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Shared Gameplay Loops

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Agradecimentos

Bem, parece que cheguei ao final do meu mestrado e do capítulo atual da minha vida académica! Tive a grande maioria da minha vida simplesmente a andar em frente, sem ter a certeza do que realmente queria fazer, e no dia 31 de Dezembro 2019, um dos meus amigos mais próximos morreu, o Caeiro. Desde esse momento que algo em mim mudou, decidi empenhar-me e fazer algo que realmente amo. Toda a minha vida adorei entretenimento, quer fosse cinema ou jogos. Realisticamente nunca ponderei conseguir ter uma carreira em nenhum dos dois, mas ao longo dos últimos anos, começou a tornar-se uma realidade mais tangível, e o pouco tempo que tive em investigação em jogos foi o tempo que mais me satisfez como pessoa até agora. Tenho de agradecer aos meus pais por deixarem-me seguir o que gosto e por sempre me terem dado essa liberdade de explorar o que quero.

A todos os meus amigos, que me ajudaram sempre que foi preciso, em especial ao Lousa, Lucas, Carol, Luís e Branco, e a todos os outros, que sabem quem são, obrigado por estarem lá para mim sempre que preciso.

Nestes últimos dois anos tive o privilégio de trabalhar com uma equipa incrível e da qual terei imensas saudades. O David, que sempre me apoiou e deu-me sugestões e ajuda, o Pedro que me introduziu a um mundo maior de desenvolvimento de jogos cá em Portugal, ao Daniel pelas ajudas técnicas e a todas as nossas conversas sobre jogos, ao André por me cativar a ser criativo e a arranjar soluções eficazes para contrabalançar quando eu complicava e pensava em todos os problemas de potenciais soluções. Obrigado também aos Joões, um que esteve lá durante a fazer a dissertação ao mesmo tempo, e que sempre me deu bons conselhos e o outro que me guiou nas boas práticas, e ao Trindade pela ajuda no final do processo envolvido com a minha dissertação. Bem, é provável que vos veja cada vez menos nos próximos anos, mas garanto que passo por umas sessões de jogos de tabuleiro de vez em quando :)

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(http://doi.org/10.54499/2022.08895.PTDC), que contou com a colaboração de vários membros.

Quanto ao futuro, tenho um objetivo, ser "game director" num projeto. Claro que posso eu fazer um jogo pequeno sozinho e completar logo esse objetivo... mas tenho ideias mais ambiciosas. Tenho imensas ideias na realidade, como acredito que a maioria das pessoas que trabalham em jogos também devem ter, mas farei tudo o que posso para tornar um projeto especial para mim realidade um dia, mas por agora está tudo dito!

Ao Futuro.

Resumo

Os jogos têm vários benefícios como uma atividade e passatempo beneficial, nomeadamente em relação aos mesmos como uma forma de conectar com outros remotamente, benefícios de saúde de jogos ativos, bem como exercitar competências cognitivas, ao lado de competências de trabalho em equipa e competências criativas.

Um dos vários benefícios dos jogos é como podem criar conectividade ("connectedness") entre famílias e amigos e formar laços sociais entre estranhos, devido à capacidade de permitir pessoas em diferentes espaços físicos interagirem através de um espaço virtual e formar ou fortalecer esses laços sociais. Esses laços sociais podem ser mantidos através de interação frequente.

Uma das melhores maneiras de fomentar a interação é através de comunicação constante. Os jogos, especialmente os cooperativos/colaborativos, de equipas e assimétricos têm a capacidade de permitir comunicação constante num ambiente livre de riscos (que tem sido visto como uma ótima maneira de construir confiança interpessoal remotamente, por exemplo).

Confiança interpessoal é uma das duas componentes na construção da confiança, juntamente com confiabilidade. Por sua vez, para fomentar a comunicação nos jogos, uma das formas que isso pode ser ajudado é concebendo jogos que sejam interdependentes.

A interdependência pode ajudar a formar laços sociais independentemente do contexto (cooperativo ou competitivo), e a interdependência altamente acoplada (mais dependência entre si) é sempre preferida à interdependência de baixo acoplamento, quando se trata de conectividade.

Em adição, dados da ESA, um inquérito sobre hábitos de jogo nos EUA, mostram-nos que 83% dos participantes jogam com outras pessoas online ou pessoalmente, com 55% a dizer que os videojogos os ajudaram a desenvolver relacionamentos mais profundos. Quando grupos de pessoas que não têm as mesmas preferências de jogo querem jogar juntos, jogar juntos torna-se um desafio, e essa é uma das principais barreiras aos jogos sociais. O meu objetivo é encontrar uma maneira de superar esse problema.

Isto poderia, em teoria, ser resolvido por um jogo que incorpora vários gêneros e estilos de jogo juntos, como um "MMO-RPG" ("massive multiplayer online - role playing game"), mas onde a jogabilidade de cada jogador é a mesma, ou pela criação de vários jogos que estão interligados de alguma forma, cada um atendendo a diferentes jogadores.

A primeira solução potencial já foi tentada e, como este tipo de jogos comerciais têm demonstrado, acabam por ser limitados em termos das diferentes experiências que criam, uma vez que integram muitas interações e mecânicas possíveis de uma forma que acrescenta profundidade,

mas acaba em uma jogabilidade semelhante entre todos os jogadores, sem que as necessidades diferentes dos jogadores sejam necessariamente atendidas. Apesar da sua variedade e elevada complexidade, estes jogos ainda se focam num ciclo de jogo ("game loop") central para todos os jogadores, limitando as opções para grupos heterogéneos que desejam jogar juntos.

Esta solução potencial, além dos "MMO-RPG"s, também está presente em jogos do tipo sandbox, como minecraft e roblox, onde o jogador é livre de fazer o que quiser, sem um caminho totalmente definido, mas este jogos também sofrem das mesmas limitações.

Uma segunda solução potencial, descrita como jogos múltiplos que estão interligados de alguma forma, é muito alcançável, uma vez que pode ser conceptualizada como jogos modulares separados, mas conectados, ou por outras palavras, pode ser um jogo com papeis altamente assimétricos onde cada papel pode atender às motivações altamente assimétricas dos jogadores. Além disso, esta abordagem permitiria a remoção de restrições típicas de jogo que vêm de ter um jogo que tenta atender ao maior número de pessoas possível, concentrando os desafios de design em papeis individuais através de assimetria, em vez de papeis simétricos altamente complexos.

Todos estes jogos poderiam então ser interligados por meio de loops de jogo compartilhados ("shared gameplay loops"). Nós exploramos um ciclo de jogo compartilhado como parte central do jogo, com papeis modulares assimétricos como parte dele.

Ao longo dos anos foram propostas diversas classificações para nos permitir saber quais os jogos que as pessoas preferem jogar, mas utilizámos uma classificação proposta pela Quantic Foundry – o "Gamer Motivational Model". Este modelo agrupa os utilizadores de acordo com suas preferências após uma breve pesquisa. É composto por 12 motivações centrais, que fazem parte de três grupos principais de motivação, a "Action-Social", "Mastery-Achievement" e a "Immersion-Creativity".

O objetivo principal foi entender como criar um jogo funcional composto por múltiplos papeis modulares que são interligados através de loops de jogo compartilhados, onde cada jogo se foca numa motivação diferente (ou lados diferentes de um espectro de motivação), e se o jogo serviu o seu propósito de atender às diferentes preferências dos jogadores escolhidos para os papeis comparativamente com jogos tradicionais.

Para esse fim, desenvolvemos um protótipo de jogo para dois jogadores que inclui dois módulos de jogo individuais (cada um com uma jogabilidade única projetada para atender a um tipo de jogador específico seguindo o modelo de motivação do jogador da Quantic Foundry) e um módulo principal compartilhado, projetado para apelar a ambos os jogadores por ter características de design de ambas os papeis individuais. Este módulo compartilhado tem pequenas alterações no jogo que ocorrem de acordo com as ações individuais do jogador em cada papel individual. O módulo de jogo que atua como ciclo de jogo compartilhado consiste num jogo de defesa de torre onde o jogador colocava torres (numa fase calma) e depois tem habilidades ativas (emocionantes) durante as rondas. Os jogadores competem para alcançar a melhor pontuação nessas ondas (uma tabela de classificação mostra as pontuações entre os jogadores). Cada jogador também jogou um papel individual que alimentou esse ciclo competitivo compartilhado. Os dois papeis individuais que

criamos foram o papel emocionante (“slasher”) e o papel calmo (“planting and gathering”). No emocionante papel, o jogador entra em uma sala cronometrada e precisa matar todos os inimigos na sala, evitando morrer e o tempo acabar. No papel calmo, o jogador não tem restrições de tempo e precisa reunir recursos, plantar plantas e coletá-las quando estiverem totalmente crescidas. O desempenho dos jogadores nos seus papeis individuais correspondentes dita quantos inimigos enviam para combater o seu oponente no ciclo de jogo compartilhado. O envio de unidades aumenta a dificuldade de jogo do oponente, potencialmente prejudicando seu desempenho na competição.

Foi realizado um estudo de utilizadores e obtidos dados quantitativos e qualitativos para entender como o uso de jogos competitivos altamente assimétricos conectados a um ciclo de jogo compartilhado (compreendendo um jogo como um todo) poderia ser usado para atender às diferentes preferências dos jogadores entre jogadores que têm diferentes preferências de jogo. Os participantes foram recrutados e colocados em grupos de dois jogadores, jogaram nosso protótipo numa sessão de estudo, onde jogaram um módulo de jogo individual, e o módulo de jogo compartilhado, no qual competiram para alcançar a melhor pontuação, e experienciaram como as ações no jogo influenciaram a jogabilidade um do outro.

Os jogadores responderam a questionários para avaliar os seus sentimentos em relação à experiência em termos de percepções justiça (“balance” - para avaliar potenciais vantagens injustas entre os papeis e se sentiram que os módulos estavam equilibrados) e participaram de uma entrevista semiestruturada.

Analisamos os dados das entrevistas com uma codificação mista indutiva e dedutiva e obtivemos os dados de questionários e registros de jogos para realizar uma análise estatística. As nossas descobertas detalharam como o nosso modelo é adequado para atender a múltiplas barreiras, nomeadamente em relação a preferências de jogo, perícia e barreiras relacionadas com o tempo através do seu design inclusivo, os factores de sociabilidade que rodeiam o nosso modelo, as percepções dos jogadores em torno do nosso jogo, entre outros temas.

Os resultados levam-nos a acreditar que há potencial nos jogos modulares assimétricos conectados por meio de loops de jogo compartilhados para atender às preferências dos jogadores ao longo do tempo numa única experiência, mas que jogos exclusivamente competitivos não deveriam ser o foco como parte central do modelo.

Palavras-chave: jogos sociais, jogos assimétricos, preferências de jogo, motivação do jogador, ciclos de jogo

Abstract

There are many types of players , which differ according to motivation, and oftentimes this leads to people who wish to play together not to do so due to their difference in gaming preferences. I explore how to create modular game roles through shared gameplay loops that allow players to enjoy games together, regardless of genre preferences and player motivations. Gameplay loops are sets of actions repeated by a player throughout a game, and loops that are shared with other players are what we define as shared gameplay loops. I will touch upon how this has not been explored previously, why it is of interest, and how previous research relates to it. Namely I will explore the importance of interaction in social gaming, adapting games to player preferences through asymmetric gameplay, alongside how three games were conceptualised, developed and used in a user study with 32 gamers and 2 game developers. This was designed to verify the benefits and drawbacks of our shared gameplay loops concept. Results indicate asymmetric modular games show potential in catering to groups of players with different in-the-moment gaming needs, especially across time.

Keywords: social gaming, asymmetric games, game preferences, player motivation, gameplay loops

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Chapter 1

Introduction

1.1 Motivation

Games and their benefits are seen as a potentially beneficial activity/pastime, namely regarding it as a way to connect with others remotely, health benefits from active games, as well as exercising cognitive skills [40, 32, 61, 28, 37, 38, 57]. This, alongside building teamwork skills and creative skills [29]. One of the many benefits of games is how it can create connectedness [41, 40] between families and friends and form social ties between strangers [23], due to its capability of allowing people in different physical spaces to interact through a virtual space and form or strengthen social bonds. Social bonds can be maintained through frequent interaction.

One of the best ways to foster interaction is through constant communication [24, 63, 23]. Games, especially cooperative/collaborative, team-based and asymmetric games have the unique feature of allowing constant communication in a risk-free environment (which has been seen as a great way to build interpersonal trust remotely [25]), for example.

Interpersonal trust is one of the two components in building trust, along with trustworthiness. In turn, to foster communication in games, one of the ways that can be helped is by designing games where players are interdependent.

(Depping et al., 2017) [24] showed that interdependence can help form social bonds no matter the context (cooperative or competitive), and (Harris et al., 2019) [41] showed that highly coupled interdependence (more dependence on each other) is always preferred to low-coupled interdependence, when it comes to connectedness.

To add to this, data from ESA [29], a survey of gaming habits in the USA, shows us that 83% of participants play with others online or in-person, with 55% saying video games helped them develop deeper relationships. However, one of the main barriers to social gaming is people having different gaming preferences [40, 37, 38, 42]. My goal is to seek out a way to overcome this problem.

This could in theory be solved by a game that either incorporates multiple genres together, like an MMO-RPG (massive multiplayer online - role playing game), but where every player's gameplay is the same, or by the creation of multiple games that are interconnected in some way, each catering to different players.

The first potential solution has been attempted in commercial games and ends up being limited. They integrate many possible interactions and mechanics in a way that adds depth but with all players having similar gameplay, and not necessarily meeting different player needs. As an example, Elder Scrolls Online [75][1], is a game where each player can choose from an array of classes, find different weapons and gear and complete quests and dungeons. Alongside the main structure, the game offers many optional elements, such as weapon, clothes and jewel crafting, an antique system which is akin to digging up archeological finds as well as other systems. All players can choose to interact with these systems as much or as little as they want and they all work towards getting specific weapons, gear or visual cosmetics. However, all of these systems are focused on obtaining the items that will be used to complete the game's quests and dungeon activities, which are the core of the game, and identical for everyone. So, if a player has no interest in the core of the game, they have no want to interact with any of the secondary individual game mechanics, and all gameplay is, in essence, the same for all players.

