in the moment. Therefore, the relationship between player motivation and player actions in the moment is difficult to establish with the current methods and conceptualisation of motivation. This may also help explain why gaming motivation sub-scales show weak to moderate correlations to in-game behaviours in previous studies, such as Billieux et al. (2013) which only correlated Discovery to exploratory behaviours at $r = 0.34$.

To overcome this limitation in the application of motivation to gameplay, future work could explore if motivation can be applied to specific gaming experiences in the same way goals were in this thesis. That is, it may be more insightful to observe players playing a game and then ask them afterwards to explain what motivated each action they engaged in. This may in turn reveal what motivation means to players in relation to the moment-to-moment experiences that happen during gameplay.

Therefore, the focus of the remaining research questions is how do players use goals to select actions, how this can be seen in gameplay, and how do goals and action selection relate to the gaming experience (both overall and contextually-situated).

8.3 RQ3: How do goals relate to action selection?

When asked to recall action selection from a specific gaming experience, players naturally discussed sequences in terms of their goals. A similar trend was also found when players discussed their general action on forum posts, where action selection sequences could also be identified as in pursuit of specific goals. Players could have multiple goals active within a gaming session, sometimes in sequence and switched between, but also simultaneously as goals can be hierarchical in nature. In doing so, players felt they had agency over their goals, as many were defined outside of what the game intended (i.e., the main quest). The agency over goal selection also led players to feel agency over their actions, though memory of actions was notably poorer than that of goals. The flexibility in goal pursuit also made it possible for players to select actions in pursuit of multiple simultaneous goals, due to their hierarchical structure. Therefore, the link between action selection and player goals is not always a simple one-to-one mapping. Instead, it is important to understand the wider context of why a goal is being pursued, as there may be more abstract, overarching goals at play.

Whilst players did frequently relate their action selection to their goals, there were numerous gaps in what was recalled in predictable patterns. Mainly, players appeared to prioritise recall of actions that related to specific goals, rather than those not as easily identifiable. For example, players frequently discussed actions that related to pursuing a specific quest (e.g., talking to an NPC, killing an enemy, travelling to a location) but were less likely to discuss actions that occurred because they were momentarily distracted from their goal, such as having their attention grabbed by a chest to loot.

It may be possible to increase player recall of specific actions and goals depending on the context in which the question is posed — those who thought aloud during their experience were more precise in their actions and their related goals. However, the use of different conditions was exploratory in nature and would need further research to confirm this effect.

Overall, there is a mutual relationship when players discuss action selection and goals — players identify a goal they had to retrace what actions were selected to achieve it, and if a goal is not readily obvious, players inspect known action sequences for meaning to establish the goal they were in pursuit of. The ability to recall both action selection and goals, and create a mapping between the two, allowed players to experience agency over their gameplay. Put another way, players use goals as a way to understand their action selection, when recalling a specific event and when explaining their general behaviour to other players. The inverse is also true; players can more readily remember their goals if they look for meaning in the action sequences they know have taken place.

8.4 RQ4: What do players experience during gameplay?

Open world gameplay involves players selecting actions they believe will lead to specific outcomes, which in turn leads them towards specific contextually-situated experiences. In turn, the game provides content for the player that may or may not align with the intended player goal, requiring the player to consistently realign their goals and respond to events occurring to them. Therefore, contextually-situated experiences arise because players attempt to pursue a goal in a system that does not guarantee it can and will occur in the way they originally intend it to. On many occasions players are interrupted by the game, or introduced to new content that momentarily grabs their attention, which requires players to evaluate their current goal. From this, players are likely to change their original goal and pursue something else, given this new information. That is not to say that being unable to complete a goal is viewed negatively; on many occasions, players are presented with new content which inspires new goals and associated changes in actions to accommodate them. Therefore, players treat their goals flexibly depending on how they can be achieved given the contextually-situated experiences they encounter, with freedom given to change their goals if needed.

Because of this, players have a wide variety of contextually-situated experiences even within the same game (as predicted by Dale & Shawn Green (2017)), which in many cases do not overlap between players, perhaps even between play sessions of the same player. Even players pursuing the same quest did not experience the exact same contextually-situated experiences, as there were variations in what happened because of the specific interactions with the game that took place. However, it is possible to abstract contextually-situated experiences into types, of which players commonly experience pursuing questlines/their own goals, exploring an area, having their attention grabbed, and being interrupted from their current goal.

Overall, players rate open world gameplay as highly immersive, especially in terms of involvement. In contrast, gameplay was not viewed as challenging, which was viewed either positively or neutrally. Players were highly experienced with the game, so knew how to navigate the game in desirable ways, which meant goal pursuit need not be difficult to be entertaining. This is different than many previous accounts of challenge, which argue it is central to the enjoyment of games (e.g., Vorderer, Hartmann, & Klimmt (2003)). Indeed, highly experienced open world players can feel competent in the game whilst experiencing next to no challenge, in contrast to the work of Abuhamdeh & Csikszentmihalyi (2012) which states challenge should be optimally balanced to skill.

Whilst much has been learned about what contextually-situated experiences players have, and how they are viewed by players, many were not recalled after the gameplay session, so it is unclear what players experienced in those moments. This raises the following theoretical question: when players rate the overall experience, are they reflecting on every contextually-situated experience, or just the ones discussed afterwards? Currently there is no way to know, but it centres the implication that what players report is not a direct account that can be mapped to everything that has been experienced.

Overall, players experience immersion by interacting with the game, and feeling like they have control over the general direction of gameplay. Players typically did not experience challenge, perhaps

because they had freedom to change actions to suit their goals. They frequently switch between goals and associated actions, in search of and in response to a variety of contextually-situated experiences. However, it is important to note that responding flexibly to in-game situations does not mean players are goal-less, lacking in goal conviction, or lacking a desire to achieve something. Instead, players accept the premise that the game will present them with a degree of randomness they must navigate to have a desirable experience. Therefore, players experience goal flexibility during gameplay, which they are free to resolve in numerous ways.

8.5 TQ: What is the experience of playing an open world game?

The overarching thesis question aims to understand what it means to 'experience' an open world game. On the surface this is similar to Research Question 4 discussed above, but they are subtly yet meaningfully different. What players experience in the moment is only one aspect of 'an experience.' Gaming experiences are a combination of what the game is able to offer a player, what happens to the player in the moment, how gameplay is reflected on, and the way such experiences are communicated to others. Therefore there are two main sides to understand; what the game is, and what the player can do. For open world games, the game provides a space that allows players to self-pace their gameplay by engaging and disengaging with tasks at will. What can be pursued and achieved contains a necessary degree of randomness so that players cannot know exactly how to achieve their goals ahead of time, though the player is roughly aware of the boundaries of this uncertainty. Therefore, players bring their own goals to pursue to the game space, but do not know the shape of their goal pursuit until after the gaming session is concluded.

Combining the above concepts explains the open world experience: having an initial goal/idea of what to do/experience, then allowing oneself to enter into a flexible negotiation with the game and respond to scenarios that emerge. Goals are brought by the player, and the game provides a selection of somewhat predictable in-game goals that may or may not align, which are navigated and resolved in the moment. At any time the general flow and goal of play can be assessed and adjusted, which is core to the enjoyment (and immersion) of the experience. This can be seen as players who experienced more instances of having their attention grabbed reported higher levels of involvement. In contrast, there was no relation between time spent on questing and involvement. Put another way, players who experienced and engaged with more instances of goals being presented by the game different than their current goal were more immersed. It is therefore more immersive to navigate what goals to pursue in good faith with the game, rather than trying to only do one goal-oriented thing (a one-sided negotiation). This is possibly because players typically have numerous goals and goals of interest to pursue, rather than just one singular goal. Players open to negotiation on what goals to follow are in 'the moment' and do not need to think too hard about what they 'should' be doing, but can instead compromise and respond flexibly.

Overall then, the open world experience is flexible goal negotiation with the game, seen via what actions are selected in interactions within contextually-situated experiences. To identify contextually-situated experiences, it is important to know the desired goals of players, the gameplay actions they take, and what goals the game offered. What players report doing post-game versus what they actually do can be used to see what players prioritised to share, which in turn shows what was meaningful about the overarching experience — i.e., their core experience. This view does not necessarily only apply to open world games, though it is more easily identifiable. Whilst open world games easily demonstrate the importance of untangling the two types of experience, all games are a series of contextually-situated experiences constructed from the player and game interacting together, of which the sum total reflection of these experiences defines the overall gaming experience. For example, games with strict narrative structures such as graphic novels can still result in different contextually-situated experiences between players depending on how they respond to the game. A player strongly resonating with a character will change what they experience in the moment, and could change how they respond to the game. What is unique about open world games however, is the inability to predict what

interactions the game will present to the player, and in what order. Consequently, open world games provide useful insights into how contextually-situated experiences form when both player and game have high levels of agency in interactions with one another. Viewing games in this way shows how player-game interactions lead to differing experiences in players, which helps understand player behaviour both at the overarching level and in the moment-to-moment gameplay.

8.5.1 The Dialogue Metaphor

To further illuminate what the open world gaming experiences is, it can be helpful to consider gameplay as a dialogue between the player and the game. This is done by extending the concept of a game as a conversation suggested by Cardona-Rivera & Young (2014) to include how players respond in turn, combined with the conception of contextually-situated experiences outlined in this thesis. This overlap is illustrated in Figure 8.1, and explained below. The player and the game represent two agents engaging in a conversation with one another. The player brings topics of conversation they wish to have (i.e., their goals of play and desired experiences), whilst the game brings topics it can offer. Game topics are semi-predicted by the player ahead of time, as they are aware of generally what conversation they *could* have with the game, in the same way people enter a conversation with a known friend with an idea of what topics are usually discussed/of interest to them. Therefore, contextually-situated experiences reflect topics currently discussed between the player and the game, which in turn are a series of exchanged utterances.