This potential solution, aside from MMO-RPGs, has also been attempted in sandbox-like games, such as minecraft [53] and roblox [59], where you are free to do as you will, with no fully defined path, but they also suffer from the same limitations.

A second potential solution, is conceptualizing how to design separate games that connect in a shared experienced. For example, one could create highly asymmetric games where each can cater to highly asymmetric gamer motivations. All these games could then be tied together through a *shared gameplay loop*. We propose a new approach where segments of a multiplayer experience are made modular, allowing players to only engage with the parts they enjoy, while still playing together.

1.2 Shared Gameplay Loops

The main goal is therefore to understand how to create a functional game composed of multiple modular roles which are tied together through shared gameplay loops, where each game focuses on different motivations[2], and if that game served its purpose at catering to the different player preferences chosen for the roles versus traditional games.

A user study was done to understand how using highly asymmetric competitive games connected with a shared gameplay loop (comprising a game as a whole) could be used to cater to different players who have different gaming preferences. Participants were recruited and put in groups of two players. Then in one lab session they both played our prototype, where they each experienced one of the two individual game modules, and the shared game module, while competing against one another to achieve the best score.

Quantitative and qualitative data was gathered through questionnaires and a semi-structured interview which assessed players' feelings regarding the experience in terms of perceptions of social presence and fairness and participated in .

[1](In this dissertation we will follow the recommendations of CHI PLAY for the citation of games https://chiplay.acm.org/2020/guidelines/, 2020)

We analysed the interview data with a mixed inductive and deductive coding and gathered the data from questionnaires and game logs to conduct a statistical analysis. Our findings detailed how our model is suited to catering to multiple barriers, namely preferences, expertise and time-related barriers through its inclusive design, the sociality [2] factors surrounding our model, player perceptions were around our game, among other themes.

The results lead us to believe there is potential in asymmetric modular games connected through shared gameplay loops to cater to players' preferences across time in a singular experience, but that solely competitive games should not be the focus as the central part of the model.

1.3 Contributions

Our main contributions with this disseration are:

- A conceptualization of shared gameplay loops, and how they can be operationalized in a functional game.
- A fully functional prototype comprising three roles created to accommodate different player preferences based on designing around player preferences.
- A user study which provides insights into how to design modular, asymmetric games to create customizable multiplayer experiences which cater to the individual while maintaining a shared experience with others.

1.4 Document Structure

The rest of the document has the following structure:

- **Chapter 2 - Background and Related Work**: In the encompassing sections I will first delve into the concepts that are needed to fully understand the work I will be doing, such as a more detailed explanation of quantic foundry's player motivation model, why games are great to promote social interaction and what gameplay loops are, and then more specifically, shared gameplay loops. Then I will look at some related work around barriers and benefits of games as a whole and then to social games in particular through the lens of the factors that affect interaction and player experience described in (Emmerich et al., 2017) [28], and within that the intricacies of designing asymmetric games and games to foster interaction as a whole.
- **Chapter 3 - Conceptualisation and Design**: In here the conceptualization process and early game concepts are specified, up to the decided solutions. Then we detail the design process and the interactions between the games in broad terms.

[2](When using the term "sociality" we refer to the presence and degree of social outcomes emerging from the experience as used in [33])

- **Chapter 4 - Implementation**: This part of the document provides an in-depth detailed view of what was implemented, how and why.
- **Chapter 5 - User Study**: Here I detail the user study, through its protocol and research questions, methods, analysis and findings.
- **Chapter 6 - Discussion**: Here I discuss the findings and how these fulfilled or not our initial research questions.
- **Chapter 7 - Conclusion and Future Work**: In this final part I provide a discussion of the whole document, looking back at the design, implementation, and findings. Furthermore I will also give suggestions on the work that can be done regarding shared gameplay loops moving forward.

Chapter 2

Related Work

In this section we will address relevant aspects to the design and development of this project, namely the Quantic Foundry's player types, why we developed an asymmetric game and what these games are, and what we define as shared gameplay loops and how all of these helped determine aspects of my game.

Then we will be looking at other aspects, namely other player typology models, the overall barriers and challenges of play, with a focus on social play, and some previously devised solutions to combat known problems. Furthermore, we will look at some existing challenges and known design solutions to social play focusing on asymmetric games, and their design components, among others.

2.1 Gamer Motivation Model

We will be using the classification proposed by Quantic Foundry – the "Gamer Motivational Model" [2]. This model groups users according to their preferences after a short survey. It comprises 12 core motivations as can be seen in 1, which are part of three main motivation clusters, the"Action-Social", "Mastery-Achievement" and the "Immersion-Creativity". Each motivation cluster has two motivation groups which define the style of play of a person taking the survey (ranging between several of these in different amounts). According to Quantic Foundry, each of these clusters is directly associated with a personality trait, so we will be able to also use other methods to measure personality if we wish to externally validate this model.

This model was created using factor analysis and analysing previous studies regarding any type of motivations in games which led to a first draft of possible motivations and the creation of a survey with 50 possible items. Then, the Quantic Foundry team used a bootstrap approach to collect the data and iterate on the model. They started with a panel of 600 people who game to create a base model, then an online app with a 5 minute survey. They kept running factor analysis and iterating until the final model, the one seen above, 2.1 was decided on. As of 2016 there were a total of 222.964 people that had taken the survey [1], most from North America and Europe, but with large enough datasets also being available from Asia and elsewhere, and as of 2019 that

[1](Gamer Motivation Profile Findings - #GamesUR US Conference, 2016)

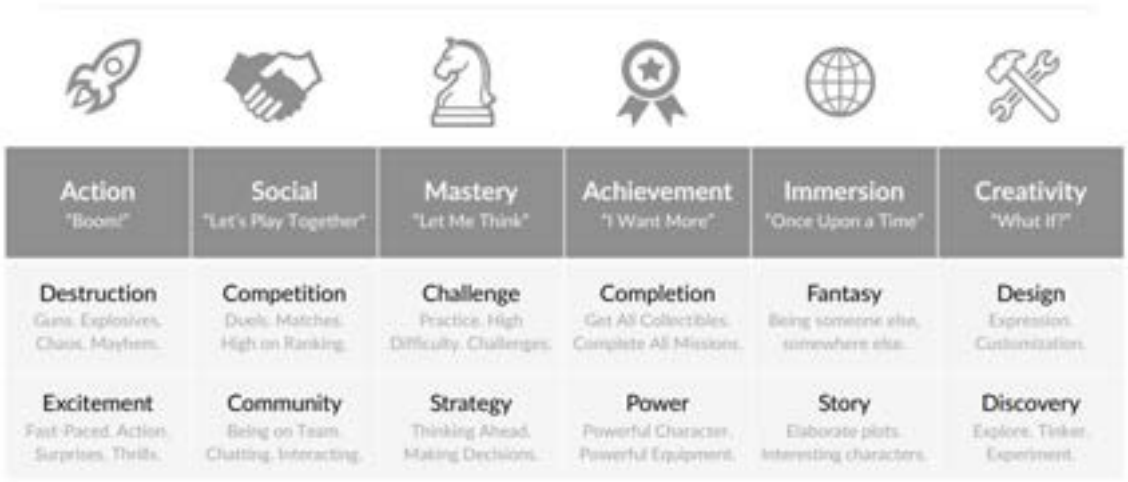

Figure 2.1: Image from [2]. Image Showcasing the main motivations of players according to the Quantic Foundry Gamer Motivation Model.

number was over 400.000 people [2].

2.2 Why Asymmetric Games?

Asymmetric games are games that focus on providing different roles, objectives, goals and/or gameplay between players. I am focusing on highly asymmetrical games where the roles of each player are completely different. One good commercial example is the game "keep talking and nobody explodes" [68]. In this game one player is trying to defuse a bomb with different modules and codes, etc, while another one is going through a non-linear manual, where the manual requires information on the bomb that only the player defusing it can see, so they can figure out what to do, press and certain sequences for the diffuser to execute and defuse the bomb in a certain time.

Frameworks of how to classify these exist, namely (Harris et al., 2016) [42] and their specification of the mechanics of asymmetry within the different levels of the MDA framework [43].

(Harris et al., 2018) [40] states these games are "uniquely positioned to bridge the gaps between individual player preferences and pre-existing social circles while providing inherently enriching social experiences", adding validity to the claim that these games are in a unique position to cater to individual player preferences.

Furthermore, asymmetric games (and some of the previously stated collaborative games), seem to be great tools to cater to people of different abilities (visually impaired and sighted players) [34], and have been shown to be great tools to foster social connectedness through their use of highly coupled [10] interdependence as a game mechanic to create communication between different people [41]. Adding to this, other studies regarding collaborative games further emphasise how essential communication is for games that focus on fostering flow [47] and interaction [74, 24].

However, as of now, no research has been done specifically into how to create a game that can

[2](A Deep Dive into the 12 Motivations: Findings from 400,000+ Gamers, 2019)

cater specifically to different player preferences. With that in mind, my goal is to create a game that caters to very different player preferences/motivations of play, following Quantic Foundry's "Gamer Motivational Model" [2]. I have stated my goal is to have multiple "roles" or a game with highly asymmetric roles, with shared gameplay loops. So, what are gameplay loops?

2.3 Gameplay Loops

Gameplay loops have been described in multiple ways, but I will be focusing on the works of (Guardiola et al., 2016) [35] and (Sicart et al., 2015) [66], both of which I intended to use since they are great as conceptual tools, are straightforward to understand, and have been used practically or have shown good practical examples of their use. (Sicart et al., 2015) [66] ended up being used in the design overview, but (Guardiola et al., 2016) [35] was ultimately not used.

(Sicart et al., 2015) [66] defines game loops formally as the set of game mechanics, computing operations and feedback mechanisms repeated by the player, allowing the player to move from mechanic to mechanic. Similar to what [35] did, but in a more analytical way that includes computer processes. In this classification, games can have multiple core loops, which can be altered to add more depth and have completely separate secondary loops that serve to add depth.

For (Guardiola et al., 2016) [35] gameplay loops are, in essence, a set of actions that is repeated throughout a game, or as Guardiola [35] puts it, "all actions performed by the player, influencing negatively or positively the outcome of the uncertain game situation in which he is engaged in".

2.4 Our Definition of Shared Gameplay Loops

In this work we will focus on designing a shared gameplay loop that integrates with other gameplay loops associated with individual roles. We define a shared gameplay loop, as an interaction loop that is shared across multiple players. For my project I will use this classification for a shared gameplay loop. These main concepts are the basis of knowledge for the work I conducted.

2.5 Player Motivation Models

In essence, describing player types means describing player motivations, so before we start talking about the positives, and barriers/challenges of games, we need to look at the reasons why people play. There have been multiple models to try and describe player models based around different principles. Let's take a look at a brief summary of some typologies along the years following the summary within [54], and other works [8]. While evaluating literature's classifications for why players play, I decided to separate the typologies according to whether they classify games or their gameplay, or if they classify the players themselves, be it according to their behaviour, personality, or others.

The first and oldest typology is Malone's Theory of Motivating Instruction (Malone et al., 1981) [52], which defined 3 categories of fun in games (challenge, fantasy and curiosity).

Then came the first player classification, Bartle's Player Types (Bartle et al., 1996) [6]. This was an informal, qualitative model of 4 player types (achievers, explorers, socialisers, killers) which did not translate directly to the other models, but could be related to them.

Then Caillois' Patterns of play (Caillois et al., 2001) [18], which was the first description of types of games based on types of playful behaviour (future authors argued the thinking was correct but information was not available at the time for it to be accurate). In Malone's Theory of Motivating Instruction, challenge and fantasy could be related directly to Caillois' concepts.

Then came the Demographic Game Design Model 1 (Bateman et al., 2005) [7]. This (DGD1) was an adaptation of the Myer-Briggs typology into games as a basis for player types. Four play styles (conqueror, manager, wanderer and participant). The main finding of this model was that hardcore and casual are player traits and not types; and that hardcore gamers should more likely be referred to as game hobbyists due to higher game literacy from playing multiple games. "The Myer-Briggs Type Indicator (MBTI) is the most widely used psychological typology (. . .) based upon a set of four axes, each assessing two opposite psychological types" [54].

During 2006 and 2007, came Yee's MMORPG user motivations study that revealed 5 user motivations for playing (achievement, relationship, immersion, escapism, and manipulation) [54]. Another study by Yee [73] talked about 3 main components with multiple sub-components (achievement, social and immersion) – arguably the most important contributions to player categorizations came from Yee.

Lazzaro's four fun keys (Lazzaro et al., 2008) [49] defined fun in games as hard fun (related to challenge), easy fun (related to exploration and curiosity), serious fun (visceral impact – escapist nature of play), and people fun (competitive/collaborative experiences in games). Some of the types of fun could be related to Caillois' and Malone's concepts. These were a set of emotional patterns [54].

Malone's, Caillois' and Lazzaro's definitions are the ones that specifically classify games or their gameplay, while the rest classify the player.

The Demographic Game Design Model 2 (Bateman et al., 2011) [8] was second demographic game design model (DGD2) was based on the Temperament Theory, which relates "four basic type patterns (. . .) to a specific skill set" [54] (logistical, tactical, strategical, diplomatic). It showed results relating to gender, player who prefers single and multiplayer games and social preferences.

In 2014 came BrainHex [54], which is a model for player satisfaction, based on the models of DGD1 & 2, with the model focusing on "an examination of play from the perspective of hypothetical neurobiological factors" and not previous psychometric models like the ones of DGDG1 & 2. This hypothetical model was created to assess possible traits to be examined in further research (from a top-down perspective). It presents seven different player archetypes (according to a particular player experience and not psychometric types necessarily) being: Seeker (motivated by interest), Survivor (motivated by the intensity of survival such as horror games), Daredevil (players who enjoy risk and "the thrill of the chase"), Mastermind (likes hard puzzles or strategy), Conqueror (want to go through a tough time and achieve success – enjoy playing against hard

enemies or against other people), Socialiser (like interacting with other people), and Achiever (goal-oriented players, with a focus on long-term achievements, which differ from conquerors). In the description of each type, the authors associate some sensory part of the brain to it. The authors conducted two demographic studies with online surveys which then classified people into a combination of the BrainHex types, with a basis from the questionnaires of DGD1 & 2. From their analysis they also further specify their types as skill-oriented (conqueror, mastermind, daredevil) or aesthetic oriented (seeker, survivor, socializer) or goal-oriented (achiever). They also identified player traits, as either 4 categories (preference for visceral play, aesthetic play, goal-oriented play or experiential play) or 2 (visceral vs aesthetic play or goal-oriented play), with further research being needed to determine right classifications for these traits.

The main limitation of Bartle's and Yee's models is its focus on massive multiplayer games, which disconnects those models from the ones of Caillois and Lazzaro [54]. Although true at the time work by (Nacke et al., 2014) [54] came out, at a later date Yee's concepts would be expanded in what would become Digital Foundry's gamer motivation model [2]. This model, which came during 2015/2016, defines 12 main motivations, and 6 categories, with 3 main motivation clusters, the Action-Social, which is associated with a broadening of the social component seen in (Yee et al., 2006) [73], Mastery-Achievement, a broadening of the achievement component and Immersion-Creativity, an expansion of the Immersion component. Since this is one of the most used models by gaming companies nowadays, and BrainHex did not have a newer iteration after (Nacke et al., 2014) [54], I will be using the Quantic Foundry model [2] in my research.

Outside of player typologies, there have been other studies regarding motivations of play, namely (Vella et al., 2016) [70] and its analysis of why and how people play alone and with others. The main takeaways regarding social play were that it "tended to generate enjoyable experiences of challenge and competence, teamwork, and connection with others", with the weight of these factors depending on who people played with and how. With known others the feelings of connection and social interaction and "fun" were above all else; while with strangers it gave convenience on when to play and autonomy in gameplay, and experiences of challenge and competence. This alongside the various typologies indicate that social play is clearly one of the many motivations for playing games. So we will stick to this, by creating a game that fosters and allows for social play, while catering to different gaming preferences, which are related to Quantic Foundry's player motivations.

2.6 Social Gaming

2.6.1 Benefits of gaming as a whole

Gaming as a whole has seen many benefits, regarding promoting physical interaction [32], to the improvement of some cognitive skills due to them being exercised in the game. This active participation has been shown to improve player's spatial awareness, especially in FPS games [61]. There have also been some positive health benefits (both positive and physical) from using games

on older adults as a preventative or rehabilitative measure, as mentioned in (Osmanovic et al., 2016) [57].

There are many studies relating to the potential of games in education [21] and for games to create empathy for others, and examples of how some games already do this to some extent [58]. Studies also exist on how student and teacher motivations are linked [3], as well as their teaching practices [50], so perhaps there may be some use in using games in this context.

(De Freitas et al., 2018) [21] talks about the four main fields that exist in the study of educational games (education science, game science, neuroscience, information science), how Human-Computer Interaction fits in the game science field, and some of the major contributions of previous research, namely the importance of play in learning, games as learning tools, using user data to personalise game experiences, among others.

2.6.2 Social Gaming Explained

We have already seen that in many typologies, social gaming can be a motivation to play games, but how can this be measured? As per (Emmerich et al., 2017) [28], one of the concepts created in literature has been that of "social presence" [41, 40], which determines awareness and involvement between players at a psychological and behavioural level. This can be measured through several methods to measure some of the sub-dimensions of social presence, such as empathy, negative feelings and behavioural engagement through self-reports to gameplay metrics [28]. Another study, (Depping et al., 2018), also uses "social capital" [23]. This framework describes relationships as either being bridging ties (friendships that are not necessarily deep, but that expose us to more facets of the "world, views, opinions, and resources") or bonding ties (emotional relationships). As a side note it should be mentioned (Depping et al., 2018) [23] focuses on people who already have established relationships when measuring social capital, but many other studies studying cooperation in some form tend to research people with little to no previous connection [60, 63, 10, 42, 41]. The interaction in games can be in-game interactions (happen inside the game) or out of game interactions (happen in the real-world), and they can be internally derived by the game or externally derived by the social context between players outside of it [28].

And what promotes social gaming? (Zagal et al., 2006) [74] which analysed board games could already state that a key factor to game collaboration was communication. And the one downside it could have was that it could lead to communication problems. (Depping et al., 2018) [23] had seen the negative effects of toxicity in a social context, but also the positive effects of cooperation and interdependence for social gaming. Aside from this, multiple papers [41, 24] also show how interdependence was a key design feature for games that wanted to promote social interaction. From this a vast array of studies exist on experimental implementations of interdependence in a multitude of contexts [42, 34, 25, 28, 37, 38]. The way this was achieved is by interdependent games requiring frequent communication between players to succeed, therefore leading to more social presence.

2.6.3 Other Benefits of Communication

As well as social presence, communication in games has other benefits, such as interpersonal trust [25]. The two main approaches to trust formation are through activities that lead to personal information exchange which bolster trustworthiness (such as social icebreakers) and activities that create an environment where interdependence is necessary to overcome a level of risk, which improve interpersonal trust (such as trust falls).

In a face-to-face context, multiple ways exist to fulfil both of these approaches [25]. However, in a remote context, (Depping et al., 2016) [25] states that there are no easy ways to create situations where there is risk and interdependence, and therefore to create interpersonal trust, with what is created usually being fragile since there aren't as many shared experiences. (Depping et al., 2016) [25] argues that games are a perfect candidate to fulfil this role since, even though they don't have real life consequences, they are proven to have the ability to give a sense of connectedness, are popular, can easily simulate risk and interdependence, and have been proven to be accepted as team building activities. To verify the hypothesis that an online collaborative game with interdependence would be suitable to create interpersonal trust, the authors in (Depping et al., 2016) [25] evaluated two sets of participants, one half completing a social icebreaker task for trust development and the other a game they created to compare the two. The game created (Labyrinth) was a networked, 2-player, asymmetric role puzzle game. It followed the design guidelines established by previous research (should be a collaborative game where players have a high degree of interdependence, face risk and have specific roles).

The results of (Depping et al., 2016) [25] showed that even though social icebreaker tasks have the ability to bolster personal information exchange that can be effective at fostering trust, in these cases it is dependent on circumstance and when one person isn't as inclined to do the social task or doesn't enjoy the task, the ability to create trust diminishes. In other words, the social task depends on the personality and the enjoyment of the experience of its participants.

The game, on the other hand, proved more robust, both for gamers and non-gamers, regardless of age and gender. The propensity to trust, enjoyment of the game and agreeableness did not affect the ability for people to feel safe with one another, supporting the idea that a game doesn't need to be "fun" to create trust between players. Furthermore, when comparing pairs of people talking about where to go in a game and about each other's preferences and personalities, there were no differences in involvement, affect, depth and formality (consistent with literature that says "the content of a conversation is distinct from its emotional and relational components"). These all point towards the game being effective toward building trust regardless of personalities and the overall enjoyment.

Another benefit of communication is how it can make games more enjoyable, by providing it as a main gameplay mechanic, such as the case of the game "among us" that uses "social deduction" as one of the main game mechanics [39]. Another use for communication in games is, as a facilitator of group flow in co-operative gaming [47]. Flow can be defined as a state in which an individual feels in "the zone" during a motivating and enjoyable activity. The results in (Kaye et

al., 2016) [47] show that the main contributors towards group flow in a co-op setting were effective communication, team-work and task-relevant knowledge of group members (mainly pertaining to skill or knowledge).

This study served to visualise that the key to achieving the state of group flow in games is mainly effective communication which in turns fosters other aspects that create flow, such as effective teamwork (a practical implication being that in a competitive context players should be grouped with those of similar skill), and "task-relevant knowledge of others", meaning you should easily know the skill of others to be able to create a flow state.

For example, it can be frustrating to be playing a player-versus-player team game and have people do illogical things given the context of the game as a whole, and when playing co-op games knowing other player's skill level is good since players tend to play differently according to their teammates. It is usually the case that if there are players playing alongside lower levels or people with lesser knowledge, many a times they tend to take the role of leaders and mentors towards them (a practical implication being that visible indicators of player skill or experience are a good way to ensure competency is maintained between members in a game).

Since these results were taken directly from gamers playing in their natural environment the results may be considered truer to life than it would have been otherwise in a laboratory setting.

Now, what are the main barriers to play in general, and social play in specific, you may ask. We can group them up according to (Emmerich et al., 2017)'s [28] suggestion of three main categories around the social context of a game. Through the composition of the player group, the game design elements, and the environment characteristics of the gameplay.

2.6.4 Barriers and Challenges to Social Gaming

Following this classification, we can now talk about the main barriers facing the player, the ones facing the game itself and the ones affecting the setting.

For the ones affecting the player and the player group is where the widest array of barriers lies. They can stem from personal taste (different game preferences of genre), to personal conditions or disabilities (psychological, physical or cognitive) causing someone to not be able to play traditional games, that can be related to age or not, to disliking toxicity that can sometimes occur in social play to the amount of time one can play [70, 37, 42], to the difficulties of playing games between different groups of people [57, 26], and constraints such as time between players.

The ones facing the game itself include technological problems and networking problems that can lead to less than desired experiences. The logistical problems in (Depping et al., 2016) [25] can be seen as these. Furthermore, in-game problems such as mismatches in skill levels also fit in this category [70].

The ones affecting the setting can be seen as any problems relating to players being apart, such as logistical issues such resulting in problems arranging schedules to play together with known others [70].

One other aspect that the game itself faces is its aesthetics [43], or how the game will be

perceived by the player. One of the ways to circumvent this problem is through the proposed asymmetries defined within the MDA in (Harris et al., 2016) [42].

2.7 Gameplay Definitions

In this section we will look at how gameplay has been defined in literature and how to create games to surpass a multitude of barriers.

2.7.1 Shared gameplay loops

Reiterating what gameplay loops are, a set of actions that is repeated throughout a game, or as (Guardiola et al., 2016) [35] puts it, "all actions performed by the player, influencing negatively or positively the outcome of the uncertain game situation in which he is engaged in". They are one of the ways a game designer can define the gameplay of a game, serving as a formal tool to represent gameplay in action. In Emmanuel Guardiola's work (Guardiola et al., 2016) [35], a way to define a gameplay loop formally is by separating actions into two types,"In Game Actions", which is an action that requires input and is concretely represented in the game, and "Out of Game Actions", which are actions that rely on the perceptive and cognitive capacity of a player that leads to In Game actions, and can be specified in terms of the action's duration. Then with these actions a flowchart can be created at a micro level, but where we can always "zoom out" to get the bigger picture – another flow chart. This definition of gameplay loop is both good as a way to study existing games, and as a way to help define gameplay of games that are being created, during its early to mid-development.

That is, however, not the only definition for game loops. As stated previously I will use Miguel Sicart's definition [66] in the design overview. (Sicart et al., 2015) [66] is Sicart's complementary work of his previous works into "Theory of Play"(Sicart et al., 2014) [65] and "Game Mechanics" (Sicart et al., 2008) [64] as well as Bjork and Holopainen's Game Design Patterns (Björk et al., 2004) [11].

(Sicart et al., 2015) [66] defines core gameplay loops and how providing other loops after the mastery of the main one provides new challenges for the player. For example, as the paper states, in Minecraft [53] the main loop includes "gather/craft/build", and then offers other more complex loops based on the main one. It then gives the example of how killing the ender dragon in that game only changes the loop to "gather/craft/build(weapons)/attack/gather", then going back again to the main loop. In (Sicart et al., 2015) [66], the authors also define secondary gameplay loops, and how secondary loops can serve to add depth to the main gameplay loop/loops. For example, as shown in (Sicart et al., 2015) [66], in the game "FIFA 15" [27] the main loops include attacking and defending and the secondary loops include skills to add more depth, which are not needed to succeed, but make players with more skill be able to perform more intricate moves.

For game design research in particular, (Sicart et al., 2015) [66] states their model of game loops has three main purposes,which revolve around better understanding the game's mechanics, their correlations and what and why players do the things they do inside the game, by "relating

game mechanics with system processes, putting them together in a series of input and feedback loops". These are all useful in the analysis of a game, and due to that I implemented some aspects of [66]'s game loops into my research.

(Sicart et al., 2015) [66] also talks about the concept of the metagame, a game within a game, as a way to understand the context of game loops in game design research, stating it is the game that arises from interaction with the game itself. By using the metagame definition we can look at games as not only interactions with the game loops but also the context that surrounds it. Even though they are interesting, the metagame part of (Sicart et al., 2015) [66] will not be used since it is mainly geared towards the analysis of games, and in a more commercial context, and of Free-to-Play games in particular.

There are also examples of attempts of creating formal languages to define gameplay loops such as (Francillette et al., 2012) [31], which views gameplay loops not as sets of actions, but rather as sets of hierarchical game cycles defined by the OCR gameplay loop. The OCR gameplay loop, is an "industry model of Objective Challenge Reward (OCR)", which is used to describe games from a macro point of view [35]. It identifies the objective as the state of a game that steers the behaviour of a player, the challenge represents the elements a player needs to face to overcome and achieve the objective, and the reward is what the player gets when achieving the objective.

As could be seen in the related work part of (Francillette et al., 2012) [31] many people have tried to describe gameplay as either the different elements that describe a game's experience, through design documents that describe the game, through rules and then defining what types they can be, or considering gameplay as a behaviour process based on mathematical structure/models. Each approach has their pros and cons but none are the de facto standard.

Since (Guardiola et al., 2016)'s [35] definition has been proven useful in a practical context I intended on using it in the initial design work of my game, but it ended up not being used. On the other hand, (Sicart et al., 2015)'s [66] gameplay loop definition appears to be quite complete, so I will use parts of its notations in my work, namely the design overview, instead of the methodology by (Francillette et al., 2012) [31], in which the author does not consider gameplay loops as sets of player actions, unlike the others [35, 66]. Furthermore, since I will be acting as both game designer and programmer, the framework provided by (Francillette et al., 2012) [31] and the complexity it adds does not seem to be needed.