However, similar to a conversation it is not possible to know what *all* topics will be discussed ahead of time. A person may approach a friend to talk about their favourite TV show, but the friend may have not seen the latest episode. They may instead want to discuss a different topic that is known to equally interest the pair, such as a favourite game. A player may wish to follow a specific quest, but along the way the game signals another quest is available that involves another one of the player's interests, such as book collecting. The situated nature of conversation means, whilst a player can enter a game with an idea of what they want to do (e.g., a goal), as soon as gameplay begins they are likely to encounter other topics of interest as well. Consequently they must navigate the flow of conversation, as suggested in the theory of situated actions (Suchman (1987)). If a player thinks the topic suggested by the game is interesting, they can redirect their gameplay to align with it. Alternatively, they can decide they are not interested and maintain their current topic, or choose a different one.

The play experience is consequently a series of contextually-situated experiences where topics are presented by both the player and the game, for the player to decide what is the most appropriate to explore. The more fluid the progression of interactions and topics, the more positive the experience is rated. Fluidity and positive experiences of conversation can be captured from post-game interviews, and situated within gameplay to explain why players felt this way. For example, players consistently interrupted from their desired goal by the game experienced frustration, as what the game offered did not align with their goals. In contrast, players who were not overly attached to their original goal were flexible and adapted to what topics the game offered, leading to less frustration even though the number of interruptions was comparable. This is similar to if a person wishes to discuss a specific topic with a disinterested partner, versus having a selection of topics they are happy to discuss with them. Therefore, the navigation of each moment of gameplay is the current topic of interest between player and game, where players aim to maintain a frictionless flow of exchanged topics.

By viewing the open world experience as a conversation, how players can partake in vastly different activities whilst still experiencing the same game can be explained. The game is a conversational partner where contextually-situated topics are discussed, and at the end of the conversation a player can reflect on how enjoyable/smooth/engaging the overall conversation was (i.e., the overall gaming experience). Over time and across multiple gameplay conversations, players can build a model of what topics the game is likely to suggest, making it easier to navigate through contextually-situated experiences to achieve desired outcomes. This constructs their overall understanding of what the game 'is' and what it is capable of offering them in terms of an experience.

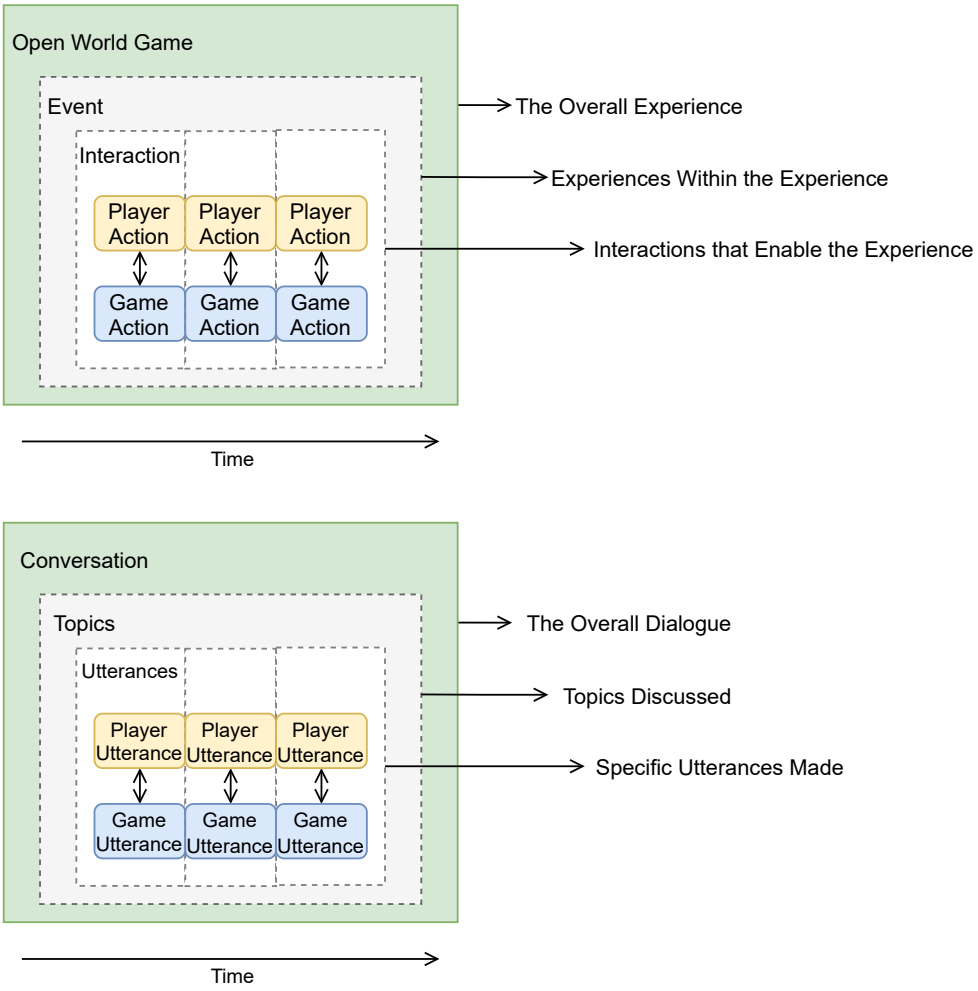


Figure 8.1: The diagram discussed in Section 2.2.1 explaining the relationship between contextually-situated experiences and the overarching experience, compared to the dialogue metaphor.

8.6 Contributions

Overall, this thesis provides insight into specific gaming experiences, using open world games as the focal example. Specifically, what it means to 'experience' a game is critically inspected to untangle the overarching experience of a game versus what events occur that players experience. Dividing the overarching from the contextually-situated illuminates how players can have entirely unrelated gameplay experiences, with no overlapping content engaged with, whilst still 'experiencing' the same game. Therefore, a key contribution of this thesis is a new way to view gaming experiences that account for the contextually-situated game events that occur. Contextually-situated experiences can be seen by observing gameplay and comparing it to post-experience player interviews (demonstrated in Chapter 7), but they can also be seen when asking players to reflect on how they define specific types of games (seen in Chapter 3). Game experience researchers wishing to understand what makes games and gameplay unique could benefit from using this framework and associated techniques used in this thesis.

A second contribution is an empirically-grounded definition of the open world experience, which specifically focuses on what players experience within these games (discussed in Chapter 3). Re-

searchers interested in open world games may find this useful as a way to communicate what exactly about these games they are investigating. Researchers could also use the contextually-specific approach used to create the definition to define other gaming experiences. The contextually-specific approach to defining concepts allows researchers to learn what a game is via what players experience when playing it. Doing so can provide insights into why games are considered similar, that would be difficult if only considering the mechanics or the designer's intent.

A third contribution of this thesis relates to the use — or perhaps, misuse — of motivation questionnaires for empirical research, explored in Chapters 4 and 5. Due to conceptual incoherence and lack of reliability in current motivation questionnaires, it is not possible to understand the open world experience in terms of motivation. By extension, the use of motivation questionnaires in any games research has been challenged. Researchers interested in how to justify questionnaire selection, and understand the differences between them, can refer to the work conducted in this thesis. In contrast, this thesis demonstrates the utility in using goals as a framework for player behaviour, as discussed in Chapters 6 and 7. This includes how to capture player goals, how they change during the course of a gaming session, the actions players take, how actions relate to goals, and the experiences players have as a consequence. Researchers could use this to describe other gaming experiences, or replicate the work in other open world games.

A fourth research contribution is the practical applications of the work. Game designers can use the findings of this thesis to build more immersive/engaging player experiences in open world games, by understanding what players value and want from open world games. For example, Studies 1 and 2 show that whilst players may not engage with the main goal/story of the game, it is still important that the game has one; players want the choice to actively choose *not* to engage with it. Further, designers can see from Studies 5 and 6 that players bring a variety of goals to their game, which are frequently switched between during and between gaming sessions. Designers could use this information to create content which aligns with the types of goals players want to achieve, such as creating more opportunities for exploring areas or role-playing. However, designers should also be mindful that players dislike the feeling of being trapped into any one goal, and so their flexibility in goal pursuit should also be preserved in the game's design.

Finally, this thesis shows how to analyse gameplay both in terms of actions players take and the reasons for doing so (shown in Chapter 7). This thesis highlights that considering actions only from the gameplay metric side obscures what players are attending to in the moment, which can instead be found through observation and post-game interviews. Researchers interested in logging and describing player actions could use this approach to better understand the meaning behind selection from the perspective of players.

8.7 Limitations & Future Work

There are a number of limitations to the work undertaken in this thesis. Firstly, apart from the work focused on player motivation, the studies in this thesis involved small sample sizes of open world players. The general definition of the open world gaming experience may not be a fully representative definition that all players agree on, and the Reddit comments used to understand goals and actions of players are unlikely to reflect all players and their potential goals. Further, only a small number of players took part in the specific gaming experience study, and so the actions and goals they have cannot inform on what all types of open world players do. However, findings across studies corroborated one another despite the differences in their research questions, sources of data, and data gathered, indicating what was found does hold across players. For example, players in Studies 1 and 2 indicated that the open world experience was one that allowed them to freely and flexibly pursue side quests alongside the main quest. Similarly, in the Reddit comments in Study 5 players discussed frequently switching between side and main quests, and in Study 6 players did pursue different quests during the 30-minute game time. Therefore, the results found from the studies have validity in explaining the open world experience. Whilst the data were not able to confirm the breadth of experiences possible within the open world experience, the data were rich and exploratory, providing a robust foundation

of the open world experience previously unknown. Consequently, future work could ask a larger variety of open world players to assess the frequency of open world experiences.

Another limitation is only one specific gaming experience was studied, taking the form of 30-minutes playtime of *Skyrim* (2011). There are hundreds of open world games that exist, and it is likely they provide unique, contextually-situated experiences that could not be explored here. However, the definition of the open world experience created from Studies 1 and 2 was used to choose *Skyrim* as the gaming experience to study, which was generated from players reflecting generally on the open world experience. In doing so, the validity of the definition has been demonstrated by applying a general definition to a specific example, but this also helped to ensure the chosen game was a prototypical example. Furthermore, patterns in what actions and goals players pursued were similar across Studies 5 and 6, despite the difference in samples and type of reflection being discussed. This further demonstrates the specific gaming experience chosen is reflective of open world gaming more generally. Finally, the intent of Study 6 was to apply the previous findings of the thesis into a specific gaming experience, and so was naturally exploratory in nature and aimed to demonstrate what was possible to learn from such experiences and experimental setups. Therefore, there are several avenues of future work to extend this thesis. For example, it will be important to look at other specific open world gaming experiences, with larger samples, to compare findings. It may even be beneficial to consider games that are at the boundary of the open world gaming definition, to see how this impacts the player experience. Survival games for example involve gathering resources typically in a large area to explore, but the need to survive can be considered restrictive on what players can and cannot do. Consequently, such games are an interesting comparison to the prototypical open world experiences considered in this thesis. Exploring such games will demonstrate if it is possible to capture contextually-situated experiences and relate them to the overall experience in other open world games.