2.7.2 How to create games to combat these barriers

So, how can we then help the players' experience and combat gaming's barriers? Well, multiple factors can help. Things such as (Beau et al., 2016)'s [9] suggestion of an automated game balancing system can help smooth out kinks between players' skill gaps, working on not only the mechanics aspect of a game, but also incentivising dynamics between players. This is in itself a game component solution of social context characteristics of games [28].

For problems related to location, the incorporation of location-based data into gameplay itself, allowing players to make a common barrier, a part of the experience [38], or having games that

don't require people playing at the same time to play in a social context, such as idle games with social features.

Now, as for the problems affecting/originating from the player, regarding the conditions players may have provides quite a challenge. This is where most research regarding older adults lies. Namely in the types of games that they like to play and the games that can help them play being mostly games that foster interaction between their loved ones [57], and using games to help them stay connected with others [32]. Ways that have been explored regarding this has namely been physically active games that are motion-based, that cater to a larger audience of people who are potentially not typical gamers by being simplistic and easily accessible, and taking into account age related changes of some players, taking into account that people who would be playing would have different ages, by implementing game aspects that mirrored everyday life to make it easier to comprehend, among others [32].

As discussed previously, games that try to strengthen or create social bonds mainly revolve around repeated interaction, which is typically achieved through communication during the game. One type of game that seems to be "uniquely positioned to bridge the gaps between individual player preferences and pre-existing social circles while providing inherently enriching social experiences" [40] (as quoted previously), that being asymmetric games, due to their ability to cater to multiple game preferences inherently, and therefore combat one of the deterrents to social play.

2.7.3 Game Design Patterns

It is important to look more specifically at what mechanics, game design patterns and other aspects have been successfully implemented in social games. As mentioned previously, interdependence has been successfully implemented in multiple instances, which (Depping et al., 2017) [24] found to be a concept not directly associated with cooperation as was previously assumed, which in itself has also been successfully implemented in social games.

Aside from these there are also game patterns which research has argued could be of use to bolster social interaction. Game design patterns are recurring interactions relevant to gameplay. These are (Rocha et al., 2008)'s [60] six patterns, and (El-Nasr et al., 2010)'s [63] follow up of seven more relevant patterns for social interaction.

Different from the game design patterns, (Vella et al., 2016) [70] studied the differences between people playing together in a competitive, cooperative and mixed play (team-based) setting. Their results showed that competitive play, "produced a strong enjoyment of experiences of competence and challenge"; cooperative play was similar to that of playing with known others, with teamwork being the main experience; and mixed play was seen as "the most fun and the most satisfaction", likely due to implementing and allowing for both competitive and cooperative gameplay, or to players seeking out enjoyable experiences for them and avoiding negative experiences that came with the other type of play (cooperative vs competitive).

For some insight on challenges that come up when developing games in a research context, specifically collaborative asymmetric games, a good example is (Harris et al., 2018) [40], which

pinpoints some of the biggest design challenges the authors faced while developing (Harris et al., 2019) [41], namely the unexpected and intricate problems that surface when trying to make roles that were first designed to be asymmetric, be able to also be symmetric. In their game (Harris et al., 2018) [40] these challenges surfaced in areas such as spawn locations, balancing between characters, changing abilities and gameplay outright, level design having to change not to become too redundant in some cases or impossible in others. This emphasises the challenges surrounding asymmetric games, their design, as well as ways the authors found to circumvent challenges while keeping the research objective as a focus in the game.

From these game design patterns, we can see how they have been used, and some only conceptualised in cooperative games, as well as challenges I may face when I'm designing my game. In a social gaming context, cooperation is one of the many ways through which communication can happen in research, however, little is known about fostering that communication in a competitive setting.

2.8 Asymmetry

2.8.1 Asymmetric games

I've stated I will be using asymmetric games. But what exactly defines an asymmetric game and what attempts have been made to create asymmetric games with promoting interaction as the main goal. Now I will briefly talk about these points in an abbreviated way.

Prior to research started delving into asymmetric games, it focused on collaborative and competitive games. Before going any further it is important to note that in this paper collaborative and cooperative games will have the same meaning, even though others such as (Zagal et al., 2006) [74] speak of distinctions between the terms. Here, both terms will involve any games where players are working together and not against each-other. Team-based games are still the one exception that incorporates aspects of both these and competitive games.

There are other suggested notations such as the one by (Voida et al., 2010) [71] regarding social interactions, by viewing interactions as being group-based and individual based, but these regard interactions during gameplay and not game definitions in and of themselves.

As (Emmerich et al., 2017)'s [28] work highlights, findings from these include the importance of interdependent gameplay in higher levels leading to less negative feelings, more empathy and more behavioural engagement than low interdependence. The design of levels with low interdependence seemed somewhat competitive, which may explain the negative feelings towards the independent condition, with the authors advising that designers should be aware that interdependence changes (at least partially) the way players communicate and that independence can create a competitive atmosphere. Shared control and time pressure did not seem to have any observable positive results regarding social interaction, although it is important to disclose that when it came to the time pressure, the amount used in the game in this study may have been too low to amount to any type of reaction to it, rather than it not being a good game pattern to use for games that pro-

mote social interaction. This is why we later in the development process were okay with having parts of some games feature time pressure.

Previously, in 2012, (Beznosyk et al., 2011) [10] detailed their results regarding the effects of closely-coupled cooperative games and loosely coupled ones and found that the patterns for 2/3 of the closely coupled games were rated considerably higher in terms of excitement, engagement, challenge, understandability and replayability than those of the loosely-coupled games, therefore suggesting that closely-coupled game patterns are more suited towards interesting and good co-operative casual games. Other work, such as (Harris et al., 2019) [41] further adds to this by showing that tightly coupled gameplay is rated higher than loosely coupled gameplay in terms of player experience. A closely-coupled game is essentially a game with higher interdependency. In his study, the patterns for cooperative play chosen were based on (El-Nasr et al., 2010)'s [63] suggested cooperative game patterns, which extends work done in (Rocha et al., 2008) [60].

Much of these works conclude that cooperation and interdependence are among the main factors that lead to social engagement in games. As seen in (Depping et al., 2018)'s [23] related work, cooperation being defined as players working together to complete a goal.

In 2017, (Depping et al., 2017)'s [24] results showed that cooperation and interdependence are different constructs that both work in tandem to affect social relationships in games. In that same year (Emmerich et al., 2017)'s [28] proposed the social context of gaming as to be composed of 3 categories (the group of players, the game design features, and the environment in which the gaming occurs), and showed how these determine the social interactions that occur in a game (internally derived and externally derived), which in turn influence the player experience in a game. Adding to this it's results also showed positive effects of interdependence in player experience. These results regarding player interdependence where the ones showed there was a clear effect in player experience, namely players "spent about 70% less time on utterances of frustration or swearing than independent players", but gave twice as much "DOIT" commands in the high interdependence condition (DOIT commands are part of the naming system involved in the method created to evaluate social interactions in games by (Emmerich et al., 2017) [28], based on concepts by (El-Nasr et al., 2010) [63], (Bromley et al., 2013) [16], as well as their own analysis). High interdependence also led to less negative feelings, more empathy and more behavioural engagement than low interdependence. The design of levels with low interdependence may have seemed competitive, which may explain the negative feelings towards the independent condition, with the authors advising that designers should be aware that interdependence changes (at least partially) the way players communicate, and that independence can create a competitive atmosphere. In (Harris et al., 2019) [41] the authors talk about design decisions to consider regarding interdependence such as designing not only for "designed interdependence", but for "emergent cooperation" as well (where there is a mechanical possibility that one player can help another, although it is not necessary, with the example given being a player's character healing ability allowing them to heal themselves as well as the other player's character.

Asymmetric games have been used in multiple studies [42, 41, 34, 9, 40, 25, 32, 62].

Most games include some kind of asymmetry, such as light role asymmetries in games that allow for role selection, but where gameplay is mostly similar such as WoW [12] and Overwatch [13], but we are focused on more highly asymmetric games. Games where the difference isn't simply regarding choices, but that affects gameplay deeply, such as different roles with different mechanics (sometimes looking like effectively two different games working as one).

Now regarding work focused specifically on asymmetric games, (Harris et al., 2016) [42] shows some of the challenges that exist when creating strongly asymmetrical games, namely the "influence of existing controller and genre familiarities, the difficulty of tuning tightly-coupled game mechanics, and the interplay between leadership, "primacy", and necessity" and then shows ways of implementing asymmetry on the three levels of the MDA framework [43] to generate different levels of interdependence between players through the beam me round scotty prototype through level design.

The MDA framework divides a game into 3 parts, the Mechanics being the decisions game designers can directly control; the Dynamics the stage when the game runs (the MDA specific paper refers to this as dynamics we want to create between players); and the Aesthetics closely relating to how a player feels about a game and the furthest from direct control from the game designer.

(Harris et al., 2016)'s [42] classification of asymmetry through the MDA framework, for mechanics defines, for example, asymmetry of interface, where the player inputs/outputs are different, and asymmetry of information where the information players know is different.

For dynamics of asymmetry and interdependence the authors talk about three main types (with subtypes), the directional dependence of each player aka if one is dependent on another, if both are dependent on each other or if their dependence is the same, the synchronicity of their actions so if events happen once of over a period of time, and their timing (asynchronously, one before the other, both must perform an action between an interval of time, among others. For Aesthetics of Asymmetry, in their "Beam Me Round Scotty" Prototype created by the authors, the story aesthetic is based on Star Trek (Captain Kirk and Scotty), which combines with heuristics of asymmetry and player's perspectives and expectations to create the aesthetic. I use this classification in my work when talking about my asymmetric game. In the follow up from (Harris et al., 2016) [42], (Harris et al., 2019) [41] focuses on the differences between symmetrical and asymmetrical games, by testing symmetrical and asymmetrical versions of their game, built upon from (Harris et al., 2016) [42], but where now there were Twin Conditions (both playing as the same characters), with the focus being on increasing social connectedness. This, of course, had several design challenges, which the authors talk about more in depth in (Harris et al., 2018) [40]. For the split conditions (asymmetric), the authors also tested different amounts of coupling - following (Beznosyk et al., 2011)'s [10] notations of loose and tight coupling. Regarding their first user experience study, some noteworthy points include players feeling more connected to a play partner when having specific asymmetric roles and controls were more intuitive and players felt more immersed in asymmetric play. Both of these support the idea that asymmetric games are great

tools to create social connectedness, and it could also be argued that the "Action-Social" cluster of Quantic Foundry is a type that can be fulfilled intrinsically through asymmetric games with medium to high interdependence.

Another paper that focuses specifically on highly asymmetric roles is (Gonçalves et al., 2021) [34], which further highlighted how the key in good asymmetric games is interesting communication. This paper talks about mixed-ability cooperative games focusing on (Wobbrock et al., 2011)'s ability-based design [72] emphasising what can a person do, aka focusing on its abilities rather than limitations, expanding it through different gameplays for different players both working towards a common goal. They developed two games to test their research questions. These were whether an asymmetric ability-based game could be engaging for both players and how interdependent ability-based challenges affect players' perceived competence and autonomy (this paper also used the MDA framework).

Other than papers specifically talking about asymmetric games and their mechanics, several papers also use them as a research tool for automated balancing of asymmetric games [9], as tools for building trust [25], for games between caregivers and adult patients [32], and audience participation games [62].

2.9 In Summary

Social gaming is one of the key motivations for playing games, as can be seen within the multiple player and game classifications. Within this context we have looked at how social gaming can be measured, studies that focused on bolstering social gaming, with a key construct being interdependence, as well as cooperation. This is because these design constructs when implemented require constant and frequent communication, which is a key to forming and maintaining social relations.

From the several barriers to gaming, the one we are taking special interest in is the problem that arises when people want to play together but can't due to not liking the same types of games. In playing together, typically people like to play cooperative games, and so we looked at some design patterns that have seen to be good for the social game we want to make.

We then looked at how literature defined games, and their gameplay, through gameplay loops. To be able to address the different types of player preferences we looked at what games are best suited to solve this problem, with the clear answer being asymmetric games. These are games where each player has a highly asymmetric role/gameplay from the other. We looked at some examples of studies that used asymmetric games, which have already been established as a good way of addressing physical or cognitive conditions of one player playing with another, as well as in terms of player satisfaction while having different roles.

However, existing examples don't necessarily focus on player's preferences by merging different genres, so that is where my main challenge lies.

Chapter 3

Conceptualisation and Design

3.1 Shared Gameplay Loops

As previously discussed, in past research the main component for social play revolves around interaction in games, in particular through design patterns such as cooperation and interdependence (among others). Initially we considered focusing on augmenting these since from the related work all its studied benefits for social play when having different asymmetric interdependent player roles are documented, but not much has been done it terms of highly asymmetric competitive games, only those with less extreme forms of asymmetry namely asymmetry of abilities, such as the previously mentioned WoW [12] and Overwatch [13]. This only caters to a specific player base, namely players who enjoy more open and extensive experiences while playing together, and most often in a cooperative setting. For other players, such as, for example, competitive players with different motivations, there aren't any game experiences they can share where they are each playing within what caters to them.

For this reason we decided to explore the capacity of highly asymmetric modular roles with shared gameplay loops to create opportunities for these players to play together, while trying to maximise each role to each player motivation, with an overall focus on competition rather than cooperation, but still trying to see if these could create a feeling of social presence between players.

Since we decided upon doing a competitive game rather than a collaborative game the design was focused on promoting interaction within the game by allowing for interaction outside of the game but not requiring the need for frequent communication that would come from interdependent roles. A competitive game between two players is in essence independent between the two players.

To this effect I looked to create an asymmetric, 2 player, asynchronous game to bring people who prefer different genres of gameplay together through one incorporated experience, as can be seen in 3.1. This was initially designed to be able to be played remotely and asynchronously to diminish what was required of players. My focus was on establishing games that have shared gameplay loops between them, but that function separately as well. Another way to consider our approach is similar to that of Ubisoft Connect [1], formerly Uplay. In this platform playing a game connected to it and completing preset challenges can give currency to a player. Then the player

[1](Ubisoft Connect, 2016)

can choose to use that currency to buy unlockable items out of a set list for any game you own, not just the one you won the points on. In our approach, instead of a shared platform with a currency unlocked by playing different games we have that platform be a game in and of itself.