8.8 Conclusion

This thesis aimed to understand how open world game players can play the same games, yet have entirely unique experiences within them. To do so, a definition of the open world experience was created, and two lenses to explain player behaviour were tested: the motivations of players to pursue specific actions/experiences, and the goals that players aim to satisfy via their actions. It was found that motivation in its current measurable format is not reliable enough to help explain the open world experience, but goals can be mapped to both player actions and the experiences they had because of them. In doing so, it was also found that the player is not the only one to provide the goals that make up the experience; the game is equally able to suggest complementary or even contrasting goals for the player to consider. The goals brought by both parties is dependent on the context of the game in the specific moment of gameplay, and so can widely vary between players and even play sessions. Consequently, whilst each individual open world experience may be unique and share little overlap to another player/play session in terms of goals and actions, there is still a discernible overarching player experience: a series of goal negotiations between the player and the game, where the give and take between the two parties leads to an enjoyable and immersive overall experience. Taken together, this thesis highlights a need to understand what happens in the moment-to-moment flow of gameplay in order to understand the overarching player experience of games.

References

Abeele, V. V., Spiel, K., Nacke, L., Johnson, D., & Gerling, K. (2020). Development and validation of the player experience inventory: A scale to measure player experiences at the level of functional and psychosocial consequences. *International Journal of Human-Computer Studies*, *135*, 102370.

Abuhamdeh, S., & Csikszentmihalyi, M. (2012). The importance of challenge for the enjoyment of intrinsically motivated, goal-directed activities. *Personality and Social Psychology Bulletin*, *38*(3), 317–330.

Abuhamdeh, S., Csikszentmihalyi, M., & Jalal, B. (2015). Enjoying the possibility of defeat: Outcome uncertainty, suspense, and intrinsic motivation. *Motivation and Emotion*, *39*(1), 1–10.

Adinolf, S., & Türkay, S. (2019). Differences in player experiences of need satisfaction across four games. *Proceedings of DiGRA 2019*.

Adler, R. F., & Benbunan-Fich, R. (2015). The effects of task difficulty and multitasking on performance. *Interacting with Computers*, *27*(4), 430–439.

Aeschbach, L. F., Perrig, S. A., Weder, L., Opwis, K., & Brühlmann, F. (2021). Transparency in measurement reporting: A systematic literature review of chi play. *Proceedings of the ACM on Human-Computer Interaction*, *5*(CHI PLAY), 1–21.

Akoglu, H. (2018). User's guide to correlation coefficients. *Turkish journal of emergency medicine*, *18*(3), 91–93.

Arthur, P., & Passini, R. (1992). *Wayfinding: people, signs, and architecture*.

Atkinson, J. W. (1957). Motivational determinants of risk-taking behavior. *Psychological review*, *64*(6p1), 359.

Atkinson, P., & Parsayi, F. (2021). Video games and aesthetic contemplation. *Games and culture*, *16*(5), 519–537.

Aung, M., Demediuk, S., Sun, Y., Tu, Y., Ang, Y., Nekkanti, S., … Drachen, A. (2019). The trails of just cause 2: spatio-temporal player profiling in open-world games. In *Proceedings of the 14th international conference on the foundations of digital games* (pp. 1–11).

Aung, M. T. (2022). *Investigating the non-disruptive measurement of immersive player experience* (Unpublished doctoral dissertation). University of York.

Azadvar, A., & Canossa, A. (2018). Upeq: ubisoft perceived experience questionnaire: a self-determination evaluation tool for video games. In *Proceedings of the 13th international conference on the foundations of digital games* (pp. 1–7).

Babutsidze, Z. (2007). How do consumers make choices?: a summary of evidence from marketing and psychology. *UNU-MERIT Working Paper Series*(005).

Banyte, J., & Gadeikiene, A. (2015). The effect of consumer motivation to play games on video game-playing engagement. *Procedia economics and finance*, *26*, 505–514.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American psychologist*, *54*(7), 462.

Bartle, R. (1996). Hearts, clubs, diamonds, spades: Players who suit muds. *Journal of MUD research*, *1*(1), 19.

Bateman, C. (2015). Implicit game aesthetics. *Games and Culture*, *10*(4), 389–411.

Baumeister, R. F. (2016). Toward a general theory of motivation: Problems, challenges, opportunities, and the big picture. *Motivation and Emotion*, *40*(1), 1–10.

Bernoulli, D. (2011). Exposition of a new theory on the measurement of risk. In *The kelly capital growth investment criterion: Theory and practice* (pp. 11–24). World Scientific.

Bettman, J. R., & Park, C. W. (1980). Effects of prior knowledge and experience and phase of the choice process on consumer decision processes: A protocol analysis. *Journal of consumer research*, *7*(3), 234–248.

Billieux, J., Van der Linden, M., Achab, S., Khazaal, Y., Paraskevopoulos, L., Zullino, D., & Thorens, G. (2013). Why do you play world of warcraft? an in-depth exploration of self-reported motivations to play online and in-game behaviours in the virtual world of azeroth. *Computers in Human Behavior*, *29*(1), 103–109.

Blandford, A. (2013). Semi-structured qualitative studies. Interaction Design Foundation.

Bonner, M. (2015). Ambiguous play pattern: A philosophical approach to the prospect-refuge theory in urban open world games by merging deleuze/guattari and de certeau. In *9th international conference on the philosophy of computer games, meaning and computer games, berlin* (Vol. 106, p. 108).

Bonner, M. (2018). On striated wilderness and prospect pacing: Rural open world games as liminal spaces of the man-nature dichotomy. In *Digra conference.*

Bopp, J. A., Opwis, K., & Mekler, E. D. (2018). "an odd kind of pleasure": Differentiating emotional challenge in digital games. In *Proceedings of the 2018 chi conference on human factors in computing systems* (p. 41).

Borges, J. B., Juy, C. L., de Andrade Matos, I. S., Silveira, P. V. A., & Darin, T. d. G. R. (2020). Player experience evaluation: a brief panorama of instruments and research opportunities. *Journal on Interactive Systems*, *11*(1), 74–91.

Bostan, B., & Berkman, M. İ. (2017). Explorations in game experience: A case study of 'horizon zero dawn'. *Proceedings of the Eurasia Graphics 2017, Istanbul, Turkey, November 4-5.*.

Bowman, S. L. (2010). *The functions of role-playing games: How participants create community, solve problems and explore identity*. McFarland.

Boyle, E. A., Connolly, T. M., Hainey, T., & Boyle, J. M. (2012). Engagement in digital entertainment games: A systematic review. *Computers in human behavior*, *28*(3), 771–780.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77–101.

Brown, E., & Cairns, P. (2004). A grounded investigation of game immersion. In *Chi'04 extended abstracts on human factors in computing systems* (pp. 1297–1300).

Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. Guilford publications.

Brühlmann, F., & Schmid, G.-M. (2015). How to measure the game experience? analysis of the factor structure of two questionnaires. In *Proceedings of the 33rd annual acm conference extended abstracts on human factors in computing systems* (pp. 1181–1186).

Brunson, J. C. (2020). Ggalluvial: layered grammar for alluvial plots. *Journal of Open Source Software*, *5*(49), 2017.

Busch, M., Mattheiss, E., Orji, R., Fröhlich, P., Lankes, M., & Tscheligi, M. (2016). Player type models: Towards empirical validation. In *Proceedings of the 2016 chi conference extended abstracts on human factors in computing systems* (pp. 1835–1841).

Cabrera-Nguyen, P. (2010). Author guidelines for reporting scale development and validation results in the journal of the society for social work and research. *Journal of the Society for Social Work and Research*, *1*(2), 99–103.

Cai, L. (2010). Metropolis-hastings robbins-monro algorithm for confirmatory item factor analysis. *Journal of Educational and Behavioral Statistics*, *35*(3), 307–335.

Cairns, P. (2019). *Doing better statistics in human-computer interaction*. Cambridge University Press.

Cairns, P., Cox, A., & Nordin, A. I. (2014). Immersion in digital games: review of gaming experience research. *Handbook of digital games*, *1*, 767.

Cairns, P., & Power, C. (2018). Measuring experiences. In *New directions in third wave human-computer interaction: Volume 2-methodologies* (pp. 61–80). Springer.

Calleja, G. (2007). Digital games as designed experience: Reframing the concept of immersion. *Unpublished Doctoral Thesis, Victoria University of Wellington, Wellington*.

Canossa, A., Martinez, J. B., & Togelius, J. (2013). Give me a reason to dig minecraft and psychology of motivation. In *2013 ieee conference on computational inteligence in games (cig)* (pp. 1–8).

Cardona-Rivera, R. E., & Young, R. M. (2014). Games as conversation. In *Tenth artificial intelligence and interactive digital entertainment conference*.

Caroux, L., Isbister, K., Le Bigot, L., & Vibert, N. (2015). Player–video game interaction: A systematic review of current concepts. *Computers in Human Behavior*, *48*, 366–381.

Cattell, R. (2012). *The scientific use of factor analysis in behavioral and life sciences*. Springer Science & Business Media.

Chalmers, R. P. (2012). mirt: A multidimensional item response theory package for the R environment. *Journal of Statistical Software*, *48*(6), 1–29. doi: 10.18637/jss.v048.i06

Chan, J. L., & DeSouza, J. F. (2013). The effects of attentional load on saccadic task switching. *Experimental brain research*, *227*(3), 301–309.

Chang, K. T.-T., Koh, A. T.-T., Low, B. Y.-Y., Onghanseng, D. J. S., Tanoto, K., & Thuong, T. S. T. (2008). Why i love this online game: The mmorpg stickiness factor. *ICIS 2008 Proceedings*, 88.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. sage.

Charnov, E. L. (1976). Optimal foraging, the marginal value theorem. *THEORETICAL POPULATION BIOLOGY*, *9*, 129–136.

Chen, M.-X., & Chen, C.-H. (2019). User experience and map design for wayfinding in a virtual environment. In *International conference on human-computer interaction* (pp. 117–126).

Chen, V. H.-h., & Duh, H. B.-L. (2007). Understanding social interaction in world of warcraft. In *Proceedings of the international conference on advances in computer entertainment technology* (pp. 21–24).

Christou, G. (2012). Exploring player perceptions that contribute to the appeal of world of warcraft. In *Proceedings of the 4th international conference on fun and games* (pp. 105–108).

Christou, G. (2014). The interplay between immersion and appeal in video games. *Computers in human behavior*, *32*, 92–100.

Clearwater, D. (2011). What defines video game genre? thinking about genre study after the great divide. *Loading...*, *5*(8).

Cole, H., & Griffiths, M. D. (2007). Social interactions in massively multiplayer online role-playing gamers. *Cyberpsychology & behavior*, *10*(4), 575–583.

Cole, T., Cairns, P., & Gillies, M. (2015). Emotional and functional challenge in core and avant-garde games. In *Proceedings of the 2015 annual symposium on computer-human interaction in play* (pp. 121–126).

Comello, M. L. G., Francis, D. B., Marshall, L. H., & Puglia, D. R. (2016). Cancer survivors who play recreational computer games: Motivations for playing and associations with beneficial psychological outcomes. *Games for health journal*, *5*(4), 286–292.

Consalvo, M., Busch, T., & Jong, C. (2019). Playing a better me: How players rehearse their ethos via moral choices. *Games and Culture*, *14*(3), 216–235.

Costikyan, G. (2013). *Uncertainty in games*. Mit Press.

Cox, A., Cairns, P., Shah, P., & Carroll, M. (2012). Not doing but thinking: the role of challenge in the gaming experience. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 79–88).

Cruz, C., Hanus, M. D., & Fox, J. (2017). The need to achieve: Players' perceptions and uses of extrinsic meta-game reward systems for video game consoles. *Computers in Human Behavior*, *71*, 516–524.

Csikszentmihalyi, M., & Csikszentmihalyi, I. S. (1992). *Optimal experience: Psychological studies of flow in consciousness*. Cambridge university press.

Czikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.

Dale, G., & Shawn Green, C. (2017). The changing face of video games and video gamers: Future directions in the scientific study of video game play and cognitive performance. *Journal of Cognitive Enhancement*, *1*(3), 280–294.

Darken, R. P., & Sibert, J. L. (1996). Wayfinding strategies and behaviors in large virtual worlds. In *Chi* (Vol. 96, pp. 142–149).

Davies, J. J., & Hemingway, T. J. (2014). Guitar hero or zero?: Fantasy, self-esteem, and deficient self-regulation in rhythm-based music video games. *Journal of Media Psychology*.

de Barba, P. G., Kennedy, G. E., & Ainley, M. D. (2016). The role of students' motivation and participation in predicting performance in a mooc. *Journal of Computer Assisted Learning*, *32*(3), 218–231.

Debus, M. S., Zagal, J. P., & Cardona-Rivera, R. E. (2020). A typology of imperative game goals. *Game Stud*, *20*(3).

Deci, E. L., & Ryan, R. M. (2000). The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological inquiry*, *11*(4), 227–268.

Demetrovics, Z., Urbán, R., Nagygyörgy, K., Farkas, J., Zilahy, D., Mervó, B., … Harmath, E. (2011). Why do you play? the development of the motives for online gaming questionnaire (mogq). *Behavior research methods*, *43*(3), 814–825.

Denham, J., & Spokes, M. (2021). The right to the virtual city: Rural retreatism in open-world video games. *new media & society*, *23*(6), 1567–1583.

Denisova, A., & Cairns, P. (2015). First person vs. third person perspective in digital games: do player preferences affect immersion? In *Proceedings of the 33rd annual acm conference on human factors in computing systems* (pp. 145–148).

Denisova, A., Cairns, P., Guckelsberger, C., & Zendle, D. (2020). Measuring perceived challenge in digital games: Development & validation of the challenge originating from recent gameplay interaction scale (corgis). *International Journal of Human-Computer Studies*, *137*, 102383.

Denisova, A., Nordin, A. I., & Cairns, P. (2016). The convergence of player experience questionnaires. In *Proceedings of the 2016 annual symposium on computer-human interaction in play* (pp. 33–37).

Deterding, S., & Zagal, J. (2018). *Role-playing game studies: Transmedia foundations*. Routledge.

Dickey, M. D. (2005). Engaging by design: How engagement strategies in popular computer and video games can inform instructional design. *Educational technology research and development*, *53*(2), 67–83.

Dickinson, A., & Balleine, B. (1994). Motivational control of goal-directed action. *Animal Learning & Behavior*, *22*(1), 1–18.

Donaldson, S. (2017). Mechanics and metagame: Exploring binary expertise in league of legends. *Games and Culture*, *12*(5), 426–444.

Drachen, A., Nacke, L. E., Yannakakis, G., & Pedersen, A. L. (2010). Correlation between heart rate, electrodermal activity and player experience in first-person shooter games. In *Proceedings of the 5th acm siggraph symposium on video games* (pp. 49–54).

Ducheneaut, N., & Moore, R. J. (2005). More than just 'xp': learning social skills in massively multiplayer online games. *Interactive Technology and Smart Education*.

Ducheneaut, N., Yee, N., Nickell, E., & Moore, R. J. (2006). Building an mmo with mass appeal: A look at gameplay in world of warcraft. *Games and Culture*, *1*(4), 281–317.

Duggan, G. B., Johnson, H., & Sørli, P. (2013). Interleaving tasks to improve performance: Users maximise the marginal rate of return. *International Journal of Human-Computer Studies*, *71*(5), 533–550.

Dunn, T. J., Baguley, T., & Brunsden, V. (2014). From alpha to omega: A practical solution to the pervasive problem of internal consistency estimation. *British journal of psychology*, *105*(3), 399–412.

Eaton, G. (1991). Wayfinding in the library: Book searches and route uncertainty. *RQ*, 519–527.

Eccles, D. W., & Arsal, G. (2017). The think aloud method: what is it and how do i use it? *Qualitative Research in Sport, Exercise and Health*, *9*(4), 514–531.

Elias, H., Almeida, F., Filgueiras, E., Rodrigues, E. P. F., & Alexandre, S. C. (2021). No-places and immersion in open world games: a rock star case study. In *Advances in design and digital communication: Proceedings of the 4th international conference on design and digital communication, digicom 2020, november 5–7, 2020, barcelos, portugal* (pp. 166–179).

Elliot, A. J., & Fryer, J. W. (2008). The goal construct in psychology. *Handbook of motivation science*, *18*, 235–250.

Erickson, W. B., Lampinen, J. M., & Leding, J. K. (2014). The weapon focus effect in target-present and target-absent line-ups: The roles of threat, novelty, and timing. *Applied Cognitive Psychology*, *28*(3), 349–359.

Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. *Psychological review*, *102*(2), 211.

Ewell, P. J., Hamilton, J. C., & Guadagno, R. E. (2018). How do videogame players identify their actions? integrating action identification theory and videogame play via the behavior identification form-gamer. *Computers in Human Behavior*, *81*, 189–197.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological methods*, *4*(3), 272.

Ferguson, C. J. (2007). The good, the bad and the ugly: A meta-analytic review of positive and negative effects of violent video games. *Psychiatric quarterly*, *78*(4), 309–316.

Ferguson, C. J., Garza, A., Jerabeck, J., Ramos, R., & Galindo, M. (2013). Not worth the fuss after all? cross-sectional and prospective data on violent video game influences on aggression, visuospatial cognition and mathematics ability in a sample of youth. *Journal of youth and adolescence*, *42*(1), 109–122.

Fine, J. M., & Hayden, B. Y. (2022). The whole prefrontal cortex is premotor cortex. *Philosophical Transactions of the Royal Society B*, *377*(1844), 20200524.

Flood, M. M. (1958). Some experimental games. *Management Science*, *5*(1), 5–26.

Floyd, F. J., & Widaman, K. F. (1995). Factor analysis in the development and refinement of clinical assessment instruments. *Psychological assessment*, *7*(3), 286.

French, A., Taylor, L. K., & Lemke, M. R. (2019). Task analysis. In *Applied human factors in medical device design* (pp. 63–81). Elsevier.

Friedman, M., & Savage, L. J. (1948). The utility analysis of choices involving risk. *Journal of political Economy*, *56*(4), 279–304.

Frome, J. (2007). Eight ways videogames generate emotion. In *Digra conference*.

García-Lanzo, S., & Chamarro, A. (2018). Basic psychological needs, passion and motivations in amateur and semi-professional esports players. *Aloma: revista de psicologia, ciències de l'educació i de l'esport Blanquerna*, *36*(2), 59–68.

Garfield, R. (2000). Metagames. *Horsemen of the apocalypse: Essays on roleplaying*, 14–21.

Gill, J. H. (2001). Avian skin diseases. *Veterinary Clinics of North America: Exotic Animal Practice*, *4*(2), 463–492.

González, V. M., & Mark, G. (2005). Managing currents of work: Multi-tasking among multiple collaborations. In *Ecscw 2005* (pp. 143–162).

González-Cutre, D., Romero-Elías, M., Jiménez-Loaisa, A., Beltrán-Carrillo, V. J., & Hagger, M. S. (2020). Testing the need for novelty as a candidate need in basic psychological needs theory. *Motivation and Emotion*, *44*(2), 295–314.

Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, *423*(6939), 534–537.

Greenberg, B. S., Sherry, J., Lachlan, K., Lucas, K., & Holmstrom, A. (2010). Orientations to video games among gender and age groups. *Simulation & Gaming*, *41*(2), 238–259.

Grice, H. P. (1975). Logic and conversation. In *Speech acts* (pp. 41–58). Brill.