Instead of it being designed as a fully contextualised game, the goal was for it to be modular, so that if wanted, other players and roles could be added at a later date. The design was to be akin to the board game merchants cove [30] in the sense that there are individual game loops (modular for my design), that get tied together in some form of a shared gameplay loop between players.

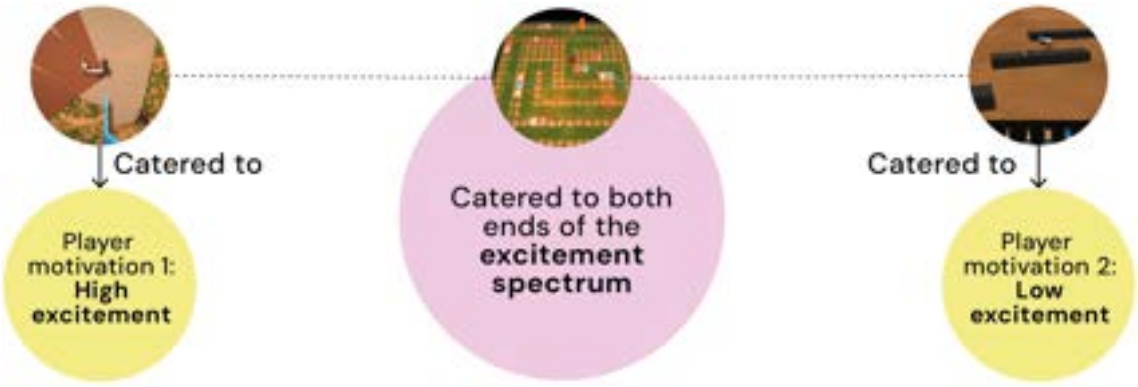

Figure 3.1: The modularity of my concept, how each motivation will be addressed in a role, and how the game includes the roles (side circles) and the shared gameplay loop between them (center circle).

Three robust game prototypes of these games were created using Unity [2], along with some premade assets, that went through many iterative stages until their final phases. They were all connected to a database (Firebase) which allowed data to be shared between them and interactions to be decided upon.

The prototypes serve as roles catered to specific player types and form a “shared gameplay loop” that serves as a proof of concept game that is evaluated in the user study.

Throughout the game design process a game design document was created specifying the general concepts, though partly after development of the tower defence game it stopped being updated, as it gradually became less relevant to the actual development.

With the overall concept described we will delve next into the design process behind the games, and later in-depth details on its implementation.

3.2 An Initiation for Different Player Motivations

The next sections feature details on our initial choices, the possible ways of implementing our “shared gameplay loop”, how three games were made to fit within goals alongside what tools were used.

[2](Unity, 20005)

3.2.1 Quantic Foundry's Gamer Motivation Model

Before deciding what our games would be and look like we needed to further analyse the Gamer Motivation Model and its core motivations. First off, looking at the 12 core motivations, we looked at what would be feasible to implement and put into a game given the expected time frame. Since social gaming, although not the goal of our research, was of interest to us, the logical choice was to pick from the four motivations within the "Action-Social" motivation cluster, seen in 3.2. This cluster comprises 4 motivations. Destruction, Excitement, Competition and Community. From these, the Community motivation was immediately ruled out since we were looking to only focus on small user groups for the user study, which ended up being groups of two people in the end. Out of the remaining three, Destruction and Excitement were the ones we considered more heavily, and ended up deciding upon the Excitement motivation. This would be our north star in designing the two highly asymmetric game roles, each role on one of the ends of this motivation spectrum, Calm and Thrilling. Then, for our shared game, it was decided it would have to be, in some way neutral, or cater to both ends of the excitement spectrum, and have additional aspects from another core motivation. Looking back at the remaining choices between Destruction and Competition we decided upon Competition on the side of High Conflict within its respective spectrum. This set our base design rules for the shared game - it would have competitive elements and needed to be shown in-game.

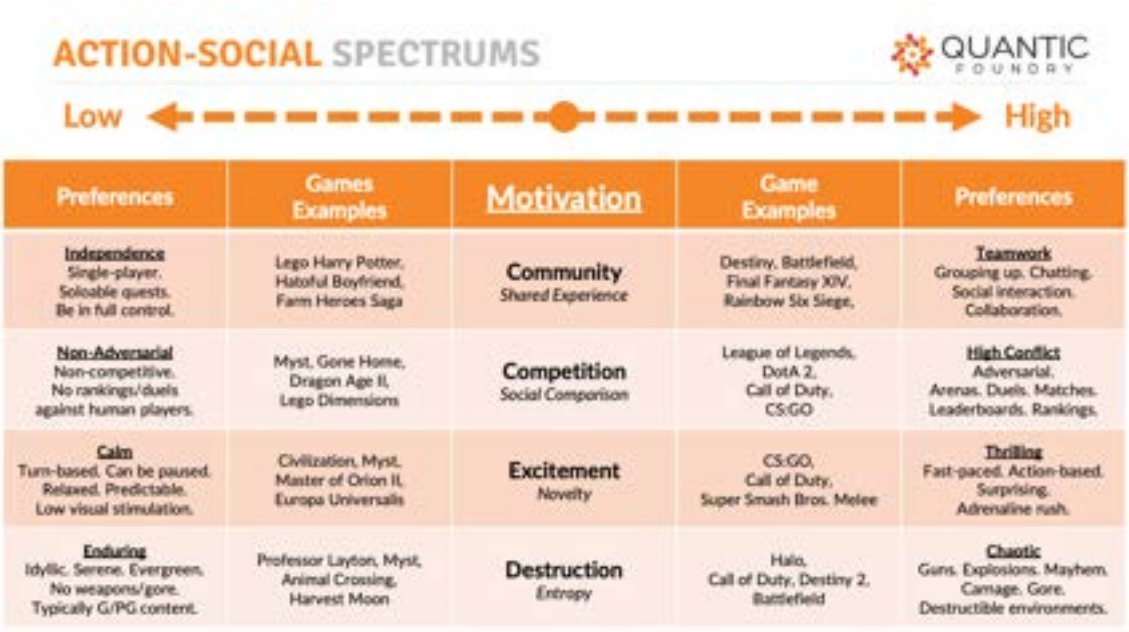

Figure 3.2: Image from [2]. Has the spectrums for the 4 core motivations in the "Action-Social" Cluster.

3.2.2 Deciding the unidirectional interaction between individual games and the shared game

Knowing what our core principals should be for each game, came another decision. How exactly would the interaction between the games occur?

Our main choices were regarding the time played, what the interaction between games would be and how that would affect the overall design.

Since the overall game structure would have a game affect another, we decided it was best for the games to be based upon the days being played, so that the effects could be felt across time. So, the game interactions could be designed around changing days.

Our Shared Gameplay Loops definition boils down to separate games with individual gameplay loops connected together in a central game module. These individual modules are highly asymmetric to show the plausibility of connecting vastly different games together. In other words, modular games connected together in a neutral game. By neutral we mean a game that has components of both, therefore, in theory, catering to both.

The main possibilities regarding interaction between games we considered had to focus on keeping the highly asymmetric Calm and Thrilling roles as separate as possible, so both of them interacting directly, would defeat the whole point of testing the validity of our shared gameplay loops concept, and was therefore not considered. All of the options we did considered involved only interactions between the shared gameplay loop game module and the asymmetric games. The first option was bidirectional interaction, where the shared module would be affected by an asymmetric role and it would then affect the asymmetric roles. However, since we decided on a game that involved playing for multiple days, if there was bidirectional interaction between the games, it could easily lead to a snowballing effect if what affected each game was carried over across days. Furthermore, it would be much more complex to implement and balance and was therefore not chosen. Then there was unidirectional interaction between roles, where the asymmetric roles would affect the shared game module. We chose this option.

Within this, there can still be multiple types of interactions, beneficial interactions between one players' asymmetric and shared module, negative interactions between the player and their opponent's shared module.

The negative interactions towards the opponent were favoured, due to them contributing to creating a sense of shared play, unlike the positive ones towards oneself, seen in 3.3.

Now with all of the motivations and the interaction decided upon, we choose exactly how the interactions between the asymmetric games and the shared game would affect it. Since the shared game had to have high conflict as a part of having Competitive elements, we choose to simply make it a competitive game, where one player is competing against the other. From there many concepts were thought of but as soon as deciding on making the shared game a tower defence style game, the idea of being able to send enemy units to the opponent clicked. That would be the main interaction.

The asymmetric games would have, within their own game loops, ways to send units to their

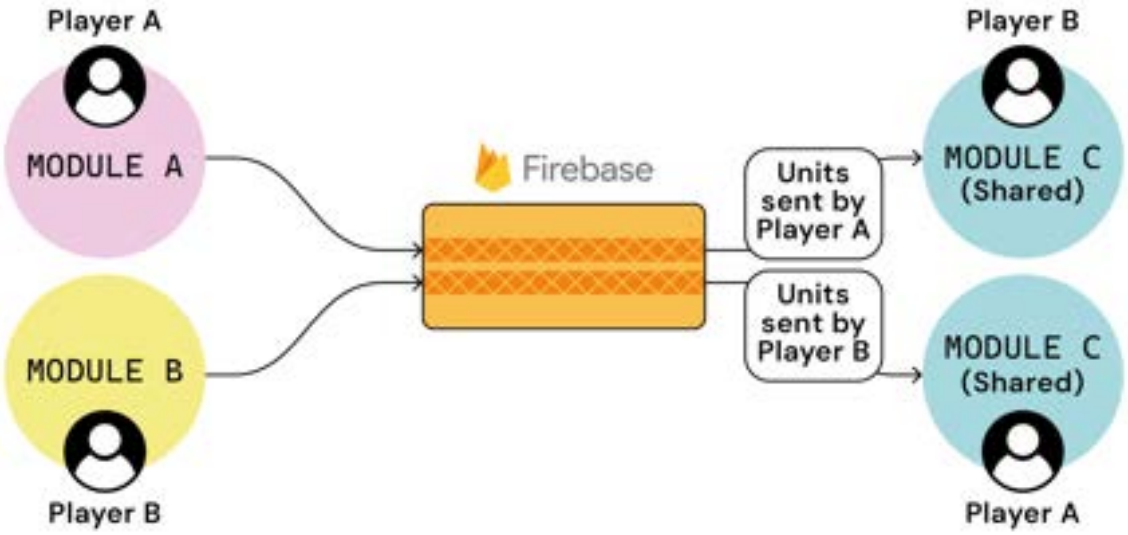

Figure 3.3: Our proposed interaction, where the units generated to the opposing.

opponent's tower defence, where one player would effectively be attacking the other. With the interaction thought of, the idea of having time matter made us decide to make it so a player's actions on a given day within one of the asymmetric games would affect the following day's shared game, the tower defence by sending additional units for their opposing player to defend against. This being the only interaction between games also made balancing significantly easier since we could always deal with set amounts of currency, a maximum number of enemy units to send and what we would later decide to be the baseline number of enemies for the shared tower defence game.

This main game interaction that directly affects the player's partner rather than the player itself makes it helps give a greater sense of the players playing together given that they weren't directly playing against one another. They were competing and having to deal with enemy units sent by the opponent, but what they actually played, meaning the maps they were on and who they fought additionally to their opponent's units was the same.

3.2.3 Conceptualising a Shared Gameplay Module

Our first step in creating a shared gameplay loop was to design a shared game module. This shared module, which we had already decided would be a tower defence game, had to have calm components and thrilling ones , alongside having high conflict.

The implemented concept involved a static map, which was different for each day. Each player would then play the same map for each day. Days no longer had wins or losses like was planned initially, but rather points and players had no health, but instead a damage taken counter, which had no limit. This point system was based upon having the most amount of currency at the end of the game and the least amount of damage taken. Initial damage dramatically reduced the possible points to balance the case of someone purposefully losing all of their first day money and only

spending it on upgrades to be stronger the following day.

Before reaching the current concept we had looked at doing something akin to a Clash Royale [69] style game with the theme being originally around types of kings attacking and defending their land, but these were dropped.

3.2.4 Conceptualising a Thrilling game (slasher)

The first of the individual modules developed was the thrilling role. The concept is going through tightly timed rooms with varying difficulties and trying to kill all enemies to win. Players can choose these difficulties within a hub. Originally, the concept was more of a dungeon crawler.

3.2.5 Conceptualising a Calm game (Planting and Gathering)

For the original concept regarding the calm role we had decided on a mix between a Minecraft [53] and Stardew Valley [20] style of game where a player could explore the world, gather resources and plant crops to “feed” units to send to their opponent. Players gather resources using tools to take care of plants and find ways to get seeds for more plants to then send them together as recipes in preset maps laid out maps (this was changed from the original open field maps which did end up being implemented, alongside the ”bed buildable” which would change the players spawn, but with the smaller map it wasn’t necessary).

3.3 Shared Gameplay Module

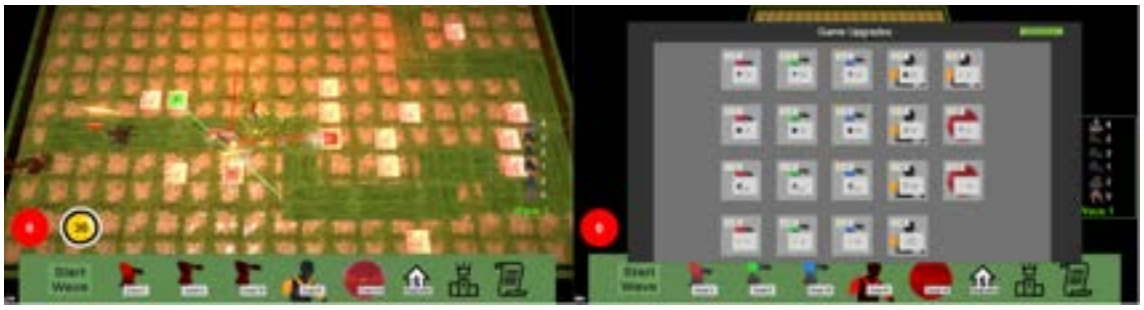

Figure 3.4: Tower Defense in the active fighting phase and the upgrades menu.

In the final concept, the winner was based on the total cumulative points across the multiple days. Each day had a set starting currency, where placing turrets and using abilities would spend them, and the only way to get them back was to gather coins that would spawn and float from dead enemies, with each of those giving the player coins back, as seen in 3.4. The daily points were shown in a leaderboard, alongside each player’s total, and in this way kept the high conflict component of the game.

The internal game now had to have two phases built into the waves, so it was chosen to have the following structure.

- **The calm strategy phase -** Before starting a wave, players could place turrets on specific map nodes, but as soon as the wave started, they could no longer add new turrets to their defences, until the current wave ended. Players could not replace or delete existing towers, so for each day their choices are permanent. After each wave additional placement nodes would appear for the player giving more placement choices and unpredictability to the overall game. Additionally now upgrades could also be bought during the game instead of after the day's game had finished. Now they only included attribute changes for the turrets and the active abilities, which will be discussed in detail later on. The upgrade menu also was later decided to be available in the thrilling phase, but due to it taking up the whole screen and the thrilling phase requiring attention to play, it was a big enough hindrance where it became apparent to players upgrades should be done before and not during a wave. This phase gave the player plenty of time to make their choices, with no time limit.

- **The thrilling active phase -** As soon as players pressed the wave start button units would start to pour out, with some seconds between one another, from the total unit pool, at random. These enemies encompass both a base set of enemies per wave per day, alongside the additional enemies sent by their opponent. In this phase, for each enemy killed, players had to focus on picking up the floating coins dropped by enemies before they disappeared (around 5 seconds), or else they would not be able to recuperate coins. Since they couldn't change or add turrets, active abilities were added to be used specifically within the path the enemy units would follow, the warrior and bomb spell. Both of these require careful placement to be effective and are significantly more costly than turrets. Their full details will be given later on. Any enemies that reach the end of the path damage the player by a set amount. This phase gave the player limited time to make their choices and to react to the incoming enemies, making it the opposite of the calm phase. As soon as a wave was finished the calm phase would start again.

These two phases alongside the scoring fulfilled our design goals and made it so players were still able to play the game standalone without any units being sent by a player's opponent.

Regarding this role's own gameplay loop, it essentially goes like (turret placement/upgrades/defend wave/use abilities), and is repeated five times until a score is achieved. There is also a secondary loop regarding score. The score is based on the sum of all day's score, which takes into account coins at the end vs damage taken. Players have the choice, before the game ends, to spend coins on more upgrades, but this will lower the score, however it can give them advantage by having even more upgrades items the next day. This choice happens every day and is therefore considered a secondary loop of choosing to upgrade or saving and keeping the better score.

Summarising, the tower defence shared role has calm, thrilling and high competitiveness components in it, while managing to be an engaging individual game even if no units are sent by an opponent. The calm phase of preparation and upgrading and the thrilling challenge of defending enemies in real-time and picking up coins, seen in 3.4, which count towards their final daily score, which is kept on a leaderboard in direct competition with their opponent.

3.4 Designing a Thrilling game (slasher)

In the final version of the thrilling role, as stated before it was changed from having dungeons to being a faster-paced game inspired by Akane [51], which we called Slasher. In this game the hub was maintained, but instead of dungeons, maze-like rooms with different enemies and difficulties were created.

In the hub the player would be met with room entrances, each with a different difficulty and the units they would send if they succeeded. The player only has a sword and can hack and slash their way through the enemies within the rooms within a limited timer. If the timer ran out or the player was killed, they gained no units and if all enemies were killed the ones seen at the room entrance would be sent. This is a skilled based game with limited room entries, a total of 15, and failure will lead to not sending units. Due to the timer it keeps its intensity and through different room variations and enemy positions across each difficulty version of each room it was hard to memorise rooms and kept the gameplay fast paced and thrilling, as intended.

The Thrilling Role Main Loop is (choose room/enter room/kill all enemies within time limit without dying/send units). This is the most streamlined gameplay loop and does not explicitly have secondary gameplay loops.

Figure 3.5: Thrilling Role hub selection and gameplay inside a room.

In summary, the thrilling role has highly intense, timed, challenging rooms which have a choice of difficulty and stakes with harder rooms giving greater unit rewards at a higher risk with limited attempts, as seen in 3.5.

3.5 Designing a Calm game (Planting and Gathering)

In the final version, seen in 3.6, the core principles remained the same, (but the final product focused less on managing crops, which was initially more the concept), with planting and gathering individual plants that could be combined in recipes to “feed” their troops to be sent to their opponent. The name came from this main goal, Planting and Gathering.

This game would have in-game days with limited sets of actions. When the actions for an in-game day ended the player would be returned to their spawn in the same map. Within these set maps the players would have places to plant and gather plants, with a system of plant evolution

and thirst, resources to gather, and the craftables to then go to a delivery station area to create recipes and “feed” troops, meaning sending them to their opponent through the Firebase Realtime Database.

From the day and move system no rush to play the game existed, ensuring that the calmness was maintained in this game.

The Calm Role Main Loop is (gather/plant/care for plants/collect/send units through recipe). This game also has additional secondary loops that give it additional depth, these being the decisions on how they spend their resources on non-essential progression, convenience buildable gameobjects. Additionally the choice to get seeds from the transmat shop as an alternative avenue to getting specific seeds can also be considered a secondary gameplay loop.

Figure 3.6: Calm Role with a player planting a type H Plant.

Overall, the calm role has no time constraints, just being constrained by the total amount of actions a player can make. They can plan, explore, plant and gather to create recipes to add units, with harder to execute recipes leading to higher rewards, but with additional total move costs to execute from the plants required taking more resources to get.

3.6 Individual Game Loops connected and contextualising our game’s structure

It is important to reiterate why we chose to connect them via a database. Not only to have data easily shared between games, but also to keep the idea of fully separate games into practice with only a database to connect them. This way they are in a way, truly “modular” games, where one could play the game they want separately, whenever they want, how many times they want, and in

the process interact with others, and play a shared game when wanting to compete with others.

If we look at the interaction loop between games we can gather a (send units/defend opponent units) loop. Having all of the individual game loops, we can create a more in-depth daily gameplay loop comprising one of the individual games and the shared game respectively, as the following in an abridged way (send units in individual role/defend against units in the tower defence). In more detail, we could have the following loops:

- In the case of the player playing the calm role: (gather/plant/care for plants/collect/send units through recipe to opponent the following day/turret placement/upgrades/defend wave with additional units from opponent from the previous day/use abilities/score).
- In the case of the player playing the thrilling role: (choose room/enter room/kill all enemies within time limit without dying/send units to opponent the following day/turret placement/upgrades/defend wave with additional units from opponent from the previous day/use abilities/score)

3.7 Playtesting and Iteration

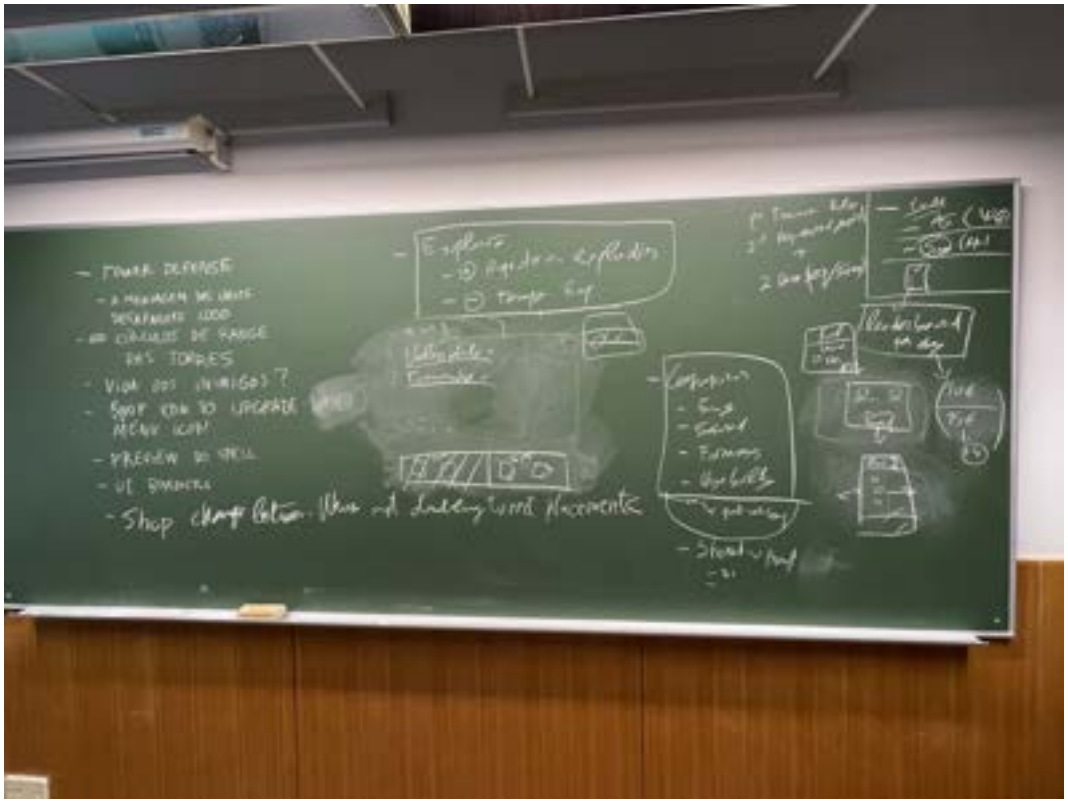

Figure 3.7: Board from a playtesting and feedback session.

The design process had many iterations and many playtesting and feedback sessions. 3.7 shows how a board tended to look after one of them. For each session, people tried out the game

builds, found flaws, new possible features, what was working and what wasn't in order to be change or to be balanced. The game development process was not straight-forward. Although a thorough conceptualization phase was done, after every implementation, problems kept arising from every build, leading to iteration on each games' features (for example, general map changes across the thrilling and calm roles or the plants in the calm role originally being able to die) and ballooning development time since many small bugs, UIs, assets and gameplay had to be changed or further developed many times over. The cycle of adapting feedback, implementing more features, cutting features that were creating trouble and finalising the game was intensive, but it led to three fully functional games with their own identities, distinct gameplay and features, which was the goal.

The main changes that came from these sessions were regarding game feel, balance, how to better the UI, and our decision to have the game be in a lab setting.

Additionally, regarding the daily system, its verification system had many changes throughout development, and had many verifications added, such as a game day timer changing amidst gameplay. The user study which will be later detailed ended up needing to be conducted in a single day.

3.8 How games are played, daily structure

Each role has the startup values from each role inside it, making the game less modular in actual execution compared to how it was originally intended and in the final user studies players ended up playing one of the games between the calm and thrilling ones.

As stated previously the actions of a player in a given day would affect their opponent in the following day when they played the shared game by making their experience harder due to having to deal with additional enemy units. The day system was designed and later implemented to feature 7 days, due to the original user study plans being for it to be that long. In the end the features, maps and variations between days were all done, but due to changes in the user study, the structure relying on real-life days was changed due to, in the end, needing to be encompassed within a single play session.

Originally the pairs of players would always play asymmetric roles and you would be choosing your role prior and associating it with your user, making it so you can only ever play the same role. And it would always be different for each player. However, then it was later required for players to maybe switch roles between days so this was changed as well as being able to play the same game against each other.

3.9 Overview of the final product

After all the iteration, prototyping and playtesting the final result were three individual games with two of them (the thrilling and calm games) connecting to the third game (the tower defence), played by both players separately, but where they are competing against one another, impacted

Figure 3.8: Our connected roles.

by one another's previous actions in the other game they each played, as seen in 3.8. These were all done in individual Unity projects and were different executables. There is one single interaction between the games, being the units sent. Each of the units sent systems were separate, but both allowed for the same amount of units to be sent to the opponent (30 in total) to keep the balance between the asymmetric game roles. These three roles are connected to Firebase's Realtime Database as their only way to communicate between one another.

Chapter 4

Implementation

In the following sections the whole process regarding the game structures, how they work, how they were implemented, what was implemented and how each component works is detailed.

Every game role is independent from each other. They may share visual similarities, but are fully functional individual game loops, which can be played separately and have no impact on each other whatsoever. As stated before, unidirectional interaction was chosen as a design choice. We chose to have two games, the thrilling game and the calm game to both interact and affect the shared game.

4.1 Core Tools

The choice to use Unity [1] over other game engines such as Godot [2] or Unreal [3] came from both ease of use, the many resources already available by the faculty to use in Unity, members associated directly and indirectly having Unity experience which could be drawn upon, as well as my direct experience using Unity previously.

Furthering the decision to use it was its easy integration with Firebase, a service that includes many helpful database features alongside an authentication service which were used.

The More Mountains Top Down Engine [4] asset helped expedite some important gameplay features between the three games, and served as a good starting point on developing top-down games.

4.2 Connecting Games

In this section we will discuss the game structure, beginning with the game links through a database, the games that were made, the database organisation in further structural detail, the iterative development process and the logging methods used. In the following sections we will delve into specific details regarding each game, its components, structure and gameplay.

[1](Unity, 20005)
[2](Godot, 2014)
[3](Unreal Engine 4, 2014)
[4](More Mountains Top Down Engine, 2018)

4.2.1 Day structure

After a player has completed the authentication process, they can enter a game. The three games share more or less the same day structure. The shared loop relies on a timestamp associated with the user registering to recognize the ongoing day and a partner code to know of a user's partner information to retrieve regarding gathering data from the opponent to identify which information it should use to influence its current session (e.g. troops sent to the shared role).

4.2.2 Login and Authentication across all games

Login and Authentication across all games was done in the same way, by relying on Firebase. Firebase authentication used emails, and attributed a partner code for each user. Once registering a user entry would also be inserted into Firebase Realtime Database, with the same data, as well as its register timestamp, and once a partner code was entered, that would also be added to the user entry and create a new entry for that user within that partner code. This partner code was what connected users between each other and was a separate branch from the users branch within the database (to see the big picture of the organization of the partner codes look at Appendix I). Login would also use Firebase Authentication and after load the corresponding data from Firebase Database.