Griffiths, M., Hussain, Z., Grüsser, S. M., Thalemann, R., Cole, H., Davies, M. N., & Chappell, D. (2011). Social interactions in online gaming. *International Journal of Game-Based Learning (IJGBL)*, *1*(4), 20–36.

Gupta, A., Carpenter, D., Min, W., Rowe, J., Azevedo, R., & Lester, J. (2022). Enhancing multimodal goal recognition in open-world games with natural language player reflections. In *Proceedings of the aaai conference on artificial intelligence and interactive digital entertainment* (Vol. 18, pp. 37–44).

Ha, E. Y., Rowe, J. P., Mott, B. W., & Lester, J. C. (2011). Goal recognition with markov logic networks for player-adaptive games. In *Seventh artificial intelligence and interactive digital entertainment conference.*

Haidt, J., & Joseph, C. (2007). The moral mind: How five sets of innate intuitions guide the development of many culture-specific virtues, and perhaps even modules. *The innate mind*, *3*, 367–391.

Hamari, J., & Tuunanen, J. (2014). Player types: A meta-synthesis. *Transactions of the Digital Games Research Association–Vol. 1, No. 2*, 29.

Hansen, P. G., Skov, L. R., & Skov, K. L. (2016). Making healthy choices easier: regulation versus nudging. *Annual review of public health*, *37*, 237–251.

Hardy, M., & Gillan, D. J. (2012). Voluntary task switching patterns in everyday tasks of different motivational levels. In *Proceedings of the human factors and ergonomics society annual meeting* (Vol. 56, pp. 2128–2132).

Hartmann, T., & Klimmt, C. (2006). Gender and computer games: Exploring females' dislikes. *Journal of Computer-Mediated Communication*, *11*(4), 910–931.

Hartmann, T., & Vorderer, P. (2010). It's okay to shoot a character: Moral disengagement in violent video games. *Journal of Communication*, *60*(1), 94–119.

Hassin, R. R., Bargh, J. A., & Zimerman, S. (2009). Automatic and flexible: The case of nonconscious goal pursuit. *Social cognition*, *27*(1), 20–36.

Hertzog, C., Dixon, R. A., Hultsch, D. F., & MacDonald, S. W. (2003). Latent change models of adult cognition: are changes in processing speed and working memory associated with changes in episodic memory? *Psychology and aging*, *18*(4), 755.

Hilgard, J., Engelhardt, C. R., & Bartholow, B. D. (2013). Individual differences in motives, preferences, and pathology in video games: the gaming attitudes, motives, and experiences scales (games). *Frontiers in psychology*, *4*, 608.

Hoffman, B., & Nadelson, L. (2010). Motivational engagement and video gaming: A mixed methods study. *Educational Technology Research and Development*, *58*(3), 245–270.

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, *30*(2), 179–185.

Hughes, N., & Cairns, P. (n.d.). No item is an island entire of itself: A statistical analysis of individual player difference questionnaires. *OSF Preprints*.

Hughes, N., & Cairns, P. (2021). Opening the world of contextually-specific player experiences. *Entertainment Computing*, *37*, 100401.

Hughes, N., Flockton, J. R., & Cairns, P. (2023). Growing together: An analysis of measurement transparency across 15 years of player motivation questionnaires. *International Journal of Human-Computer Studies*, *169*, 102940.

Iacovides, I., & Mekler, E. D. (2019). The role of gaming during difficult life experiences. In *Proceedings of the 2019 chi conference on human factors in computing systems* (pp. 1–12).

Inchamnan, W., & Wyeth, P. (2013). Motivation during videogame play: analysing player experience in terms of cognitive action. In *Proceedings of the 9th australasian conference on interactive entertainment: Matters of life and death* (p. 6).

Jansz, J., Avis, C., & Vosmeer, M. (2010). Playing the sims2: An exploration of gender differences in players' motivations and patterns of play. *New Media & Society*, *12*(2), 235–251.

Jennett, C., Cox, A. L., Cairns, P., Dhoparee, S., Epps, A., Tijs, T., & Walton, A. (2008). Measuring and defining the experience of immersion in games. *International journal of human-computer studies*, *66*(9), 641–661.

Jin, S.-A. A. (2012). "toward integrative models of flow": Effects of performance, skill, challenge, playfulness, and presence on flow in video games. *Journal of Broadcasting & Electronic Media*, *56*(2), 169–186.

Joeckel, S., Bowman, N. D., & Dogruel, L. (2012). Gut or game? the influence of moral intuitions on decisions in video games. *Media Psychology*, *15*(4), 460–485.

Johansen, A. B., Brendryen, H., Darnell, F. J., & Wennesland, D. K. (2013). Practical support aids addiction recovery: The positive identity model of change. *BMC psychiatry*, *13*(1), 1–11.

Johnson, D., & Gardner, J. (2010). Personality, motivation and video games. In *Proceedings of the 22nd conference of the computer-human interaction special interest group of australia on computer-human interaction* (pp. 276–279).

Johnson, D., Gardner, M. J., & Perry, R. (2018). Validation of two game experience scales: the player experience of need satisfaction (pens) and game experience questionnaire (geq). *International Journal of Human-Computer Studies*, *118*, 38–46.

Johnson, D., Nacke, L. E., & Wyeth, P. (2015). All about that base: differing player experiences in video game genres and the unique case of moba games. In *Proceedings of the 33rd annual acm conference on human factors in computing systems* (pp. 2265–2274).

Johnson, D., Wyeth, P., Sweetser, P., & Gardner, J. (2012). Personality, genre and videogame play experience. In *Proceedings of the 4th international conference on fun and games* (pp. 117–120).

Jöreskog, K. G. (1999). *How large can a standardized coefficient be.*

Juul, J. (2002). The open and the closed: Games of emergence and games of progression. In *Cgdc conf.*

Kahn, A. S., Shen, C., Lu, L., Ratan, R. A., Coary, S., Hou, J., … Williams, D. (2015). The trojan player typology: A cross-genre, cross-cultural, behaviorally validated scale of video game play motivations. *Computers in Human Behavior*, *49*, 354–361.

Kahneman, D., & Tversky, A. (2013). Prospect theory: An analysis of decision under risk. In *Handbook of the fundamentals of financial decision making: Part i* (pp. 99–127). World Scientific.

Kay, M., & Powley, E. J. (2018). The effect of visualising npc pathfinding on player exploration. In *Proceedings of the 13th international conference on the foundations of digital games* (p. 60).

Kaye, L. K., & Bryce, J. (2012). Putting the fun factor into gaming: The influence of social contexts on the experiences of playing videogames. *International Journal of Internet Science*, *7*(1), 24–38.

Kensinger, E. A. (2007). Negative emotion enhances memory accuracy: Behavioral and neuroimaging evidence. *Current Directions in Psychological Science*, *16*(4), 213–218.

Khoo, A. (2012). Video games as moral educators? *Asia Pacific journal of education*, *32*(4), 416–429.

Kim, Schmierbach, M., Chung, M.-Y., Fraustino, J. D., Dardis, F., & Ahern, L. (2015). Is it a sense of autonomy, control, or attachment? exploring the effects of in-game customization on game enjoyment. *Computers in Human Behavior*, *48*, 695–705.

Kim, Y., & Ross, S. D. (2006). An exploration of motives in sport video gaming. *International Journal of Sports Marketing and Sponsorship*.

Király, O., Bőthe, B., Ramos-Diaz, J., Rahimi-Movaghar, A., Lukavska, K., Hrabec, O., … others (2019). Ten-item internet gaming disorder test (igdt-10): Measurement invariance and cross-cultural validation across seven language-based samples. *Psychology of Addictive Behaviors*, *33*(1), 91.

Klimmt, C., Schmid, H., & Orthmann, J. (2009). Exploring the enjoyment of playing browser games. *CyberPsychology & Behavior*, *12*(2), 231–234.

Kline, P. (2000). *A psychometrics primer*. London: Free Association.

Kosa, M., & Spronck, P. (2018). What tabletop players think about augmented tabletop games: a content analysis. In *Proceedings of the 13th international conference on the foundations of digital games* (pp. 1–8).

Kou, Y. (2020). Toxic behaviors in team-based competitive gaming: The case of league of legends. In *Proceedings of the annual symposium on computer-human interaction in play* (pp. 81–92).

Krcmar, M., & Cingel, D. P. (2016). Moral foundations theory and moral reasoning in video game play: Using real-life morality in a game context. *Journal of Broadcasting & Electronic Media*, *60*(1), 87–103.

Krippendorff, K. (2018). *Content analysis: An introduction to its methodology*. Sage publications.

Kruglanski, A. W., Shah, J. Y., Fishbach, A., Friedman, R., Chun, W. Y., & Sleeth-Keppler, D. (2002). A Theory of Goal Systems. *Advances in Experimental Social Psychology*, 331–378.

Kruglanski, A. W., Shah, J. Y., Fishbach, A., Friedman, R., Chun, W. Y., & Sleeth-Keppler, D. (2018). A theory of goal systems. In *The motivated mind* (pp. 207–250). Routledge.

Kumari, S., Deterding, C. S., & Freeman, J. (2019). The role of uncertainty in moment-to-moment player motivation: A grounded theory. In *Chi play'19* (pp. 351–363).

Kumari, S., Power, C., & Cairns, P. (2017). Investigating uncertainty in digital games and its impact on player immersion. In *Extended abstracts publication of the annual symposium on computer-human interaction in play* (pp. 503–509).

Kuss, D. J., Louws, J., & Wiers, R. W. (2012). Online gaming addiction? motives predict addictive play behavior in massively multiplayer online role-playing games. *Cyberpsychology, Behavior, and Social Networking*, *15*(9), 480–485.

Ladanyi, J., & Doyle-Portillo, S. (2017). The development and validation of the grief play scale (gps) in mmorpgs. *Personality and Individual Differences*, *114*, 125–133.

Lafrenière, M.-A. K., Verner-Filion, J., & Vallerand, R. J. (2012). Development and validation of the gaming motivation scale (gams). *Personality and Individual Differences*, *53*(7), 827–831.

Larrick, R. P. (1993). Motivational factors in decision theories: The role of self-protection. *Psychological Bulletin*, *113*(3), 440.

Lauriola, M., & Levin, I. P. (2001). Personality traits and risky decision-making in a controlled experimental task: An exploratory study. *Personality and individual differences*, *31*(2), 215–226.

Lazarro, N. (2004). Why we play games: Four keys to more emotion without story. In *Game developer's conference, san jose*.

Lee, C., Lee, K., & Lee, D. (2017). Mobile healthcare applications and gamification for sustained health maintenance. *Sustainability*, *9*(5), 772.

Lee, D., & Schoenstedt, L. J. (2011). Comparison of esports and traditional sports consumption motives. *ICHPER-SD Journal Of Research*, *6*(2), 39–44.

Lefebvre, H. (2012). From the production of space. In *Theatre and performance design* (pp. 81–84). Routledge.

Lewis, M. L., Weber, R., & Bowman, N. D. (2008). "they may be pixels, but they're my pixels:" developing a metric of character attachment in role-playing video games. *CyberPsychology & Behavior*, *11*(4), 515–518.

Likert, R. (1932). A technique for the measurement of attitudes (archives of psychology, no: 140). *New York City: Columbia University*, *7*(3).

Lin, H., & Wang, H. (2014). Avatar creation in virtual worlds: Behaviors and motivations. *Computers in Human Behavior*, *34*, 213–218.

Liszio, S., & Masuch, M. (2016). Lost in open worlds: Design patterns for player navigation in virtual reality games. In *Proceedings of the 13th international conference on advances in computer entertainment technology* (p. 7).

Loffredo, D., & Tavakkoli, A. (2016). Analyzing motives, preferences, and experiences in video game play. In *The 20th world multi-conference on systemics, cybernetics and informatics (wmsci 2016)* (pp. 45–49).

Lussier, D. A., & Olshavsky, R. W. (1979). Task complexity and contingent processing in brand choice. *Journal of Consumer Research*, *6*(2), 154–165.

Marsh, H. W. (1994). Sport motivation orientations: Beware of jingle-jangle fallacies. *Journal of Sport and Exercise Psychology*, *16*(4), 365–380.

Matsunaga, M. (2010). How to factor-analyze your data right: Do's, don'ts, and how-to's. *International journal of psychological research*, *3*(1), 97–110.

Maurer, T. J., & Pierce, H. R. (1998). A comparison of likert scale and traditional measures of self-efficacy. *Journal of applied psychology*, *83*(2), 324.

McAllister, G., Mirza-Babaei, P., & Avent, J. (2013). Improving gameplay with game metrics and player metrics. In *Game analytics* (pp. 621–638). Springer.

McMahon, N., Wyeth, P., & Johnson, D. (2012). Personality and player types in fallout new vegas. In *Proceedings of the 4th international conference on fun and games* (pp. 113–116).

Melhart, D., Azadvar, A., Canossa, A., Liapis, A., & Yannakakis, G. N. (2019). Your gameplay says it all: Modelling motivation in tom clancy's the division. In *2019 ieee conference on games (cog)* (pp. 1–8).

Melhart, D., Liapis, A., & Yannakakis, G. N. (2022). The arousal video game annotation (again) dataset. *IEEE Transactions on Affective Computing*.

Merhi, M. I. (2016). Towards a framework for online game adoption. *Computers in Human Behavior*, *60*, 253–263.

Mills, D. J., Milyavskaya, M., Heath, N. L., & Derevensky, J. L. (2018). Gaming motivation and problematic video gaming: The role of needs frustration. *European Journal of Social Psychology*, *48*(4), 551–559.

Milton Adams, J., & Hart, W. (2015). Can the means justify the ends? a pleasant journey toward a goal increases the value of the goal. *Social Cognition*, *33*(2), 133–148.

Min, W., Ha, E. Y., Rowe, J., Mott, B., & Lester, J. (2014). Deep learning-based goal recognition in open-ended digital games. In *Tenth artificial intelligence and interactive digital entertainment conference*.

Min, W., Mott, B., Rowe, J., Taylor, R., Wiebe, E., Boyer, K. E., & Lester, J. (2017). Multimodal goal recognition in open-world digital games. In *Thirteenth artificial intelligence and interactive digital entertainment conference*.

Mitchell, T. R. (1982). Motivation: New directions for theory, research, and practice. *Academy of management review*, *7*(1), 80–88.

Molina, J. A., Giménez-Nadal, J. I., Cuesta, J. A., Gracia-Lazaro, C., Moreno, Y., & Sanchez, A. (2013). Gender differences in cooperation: experimental evidence on high school students. *PloS one*, *8*(12), e83700.

Moll, P., Frick, V., Rauscher, N., & Lux, M. (2020). How players play games: observing the influences of game mechanics. In *Proceedings of the 12th acm international workshop on immersive mixed and virtual environment systems* (pp. 7–12).

Monterrat, B., Lavoué, É., & George, S. (2017). Adaptation of gaming features for motivating learners. *Simulation & Gaming*, *48*(5), 625–656.

Moore, P., & Van Pham, H. (2015). On context and the open world assumption. In *2015 ieee 29th international conference on advanced information networking and applications workshops* (pp. 387–392).

Mora-Cantallops, M., & Sicilia, M.-Á. (2018). Exploring player experience in ranked league of legends. *Behaviour & Information Technology*, *37*(12), 1224–1236.

Moreira, V., & Okimoto, M. L. (2018). The relation of attention between player profiles: A study on the eye-tracking and profile brainhex. In *International conference on applied human factors and ergonomics* (pp. 425–434).

Moser, C., & Fang, X. (2015). Narrative structure and player experience in role-playing games. *International Journal of Human-Computer Interaction*, *31*(2), 146–156.

Moura, D., & Bartram, L. (2014). Investigating players' responses to wayfinding cues in 3d video games. In *Proceedings of the extended abstracts of the 32nd annual acm conference on human factors in computing systems* (pp. 1513–1518).

Munn, Z., Peters, M. D., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? guidance for authors when choosing between a systematic or scoping review approach. *BMC medical research methodology*, *18*(1), 1–7.

Muriel, D., & Crawford, G. (2018). *Video games as culture: considering the role and importance of video games in contemporary society*. Routledge.

Murnane, E. (2018). *Emergent narrative: stories of play, playing with stories.*

Nacke, L. E., Bateman, C., & Mandryk, R. L. (2011). Brainhex: preliminary results from a neurobiological gamer typology survey. In *International conference on entertainment computing* (pp. 288–293).

Nacke, L. E., Bateman, C., & Mandryk, R. L. (2014). Brainhex: A neurobiological gamer typology survey. *Entertainment Computing*, *5*(1), 55–62.

Nell, V. (1988). *Lost in a book: The psychology of reading for pleasure.* Yale University Press.

Nunally, J. C., & Bernstein, I. (1978). Psychometric theory. ed. *NY: McGraw-Hill*.

O'Brien, H. L., & Toms, E. G. (2008). What is user engagement? a conceptual framework for defining user engagement with technology. *Journal of the American society for Information Science and Technology*, *59*(6), 938–955.

Oliver, M. B., Bowman, N. D., Woolley, J. K., Rogers, R., Sherrick, B. I., & Chung, M.-Y. (2016). Video games as meaningful entertainment experiences. *Psychology of popular media culture*, *5*(4), 390.

Oswald, C. A., Prorock, C., & Murphy, S. M. (2014). The perceived meaning of the video game experience: An exploratory study. *Psychology of Popular Media Culture*, *3*(2), 110.

O'Brien, H. (2016). Theoretical perspectives on user engagement. In *Why engagement matters* (pp. 1–26). Springer.

Pace, T., Bardzell, S., & Bardzell, J. (2010). The rogue in the lovely black dress: intimacy in world of warcraft. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 233–242).

Park, J., Song, Y., & Teng, C.-I. (2011). Exploring the links between personality traits and motivations to play online games. *Cyberpsychology, Behavior, and Social Networking*, *14*(12), 747–751.

Pasch, M., Bianchi-Berthouze, N., van Dijk, B., & Nijholt, A. (2009). Movement-based sports video games: Investigating motivation and gaming experience. *Entertainment computing*, *1*(2), 49–61.

Payne, J. W. (1976). Task complexity and contingent processing in decision making: An information search and protocol analysis. *Organizational behavior and human performance*, *16*(2), 366–387.

Payne, S. J., Duggan, G. B., & Neth, H. (2007). Discretionary task interleaving: heuristics for time allocation in cognitive foraging. *Journal of Experimental Psychology: General*, *136*(3), 370.

Peever, N., Johnson, D., & Gardner, J. (2012). Personality & video game genre preferences. In *Proceedings of the 8th australasian conference on interactive entertainment: Playing the system* (pp. 1–3).

Peracchia, S., Presaghi, F., & Curcio, G. (2019). Pathologic use of video games and motivation: Can the gaming motivation scale (gams) predict depression and trait anxiety? *International journal of environmental research and public health*, *16*(6), 1008.

Phan, M. H., Jardina, J. R., Hoyle, S., & Chaparro, B. S. (2012). Examining the role of gender in video game usage, preference, and behavior. In *Proceedings of the human factors and ergonomics society annual meeting* (Vol. 56, pp. 1496–1500).

Pirker, J., Griesmayr, S., Drachen, A., & Sifa, R. (2016). How playstyles evolve: progression analysis and profiling in just cause 2. In *International conference on entertainment computing* (pp. 90–101).

Pirolli, P., & Card, S. (1995). Information foraging in information access environments. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 51–58).

Power, C., Cairns, P., Denisova, A., Papaioannou, T., & Gultrom, R. (2018). Lost at the edge of uncertainty: Measuring player uncertainty in digital games. *International Journal of Human–Computer Interaction*, 1–13.

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of general psychology*, *14*(2), 154–166.

Quick, J. M., Atkinson, R. K., & Lin, L. (2012). Empirical taxonomies of gameplay enjoyment: Personality and video game preference. *International Journal of Game-Based Learning (IJGBL)*, *2*(3), 11–31.

R Core Team. (2021). R: A language and environment for statistical computing [Computer software manual]. Vienna, Austria. Retrieved from `https://www.R-project.org/`

Ravaja, N., Saari, T., Salminen, M., Laarni, J., & Kallinen, K. (2006). Phasic emotional reactions to video game events: A psychophysiological investigation. *Media psychology*, *8*(4), 343–367.