4.2.3 Three separate games linked by one Realtime database

As stated before all games used the same database, and the data from each game role was independent from one another within Firebase. However, all info could be read by any game role (and in some cases had to be when generating new days and carrying over the shared module upgrades, as an example). Because they are independent each role can be played no matter if there are other players or not. If we wanted to now add a fourth role that influenced the tower defense also by just sending units, we would simply need it to send units in the same way as the database, and have the same shared day structure as the other roles.

4.2.4 Logs for each game

It was decided games should have logs of the players actions and results in a way to easily view those logs, according to the games player. These logs are situated within a users' own entry in the database.

Each log is in a timestamp of the exact moment it was sent to Firebase, with the fields pertaining to an action, a text field where what was done is explained, that actions' cost, alongside it's date in a different format, and any possible reward that may be associated with such an action. Specifically within the tower defence logs, some would also state the current currency for the player at that time. Check Appendix I for further details on the Firebase structure.

Logs have a parser that checked the info field and subdivided its contents into the action, cost and reward fields.

4.2.5 Firebase Realtime Database structure change in final builds

Even though all roles were meant for a session occurring during real days and the whole system was built around it, due to the previously mentioned constraints of the study it would have to be able to be played continuously in the same day. To do so, the initially used day search was changed to forcibly be a specific day, and builds were then created for a specific role for each day, meaning when that role was opened if it did not exist, that "forced" new day would be created. So in the end, for the study, multiple executables were used to simulate the various days, even though a fully fledged system exists for it to be a single game, which updates automatically when the in-game timer counting from the register timestamp goes over the 24 hour period, including cases where it does so in the middle of a play session. For the study the real day timer on the top bar of the screen present in all roles was also removed since this was no longer needed. Furthermore, since fewer days would be played, only one calm role game map and two shared tower defence game maps were used.

4.3 Development Resources

In terms of assets, for the shared game role, the assets for the original turrets, nodes, spell bomb, path and map items were done by me; in the calm role, the assets for the rocks, wood, trees, pond, ground zone, well, bed (not in the final build), all 6 different tools the player character uses were all made by me.

Across all game roles, some of the visual assets came directly from More Mountains Top Down Engine [5], namely the warrior character in the tower defence, the fully grown Plant A, from which all growth variations and differences for other plants were then created by me, and a standard health bar, from which mine were then created, for the calm role and the playable character for both the calm and thrilling roles.

For the shared role, some of the scene props, namely the ones which were meshes which were overlaid across the maps, the final enemy spawn zone statue came from a Unity Asset Pack [6], the enemy models from multiple sources [7][8][9][10], the updated turret look from another source [11], the icons from various sources [12][13][14][15][16].

For the calm role, some of the scene props, namely the ones which were combined to form the interactable locations, as well as the ship next to the player spawn came from the previously

[5](More Mountains Top Down Engine, 2018)
[6](3d-game-kit-props-pack-135218 from Unity Technologies, 2018)
[7](01-monster-rake-189460 from HATOGAME, 2021)
[8](01-monster-wolf-boss-189463 FROM HATOGAME, 2021)
[9](monster-4-low-poly-208684 from Dorlak_1989, 2021)
[10](Meshtint Polygonal Metalon from MESTINT STUDIOS, 2019)
[11](sci-fi-turrets-cannon-69615 from Vertex Studio, 2017)
[12](Leaderboard$_4489655 icon from Flaticon$, 2024)
[13](scroll$_4107910 icon from Freepik$, 2024)
[14](low-price$_1535927 icon from Flaticon$, 2024)
[15](damage$_7037179 icon from Flaticon$, 2024)
[16](bullet-4090062 icon from thenounproject.com/creator/dig1t/, 2024)

mentioned Unity Asset Pack, the icons from various sources [17][18][19][20][21][22].

For the thrilling role, some of the hub scene props, namely the hub items, and ground texture came from already mentioned Unity Asset Pack, the enemy models from one source [23], the hub upper corridor prop from another [24].

In order to fully immerse players, all games feature a looping soundtrack, each to intensify whatever feelings are intended with each role. In the shared tower defence game it is a fun ambiance music, in the calm role game, a minecraft-like ambiance music and for the thrilling role game an intense music to add to the already existing pressure. Additionally, all actions in every game have sound effects. Everything from picking up coins, turrets shooting, spawning bombs, deploying abilities and turrets, enemies dying, waves ending and starting, checking and hovering over UI items, to the ending screen in the shared game in the shared tower defence game; to chopping a tree, gathering resources, planting, watering and gathering a plant, a faint if a plant dries instead, buying seeds and sending recipes in the calm role game; to entering a room, slashing, dashing, running, hearing enemy fire, explosions and deaths, as well as your own alongside success or failure to beat rooms in the thrilling role game. The sound effects came from free sound libraries and directly from More Mountains Top Down Engine. As for similar UI, most pause menus, as well as the level select screen, were adapted also from More Mountains Top Down Engine.

4.4 Shared Module - Tower Defence

4.4.1 Game Structure - Area of Play, Overall Game Structure, Calm and Thrilling Phases

The shared game which all players play and compete against each other in is the tower defence game. In this game the goal is to have the highest score across a total of five waves. The score is calculated based upon the number of coins remaining at the end of the game and the damage taken. Taking no damage is highly beneficial and vastly improves scores, but after a few enemy units damage a player's score will become most dependent on the player's remaining coins. Coins are the single active currency in this game. Each time the tower defence is played, the player starts with 90 coins. The game has two main phases per wave, the calm passive planning phase and the thrilling active real-time action and reaction phase, which is shown in 4.1.

Before each wave, the enemies incoming in that wave can be seen on the right hand side of the screen. The calm phase is where the player can place turrets onto nodes, and these turrets cannot be deleted or replaced. When the wave starts this action becomes unavailable. Additionally,

[17] (bucket$_1$90544$iconfromFlaticon$, 2024)
[18] (gloves$_7$213936$iconfromFlaticon$, 2024)
[19] (harvest$_1$037193$iconfromFreepik$, 2024)
[20] (shovel$_5$826670$iconfromFreepik$, 2024)
[21] (watering-plants$_4$666848$iconfromFreepik$, 2024)
[22] (boots$_6$858763$iconfromFreepik$, 2024)
[23] (futuristic-soldier-scifi-character-202085 from AlexMakes3D, 2021)
[24] (sci-fi-styled-modular-pack-82913 from karboosx, 2017)

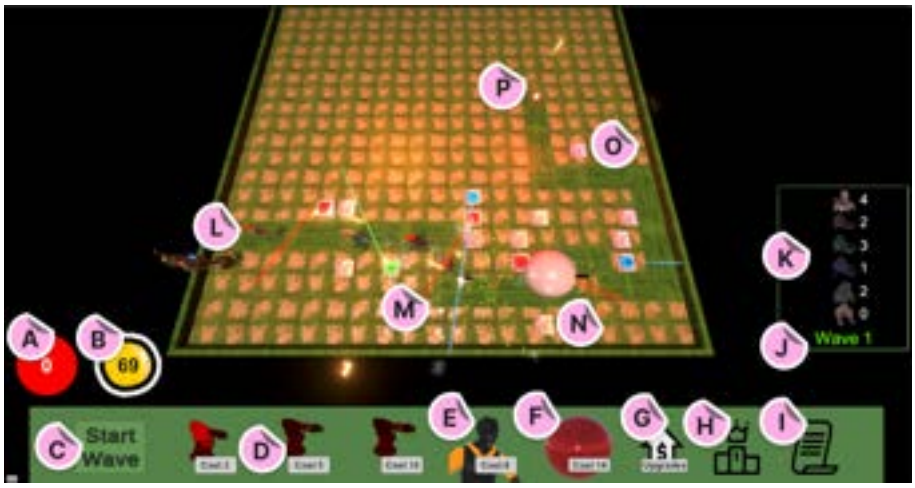

Figure 4.1: Tower Defense thrilling phase depicting an ongoing wave with the player about to use their spell bomb ability. A - damage taken counter; B - coins in the player inventory; C - start wave button; D - turret buttons, disabled and with a red tint since they can't be selected mid-wave; E - warrior select button; F - spell bomb select button; G - upgrade menu button; H - leaderboard button; I - enemies sent by opponent this wave panel button; J - current wave; K - enemies in this wave, according to type; L - enemy spawn point near the statue; M - turret line of sight, with size matching that turret type's current range, only appears inside the map; N - spell bomb has been selected and the player is hovering over the path with it, if they pressed down with the left mouse button, it will deploy the spell bomb; O - turret placement node; P - player's core

players can calmly go to their upgrade menu and choose what to invest into. These upgrades will update current assets as well as the next day's rounds. This menu can be accessed during a round, however with the ongoing aspects of the active phase it is extremely impractical and hinders gameplay. After choosing the turrets and placements according to incoming units on the wave, players can start the wave - this causes the turrets to become unselectable, and allows the player to use their two active abilities, the warrior and the spell bomb. If enemies manage to reach the end of the path and the player's core (the glowing red ball at the end of the path of each map) 10 damage is dealt to the player per enemy. All enemies do the same amount of damage. After a wave ends, a new set of nodes appear on the map in addition to the old ones, providing more places to place turrets, and more options to the player. To recuperate coins there is only one way. Killed enemies drop a hovering coin that comes upwards onto the screen for 5 seconds. If grabbed, 2 coins are added to the players' total coins, if not, no coins whatsoever are added. This was done in order to force players to be attentive and keep the gaming as thrilling and engaging as possible. After the five waves, the score is calculated and the scores are shown on a leaderboard alongside that of their opponent, for each day, as well as a cumulative total.

4.4.2 Player Gameplay and Inputs

The player can move the map around using WASD and the mouse wheel to zoom in and out for ease of placing turrets, abilities and grabbing coins.

4.4.3 Map Layouts

We built a different map for each day. Each map has a spawn zone with 3 hidden spawn points at one end of a path, then a path, which is different on every map, which at the end has the player's core. Enemies are generated at one end of the path and follow the shortest existing path between them and their objective. If killed, they generate the coins, this game's main and only currency. If the enemy units reach the end of the map and reach their pathing target goal, the player core, they deal 10 damage to the player and their gameobject is destroyed.

In the map development process two of the maps were conceptualised inside the game first, which ended up being the first and second day maps, which were the very first things developed across all three games. Some maps can be seen in 4.2, alongside an early build.

Figure 4.2: The first day map, second map early build and the sixth day map.

4.4.4 Enemy Types and differences

Enemy AI follows More Mountain's Top Down Engine [25] AI Brain logic and has it to where they travel from their spawn with a set objective, being the player's core, going only through the path.

Figure 4.3: Enemy models: normal, red, green, bluish purple, warrior beast and spell.

There are six enemy types, shown in 4.3. They all vary in terms of health, speed, and what can kill them, but all do the same player damage if they reach their objective. The normal enemy can be killed from any source, the scarabs (red, green and bluish purple) from turrets (each turret targets two of these) and the spell bomb, the warrior beast enemy from the warrior and spell bomb and the spell enemy exclusively from the spell bomb.

4.4.5 Additional units gathered from opponent

If units have been sent by the opponent, at the beginning of every round a screen with the additional units can be seen as shown in 4.4.

[25] (More Mountains Top Down Engine, 2018)

Figure 4.4: Tower Defence pop-up menu with the additional units sent by the opponent for the current wave.

4.4.6 Turret and Ability Types

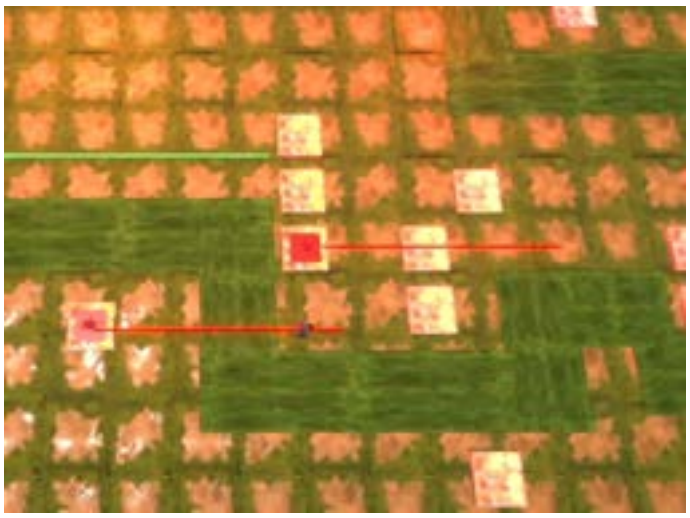

Figure 4.5: Turret in-game showcase of the visual range through a line of that matches and changes according to the current range value.

Turrets have different attributes (targets, range - which can be seen represented in a line of sight line in 4.5, damage, fire rate, and cost) and come in three different types. They are placed in any node available on the map and cannot obstruct the enemy unit path.

The active abilities work as follows:

Warrior, seen first in 4.6: A player can use warrior by choosing him from the bottom UI bar and placing him on the walking path of the map, which will spawn the warrior in the general vicinity of where it was selected, not exactly where the player pressed. The warrior will then act

independently based on their current targets and attributes, and disappear after their active timer is over. It is the only unit in the game which can be upgraded to have additional targets and multiple can be used simultaneously.

Spell Bomb, seen second in 4.6: Players select this ability the same way they select the warrior, however, an area of effect (AOE) object appears precisely where the players clicked on the path. It will stay there and insta kill whoever touches it as long as it is active then disappear. Multiple can be used sequentially.

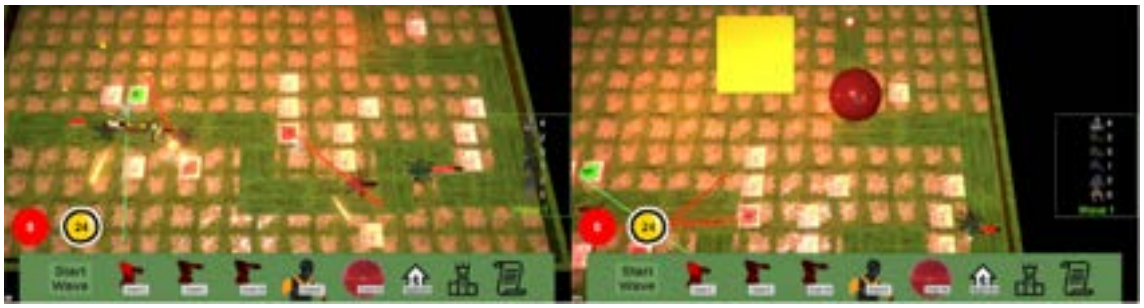

Figure 4.6: Active abilities - warrior and spell bomb in action.