Reeve, J. (2016). A grand theory of motivation: Why not? *Motivation and Emotion*, *40*(1), 31–35.

Revelle, W. (2018). psych: Procedures for psychological, psychometric, and personality research [Computer software manual]. Evanston, Illinois. Retrieved from `https://CRAN.R-project.org/package=psych` (R package version 1.8.12)

Ricker, T. J., Vergauwe, E., & Cowan, N. (2016). Decay theory of immediate memory: From brown (1958) to today (2014). *Quarterly Journal of Experimental Psychology*, *69*(10), 1969–1995.

Rigby, S., & Ryan, R. (2007). The player experience of need satisfaction (pens) model. *Immersyve Inc*, 1–22.

Rogers, K., Jörg, M., & Weber, M. (2019). Effects of background music on risk-taking and general player experience. In *Proceedings of the annual symposium on computer-human interaction in play* (pp. 213–224).

Rosch, E. H. (1973). Natural categories. *Cognitive psychology*, *4*(3), 328–350.

Rosen, M. A., Salas, E., Lyons, R., & Fiore, S. M. (2008). Expertise and naturalistic decision making in organizations: Mechanisms of effective decision making. In *The Oxford Handbook of Organizational Decision Making.* Oxford University Press.

Ruddle, R. A. (2005). The effect of trails on first-time and subsequent navigation in a virtual environment. In *Ieee proceedings. vr 2005. virtual reality, 2005.* (pp. 115–122).

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary educational psychology*, *25*(1), 54–67.

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and emotion*, *30*(4), 344–360.

Samuel, P., Mall, R., & Bothra, A. K. (2008). Automatic test case generation using unified modeling language (uml) state diagrams. *IET software*, *2*(2), 79–93.

Sanchez, D. R., & Langer, M. (2019). Video game pursuit (vgpu) scale development: Designing and validating a scale with implications for game-based learning and assessment. *Simulation & Gaming*, 1–32.

Sanchez, D. R., & Langer, M. (2020). Video game pursuit (vgpu) scale development: Designing and validating a scale with implications for game-based learning and assessment. *Simulation & Gaming*, *51*(1), 55–86.

Sanders, T., & Cairns, P. (2010). Time perception, immersion and music in videogames. In *Proceedings of the 24th bcs interaction specialist group conference* (pp. 160–167).

Schaekermann, M., Ribeiro, G., Wallner, G., Kriglstein, S., Johnson, D., Drachen, A., … Nacke, L. E. (2017). Curiously motivated: Profiling curiosity with self-reports and behaviour metrics in the game" destiny". In *Proceedings of the annual symposium on computer-human interaction in play* (pp. 143–156).

Schneider, E. F., Lang, A., Shin, M., & Bradley, S. D. (2004). Death with a story: How story impacts emotional, motivational, and physiological responses to first-person shooter video games. *Human communication research*, *30*(3), 361–375.

Schoenau-Fog, H. (2011). The player engagement process-an exploration of continuation desire in digital games. In *Digra conference.*

Schomaker, J. (2019). Unexplored territory: beneficial effects of novelty on memory. *Neurobiology of Learning and Memory*, *161*, 46–50.

Schrader, P., & McCreery, M. (2008). The acquisition of skill and expertise in massively multiplayer online games. *Educational Technology Research and Development*, *56*(5-6), 557–574.

Schreiner, D. C., Yalcinbas, E. A., & Gremel, C. M. (2021). A push for examining subjective experience in value-based decision-making. *Current Opinion in Behavioral Sciences*, *41*, 45–49.

Schultheiss, D. (2007). Long-term motivations to play mmogs: A longitudinal study on motivations, experience and behavior. In *Digra conference.*

Sherry, J. L., Lucas, K., Greenberg, B. S., & Lachlan, K. (2006). Video game uses and gratifications as predictors of use and game preference. *Playing video games: Motives, responses, and consequences*, *24*(1), 213–224.

Si, C., Pisan, Y., Tan, C. T., & Shen, S. (2017). An initial understanding of how game users explore virtual environments. *Entertainment Computing*, *19*, 13–27.

Singhal, T., & Schneider, O. (2021). Juicy haptic design: Vibrotactile embellishments can improve player experience in games. In *Proceedings of the 2021 chi conference on human factors in computing systems* (pp. 1–11).

Sjöblom, M., Törhönen, M., Hamari, J., & Macey, J. (2017). Content structure is king: An empirical study on gratifications, game genres and content type on twitch. *Computers in Human Behavior*, *73*, 161–171.

Skalski, P., Dalisay, F., Kushin, M., & Liu, Y.-I. (2012). Need for presence and other motivations for video game play across genres. *Proceedings of the Presence Live*.

Sloan, R. J. (2016). An impression of home: player nostalgia and the impulse to explore game worlds. In *Digra/fdg'16-abstract proceedings of the first international joint conference of digra and fdg, 1 (13).*

Slovic, P. (1995). The construction of preference. *American psychologist*, *50*(5), 364.

Smith, S. P., & Du'Mont, S. (2009). Measuring the effect of gaming experience on virtual environment navigation tasks. In *2009 ieee symposium on 3d user interfaces* (pp. 3–10).

Soutter, A. R. B., & Hitchens, M. (2016). The relationship between character identification and flow state within video games. *Computers in human behavior*, *55*, 1030–1038.

Stenros, J. (2017). The game definition game: A review. *Games and culture*, *12*(6), 499–520.

Streiner, D. L. (2003). Starting at the beginning: an introduction to coefficient alpha and internal consistency. *Journal of personality assessment*, *80*(1), 99–103.

Stuart, K. (2008). Interview: the science and art of metacritic. *The Guardian*. Retrieved 7th Oct 2022, from `https://www.theguardian.com/technology/gamesblog/2008/jan/17/interviewtheartofmetacriti`

Suárez, L., Thio, C., & Singh, S. (2013). Why people play massively multiplayer online games? *International Journal of e-Education, e-Business, e-Management and e-Learning*, *3*(1), 7.

Suchman, L. A. (1987). *Plans and situated actions: The problem of human-machine communication*. Cambridge university press.

Sullivan, A., Mateas, M., & Wardrip-Fruin, N. (2012). Making quests playable: Choices, crpgs, and the grail framework. *Leonardo Electronic Almanac*, *17*(2).

Szycik, G. R., Mohammadi, B., Hake, M., Kneer, J., Samii, A., Münte, T. F., & Te Wildt, B. T. (2017). Excessive users of violent video games do not show emotional desensitization: an fmri study. *Brain imaging and behavior*, *11*(3), 736–743.

Szymanezyk, O., Dickinson, P., & Duckett, T. (2011). From individual characters to large crowds: augmenting the believability of open-world games through exploring social emotion in pedestrian groups. *DiGRA*.

Tamborini, R., Bowman, N. D., Prabhu, S., Hahn, L., Klebig, B., Grall, C., & Novotny, E. (2018). The effect of moral intuitions on decisions in video game play: The impact of chronic and temporary intuition accessibility. *New Media & Society*, *20*(2), 564–580.

Tamborini, R., & Skalski, P. (2006). The role of presence in the experience of electronic games. *Playing video games: Motives, responses, and consequences*, 225–240.

Tan, C. T., Leong, T. W., & Shen, S. (2014). Combining think-aloud and physiological data to understand video game experiences. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 381–390).

Tanenbaum, J. (2013). How i learned to stop worrying and love the gamer: Reframing subversive play in story-based games. In *Digra conference.*

Tekofsky, S., Miller, P., Spronck, P., & Slavin, K. (2016). The effect of gender, native english speaking, and age on game genre preference and gaming motivations. In *International conference on intelligent technologies for interactive entertainment* (pp. 178–183).

Thominet, L. (2017). Tracing player experience: A content analysis of player feedback tickets. In *Proceedings of the 35th acm international conference on the design of communication* (pp. 1–9).

Tomai, E., Salazar, R., & Flores, R. (2013). Mimicking humanlike movement in open world games with path-relative recursive splines. In *Proceedings of the aaai conference on artificial intelligence and interactive digital entertainment* (Vol. 9, pp. 93–99).

Tondello, G. F., Arrambide, K., Ribeiro, G., Cen, A. J.-l., & Nacke, L. E. (2019). "i don't fit into a single type": A trait model and scale of game playing preferences. In *Ifip conference on human-computer interaction* (pp. 375–395).

Trepte, S., & Reinecke, L. (2010). Avatar creation and video game enjoyment. *Journal of Media Psychology*.

Turkay, S., & Adinolf, S. (2018). Understanding online collectible card game players' motivations: a survey study with two games. In *Proceedings of the 30th australian conference on computer-human interaction* (pp. 501–505).

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases: Biases in judgments reveal some heuristics of thinking under uncertainty. *science*, *185*(4157), 1124–1131.

Tyack, A., & Mekler, E. (2020). Self-determination theory in hci games research: Current uses and open questions. In *Chi 2020 - proceedings of the 2020 chi conference on human factors in computing systems.* ACM. doi: 10.1145/3313831.3376723

Tyack, A., & Wyeth, P. (2021). " the small decisions are what makes it interesting" autonomy, control, and restoration in player experience. *Proceedings of the ACM on Human-Computer Interaction*, *5*(CHI PLAY), 1–26.

Tyack, A., Wyeth, P., & Johnson, D. (2016). The appeal of moba games: What makes people start, stay, and stop. In *Proceedings of the 2016 annual symposium on computer-human interaction in play* (pp. 313–325).

Vahlo, J., & Hamari, J. (2019). Five-factor inventory of intrinsic motivations to gameplay (img). In *Proceedings of the 52nd hawaii international conference on system sciences* (pp. 2476–2485).

Van Ooijen, E. (2019). Virtual extinction: On the rhetoric of hunting and killing animals in open world video games. *Human IT: Journal for Information Technology Studies as a Human Science*, *14*(3), 26–47.

Volicer, L., Frijters, D. H., & van der Steen, J. T. (2013). Apathy and weight loss in nursing home residents: longitudinal study. *Journal of the American Medical Directors Association*, *14*(6), 417–420.

Vorderer, P., Bryant, J., Pieper, K. M., & Weber, R. (2006). Playing video games as entertainment. In *Playing video games: Motives, responses, and consequences* (pp. 1–8). Routledge Taylor & Francis Group.

Vorderer, P., Hartmann, T., & Klimmt, C. (2003). Explaining the enjoyment of playing video games: the role of competition. In *Proceedings of the second international conference on entertainment computing* (pp. 1–9).

Voulgari, I., Komis, V., & Sampson, D. G. (2014). Player motivations in massively multiplayer online games. In *2014 ieee 14th international conference on advanced learning technologies* (pp. 238–239).

Walker, W. R., Vogl, R. J., & Thompson, C. P. (1997). Autobiographical memory: Unpleasantness fades faster than pleasantness over time. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, *11*(5), 399–413.

Wavish, P. (1996). Situated action approach to implementing characters in computer games. *Applied Artificial Intelligence*, *10*(1), 53–74.

Weaver, A., & Lewis, N. (2012). Mirrored morality: An exploration of moral choice in video games. *Cyberpsychology, Behavior, and Social Networking*, *15*(11), 610–614.

West, R., & Leskovec, J. (2012). Human wayfinding in information networks. In *Proceedings of the 21st international conference on world wide web* (pp. 619–628).

Wiggins, B. J., & Christopherson, C. D. (2019). The replication crisis in psychology: An overview for theoretical and philosophical psychology. *Journal of Theoretical and Philosophical Psychology*, *39*(4), 202.

Wolf, M. J. (2021). The experience and exploration of worlds in single-player video games. *Images. The International Journal of European Film, Performing Arts and Audiovisual Communication*, *29*(38), 223–230.

Wong, R. Y.-m., & Hong, Y.-y. (2005). Dynamic influences of culture on cooperation in the prisoner's dilemma. *Psychological science*, *16*(6), 429–434.

Worth, N. C., & Book, A. S. (2015). Dimensions of video game behavior and their relationships with personality. *Computers in Human Behavior*, *50*, 132–140.

Wu, J.-H., Wang, S.-C., & Tsai, H.-H. (2010). Falling in love with online games: The uses and gratifications perspective. *Computers in Human Behavior*, *26*(6), 1862–1871.

Yee, N. (2006a). The demographics, motivations, and derived experiences of users of massively multi-user online graphical environments. *Presence: Teleoperators and virtual environments*, *15*(3), 309–329.

Yee, N. (2006b). Motivations for play in online games. *CyberPsychology & behavior*, *9*(6), 772–775.

Yee, N., Ducheneaut, N., & Nelson, L. (2012). Online gaming motivations scale: development and validation. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 2803–2806).

Yee, N., Ducheneaut, N., Yao, M., & Nelson, L. (2011). Do men heal more when in drag? conflicting identity cues between user and avatar. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 773–776).

Yoo, S. B. M., Hayden, B. Y., & Pearson, J. M. (2021). Continuous decisions. *Philosophical Transactions of the Royal Society B*, *376*(1819), 20190664.

Zagal, J. P., & Deterding, S. (2018). *Role-playing game studies: Transmedia foundations*. Routledge.

Zagal, J. P., Mateas, M., Fernández-Vara, C., Hochhalter, B., & Lichti, N. (2007). Towards an ontological language for game analysis. *Worlds in play: International perspectives on digital games research*, *21*, 21.

Zendle, D., & Cairns, P. (2018). Video game loot boxes are linked to problem gambling: Results of a large-scale survey. *PloS one*, *13*(11), e0206767.

Zendle, D., Cairns, P., & Kudenko, D. (2018). No priming in video games. *Computers in Human Behavior*, *78*, 113–125.

Zhang, J., & Fu, X. (2015). The influence of background music of video games on immersion. *Journal of Psychology & Psychotherapy*, *5*(4), 1.

Zhao, Y. C., Wu, D., Song, S., & Yao, X. (2022). Exploring players' in-game purchase intention in freemium open-world games: The role of cognitive absorption and motivational affordances. *International Journal of Human–Computer Interaction*, 1–17.

Zurita Ortega, F., Medina Medina, N., Gutierrez Vela, F. L., & Chacon Cuberos, R. (2020). Validation and psychometric properties of the gameplay-scale for educative video games in spanish children. *Sustainability*, *12*(6), 2283.

Ludology

[G1] *Assassins Creed: Odyssey.* (2018, October 05). Ubisoft.

[G2] *Braid.* (2008, August 6). Microsoft Game Studios.

[G3] *Breath of the Wild.* (2017, March 3). Nintendo.

[G4] *Candy Crush.* (2012, April 12). King.

[G5] *Cities: Skylines.* (2015, March 10). Paradox Interactive.

[G6] *Civilisation V.* (2010, September 21). 2K Games.

[G7] *Dark Souls.* (2011, September 22). Bandai.

[G8] *Destiny.* (2014, September 09). Activision.

[G9] *Detroit: Become Human.* (2018, May 25). Sony Interactive Entertainment.

[G10] *Dungeons & Dragons.* (1974). TSR.

[G11] *Elder Scrolls: Online.* (2014, April 4). Bethesda Studios.

[G12] *Fallout 3.* (2008, October 28). Bethesda Softworks.

[G13] *Fallout 4.* (2015, November 10). Bethesda Softworks.

[G14] *Fortnite.* (2017, July 25). Epic Games.

[G15] *Forza.* (2005, May 3). Xbox Game Studios.

[G16] *God of War.* (2018, April 20). Sony Interactive Entertainment.

[G17] *Grand Theft Auto V.* (2013, September 17). Rockstar Games.

[G18] *I-Fluid.* (2008, July 22). Exkee.

[G19] *Just Cause 2.* (2010, March 23). Square Enix.

[G20] *League of Legends.* (2009, October 27). Riot Games.

[G21] *Minecraft.* (2011, November 18). Mojang Studios.

[G22] *Mutant Year Zero: Road to Eden.* (2019, July 30). Funcom.

[G23] *Portal.* (2007, October 10). Valve.

[G24] *Portal 2.* (2011, April 18). Valve.

[G25] *Red Dead Redemption II.* (2018, October 26). Rockstar Games.

[G26] *Skyrim.* (2011, November 11). Bethesda Softworks.

[G27] *Space Merchant Realms.* (2003). http://www.smrealms.de.

[G28] *Spyro the Dragon.* (1998, September 09). Sony Computer Entertainment.

[G29] *StarCraft: BroodWar.* (1998, December 18). Blizzard Entertainment.

[G30] *Subnautica.* (2018, January 23). Unknown Worlds Entertainment.

[G31] *Tetris.* (1984, June 6). Alexey Pajitnov.

[G32] *The Sims 2.* (2004, September 14). Electronic Arts.

[G33] *The Witcher 3.* (2015, May 19). CD Projekt Red.

[G34] *Tom Clancy's The Division.* (2016, March 8). Ubisoft.

[G35] *Wii Sports.* (2006, November 19). Nintendo.

[G36] *World of Warcraft.* (2004, November 23). Blizzard Entertainment.

Appendix A

Introduction

The five games chosen to illustrate typical completion rates of open world games were collected via a search on *Steam* for 'top rated single-player open world role-playing games'. These games were *Assassins Creed: Odyssey* (2018), *Fallout 4* (2015), *Grand Theft Auto V* (2013), *Skyrim* (2011), and *The Witcher 3* (2015). They were chosen from this selection as they included information about Steam achievements on their store pages. Achievements are badges that users receive when completing specific in-game events/actions. Alongside this, it is possible to see the current percentage of players who have earned this achievement. To understand open world main quest completion rates, only achievements relating to completing the main quest were considered. These were identified by cross-referencing the name of the achievement to what it corresponds to in the game; if the achievement was unlocked for completing a main quest, it was included.

The number of achievements relating to the main quest varied between games, with a range of 5 to 10. The percentage of completion of each achievement was plotted in Figure 1.1, and the average completion of each achievement was calculated to see the general trend.

Appendix B

Studies 1 & 2

Interview Questions

1. What open world games do you play?
    a. What do you enjoy about them?
    b. What do you dislike about them?
2. Questions about open world features gained from Study 1:
    a. How important to you is world content in open world games?
    b. How important to you is world size?
    c. How important to you is the freedom to explore?
    d. How important to you is the beauty of the world?
    e. How important to you is having a variety of quests?
    f. How important to you is having activities to do in the world?
    g. How important to you is how quests are structured?
    h. How important to you is interactivity with the world?
    i. How important to you is the time to complete the game?
    j. How important to you is game difficulty?
3. What is a 'closed world' game?
4. Any further comments?

Appendix C

Studies 3 & 4

C.1 Study 3

Materials involved in Study 3 can be found at **https://osf.io/zetbw/**, which includes:

1. The data used in the content analysis, made open access
2. The full list of papers analysed

C.2 Study 4

Materials involved in Study 4 can be found at **https://osf.io/95a4c/**, which includes:

1. The data used, made open access
2. The raw code file used for analysis
3. The original item wording vs the wording used in the study
4. Annotated PDFs of code for each specific analysis section

Appendix D

Study 6

Post-Interview Questions

1. When I stopped you, the last thing you were doing was [action]. At the start of the session, you were doing [action]. What I'm going to ask you to do is walk me through everything you did between those two points --- preferably chronologically, but it's okay if things are out of place. No detail is too small.
2. What was the most memorable point?
3. What was the least enjoyable part?
4. Did you have any goals when you were playing?
5. Did you have more than one?
6. How did you navigate multiple goals?
7. Did you ever find yourself distracted from what you were trying to do?

IEQ Short Form

Scored from 1 (Disagree Strongly) to 5 (Agree Strongly)

1. I felt consciously aware of being in the real world whilst playing (Real World Disassociation)
2. I found the game challenging (Challenge)
3. I found myself so involved that I was unaware I was using controls (Real World Disassociation)
4. I enjoyed playing the game (Involvement)
5. The game was something that I was experiencing, rather than just doing (Involvement)
6. I found the game easy (Challenge)
7. I felt in suspense about whether or not I would do well in the game (Challenge)
8. I forgot about my everyday concerns (Real World Disassociation)
9. I felt motivated when playing (Involvement)
10. I felt focused on the game (Involvement)
11. I felt that I was separated from the real-world environment (Real World Disassociation)