4.4.7 Upgrades with carry over and their effects

The following attributes can be upgraded:

- For turrets - cost, range, damage, fire rate.
- For the warrior - cost, targets, speed, damage, duration.
- For the spell bomb - cost and active timer.

The values always update a set amount for each upgrade, but it is up to the player to try them out to know the amount. Players have no way to know how much upgrades will impact them, making them have to deliberate more on whether it might be worth it or not. Furthermore they all provide meaningful upgrades in order to allow for emergent strategies within each player.

4.4.8 UI in the Tower Defence game

As seen in 4.1, the UI layout has, on the right-side the total number of enemies incoming (K) this wave and of what types, as well as the current wave number (J). Then just above the bottom bar, on the left we see the damage taken bubble in red (A) and the current coins inside a giant coin icon (B). Every other item of interest to the player aside from the ones related to direct interaction with the ongoing game is in this bottom UI bar. Here is the start wave button (C), the turret and active ability buttons (D, E, F), with on-hover panels showcasing their attributes, seen in 4.7.

When turrets or active abilities are unavailable, becoming inactive abilities, they have a red tint in their image, which can be seen in 4.1. To the right of that is the upgrades menu button. Originally, the upgrade menu was a sideways scrollable menu that was always on screen, and

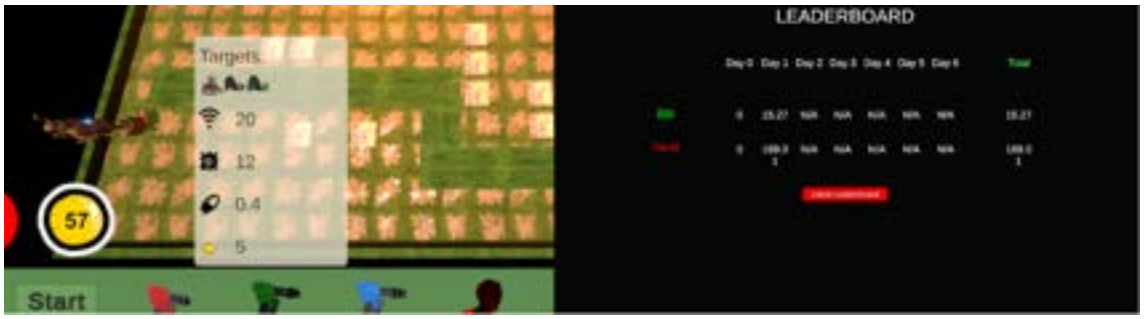

Figure 4.7: Tower Defense on-hover panel from the selectable turrets and abilities and the leaderboard.

showed every upgrade. Then it was changed to show the upgrades pertaining to the last clicked turret/ability in the bottom UI bar, but that was ultimately changed in favour of a static upgrade menu as the one seen in 3.4. For each upgrade option we can see to what it belongs to, the icon of what it is referring to, the cost, and the current value of that stat/attribute, but not how much the upgrade will affect it. To buy an upgrade the player simply needs to press it. To the right of the upgrade bar is the leaderboard, which can be seen open in 4.7. This simple leaderboard shows the players names and their scores relating to the days they played, as well as total scores for each player, across a set of days. To the right of that is the final icon, the scroll icon, which just shows the pop-up menu that shows up at the beginning of every wave if additional enemies were sent by the opponent, as see in 4.4 If no enemies at all were sent the menu won't ever appear, and this is a way to look at it, although it will just state the "player's opponent sent no additional enemies to fight him this wave".

4.5 Calm Role Game

4.5.1 Game Structure - Area of Play, Overall Game Structure

In the calm role game as soon as players log in they are spawned in a farmlike field next to a ship, as seen in 4.8. In here they can see trees, a lake, plottable land zones, rocks, plants scattered around, and two areas, a shop station called transmat shop and a delivery station.

Originally these maps were near endless and had randomly generated resources, interactables and plants scattered, but due to changes, they were later changed to be smaller maps with pre-set assets in them.

As shown in the top left corner of their screen in 4.8, players can see the current day they are on - the days go from 0 to 4, so a total of 5 days - with 25 possible moves for each day in C. This totals up to 125 total possible moves within a play session. After each day, a day end screen appears, and the player spawns back next to their ship, however, all current ongoing progression remains the same. Furthermore, above the movement UI, they can see a red bar, where any resources they use and their quantities will appear seen as A, and a green bar seen as B, where any resources or units they acquire and their quantity will appear.

Figure 4.8: The calm role. A - logs resources used/lost; B - logs resources gained/earned; C - in-game day count and move counter; D - buildables; E - tools; F - plant Buttons; G - seed inventory; H - collectible resources inventory; I - plants collected inventory; J - player spawn next to ship; K - ground zone for plants; L - plants; M - rocks; N - trees; O - water source; P - transmat shop; Q - delivery station.

Their goal is to create recipes from the delivery station to gather additional denizens to attack their opponent in the shared game.

Moves are spent resetting the available recipes, by collecting water, chopping wood, building wells or planting areas, planting plants and watering plants. Sending recipes out, buying seeds from the shop station, collecting rocks and wood and gathering plants do not cost moves.

The game loop consists of exploring the map, planting and gathering plants and resources to send in the delivery station and finding how to unlock seeds.

The player starts with just 3 seeds of one of the 3 basic types of seeds in the game - green, red and orange, seen on the top of their inventory bar, on the top right of the screen as shown in 4.8 as G. There is an additional seed type - white - which the player can only unlock by planting a specific type of plant.

4.5.2 UI in the Calm Role game

The UI was overhauled, from showing text to more visual images, in placement, colours, icons, as well as simplifying and reducing the size of UI items to be smaller. When referring to items in this paragraph I mean seeds, resources and plants. Following the UI detailed in 4.8, first on the top left the red bar shows items spent and moves used. The green bar shows items and/or units gained. Below that we have the day counter going from one to 4, the max move counter, always at what the max move counter is set at, which ended up being 25 moves. Finally the moves

remaining for that day. When a day ends a screen showing “the day has passed” and “a new day appears”. In the bottom UI seen in 4.8 the player can see first, the craftables “ground zone” and “well”, then the six existing tools, and finally the plants they can select, which on-hover, reveal a panel with their pertaining seed and collectable resource costs, similar to how it appears in the tower defence, seen in 4.7. On the right-hand side we see the inventory. First the seeds the player owns, then the collectable resources, and finally, any full grown plants. Then in the transmat shop, seen in 4.12, 4 trade deals for seeds are shown, where for one seed of a type, there is a seed and/or collectible resource cost attached to it. To purchase one, the player simply needs to click on the option decided and they will get the feedback of items spent, item gained and hear a sound effect. Finally in the delivery station UI seen in 4.12, the player can see three recipe cards, a reset cards button and an informational panel below that indicating enemy units already sent.

4.5.3 Map Layouts

Although, as stated previously there was only one map, with randomly generated trees, rocks, ponds, ground zones and plants scattered around, and back then instead of a delivery station the recipes were always available to choose from on the side of the UI, that needed to change. From then taking the same base and assets, 8 different maps with general layouts were sketched out and turned into full smaller maps, with different map positions, but essentially, the same overall resources between maps. To make them smaller, although they appear to be limitless, they do have invisible barriers, which the players can’t get past. Later, in the user study, only one of these maps was used, the one for the starting day. 4.9 has an envisioned map and its completed counterpart.

Figure 4.9: The original map with random placements of collectable resources and early UI, and the starting map.

4.5.4 Resource types

Seeds are what players use to plant plants in ground zones. Each plant costs a set amount of seeds of one or more types. The plants used in the harder recipes always include at least one plant that requires these.

Each time a plant is gathered, one of that type is added to the player inventory, as well as getting one or more of the seeds used to create it, with a chance at others included in its making.

For example, when planting a plant of type A, it costs green seeds. When gathering the completed plant, it will give one Plant A to the inventory, alongside 1 or more green seeds in return.

This way, players can keep planting more, the more they gather. This is also one of the ways they can get white seeds. If they gather one of the existing plants hidden in the map that contains one of these they will get it, or if they plant a "Plant G", which requires green, red and orange seeds, they will find out this plant also always rewards a white seed.

Aside from seeds players can also get collectable resources. Rocks, wood and water, shown on the right side of the screen in 4.8 as H. To gather these, the players must use their tools.

4.5.5 The tools of the trade

Tools are shown on the bottom bar of the screen between buildables and the plants they can plant as seen in 4.8 as E.

In order to get wood, players must first select the axe tool on the bottom UI bar as seen in 4.8, or by using "1" on their keyboard. Then they must click on a tree, seen as N in 4.8 at the cost of one move. Then, wood begins to float on the screen. Players must either press "4" on their keyboards or select the gloves from their tools UI and click on the wood, at no move cost, adding two wood to their resource inventory.

Rocks, seen as M in 4.8, which are only useful for the two craftables in the game seen in the bottom UI bar to the left as D in 4.8, the "ground zone" and the "well"; or in the resources shop, can be picked up by selecting the shovel from the UI, or by pressing "2" on the keyboard, gaining one rock, at no move cost.

Finally, water can be picked up in the same manner by pressing the bucket or "3" on the keyboard and clicking on a pond such as the one seen in 4.8 as O, adding one water to the collectible inventory, at one move cost. The watering canteen tool ("5") and the harvesting tool ("6") will be talked about later, when discussing plants.

Figure 4.10: The 6 tools, axe, shovel, bucket, gloves, canteen and harvester.

These tools, when selected appear on the playable avatar's hand as seen in 4.10. They were made in Unity with simple geometry to give visual representation to what the player had selected. Additionally while active, the mouse cursor also is changed to their respective icon.

4.5.6 Craftables

So what are the craftables? Well, they are additional optional items in the game. The "ground zone" allows you to place additional planting space wherever you like, and is identical to the ones shown in 4.8 as K; and the "well" allows for an additional water source, making it so you no longer have to go to the pond to gather water. These can be placed anywhere the player likes and as many of them as wanted can be placed. To use them, they must be selected from the bottom UI and placed where wanted on the map if the player has the resources needed for them.

Additionally, there was also a bed, which was later cut. The bed was removed since it simply changed the spawn location of the player to it after a day had passed. However, given the smaller final maps, it was no longer needed.

4.5.7 Plants and how they work

And what is water used for? Well, watering plants! Plants can appear in the map, or can be manually planted by selecting them from the bottom UI bar shown in 4.8 as F, which will generate a tracking sphere-like object of the gameobject's proportions, to be placed on a ground zone.

If placed anywhere else it is deselected and nothing happens. If placed correctly and without colliding with existing plants in the ground zone, a plant has successfully been planted.

Figure 4.11: Calm role plant from plantation, progression, full thirst, watering and the fully grown plant ready for harvesting.

As can be seen across 4.11, plants start off small, and have two bars. The top blue bar which indicates their thirst. It starts full and slowly drains. The bottom is the progress bar which starts empty and has two stages of growth - half grown and fully grown. The time between these is different for each plant, alongside the time it takes for them to dry from thirst. Some of the smaller plants can get almost fully grown before they need water, whereas others need water before they are even half grown.

Each progress step (new plant, half grown, fully grown) visually updates the plant growth as well as their bar.

If a plant dries, meaning its thirst bar is emptied, its current progress is halted and it starts back up from the beginning timer for that stage once its thirst is quenched (meaning it is watered). When the plant is in this state, the thirst bar disappears and a watering icon can be seen next to the plant's growth bar. This means if it dries and is half grown, the timer will only be the one for the final growth step and the plant will never go back to a previous progress step. Plants can be watered at any time, but if they are watered without drying, and with the right timing, most plants take 1 watering to fully grow. But if players are not careful, they can find themselves spending more water, and therefore more moves than needed to have a fully grown plant. To water the

plants, players must select the watering canteen tool, from the tool UI, or by pressing “5” on the keyboard, and then clicking on the desired plant to water it, which fully refills the thirst bar fully, at the cost of one move and one water from the resource inventory.

When a plant if fully grown, they simply have to use the harvesting tool from the UI, or use “6” on the keyboard and click the plant to gather it, its reward seeds, and the plant itself which goes into the plant inventory, seen at the bottom of the right bar of the UI in 4.8 as I, at no move cost. This does not cost moves so that in the final few moves players can try to complete as many recipes as possible with as little penalties as possible.

4.5.8 Transmat Shop and Delivery Station

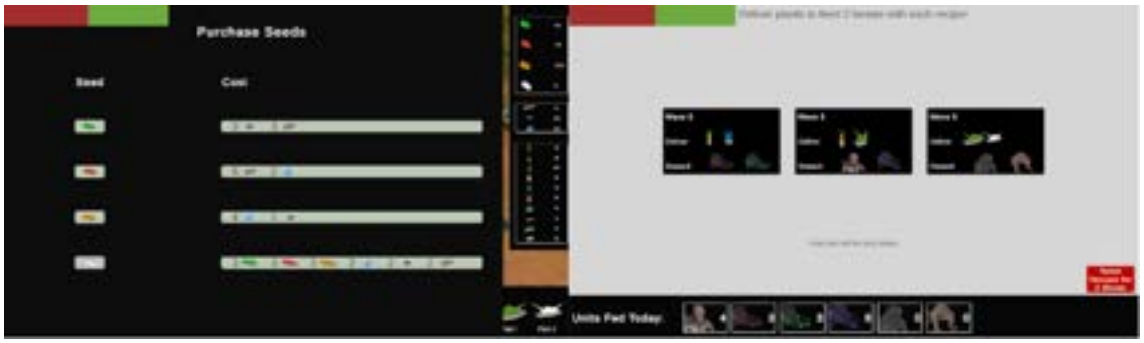

Figure 4.12: Transmat Shop and menu and the Delivery Station’s menu with the available recipes.

The transmat shop seen in 4.8 as P is one of the three ways players can unlock the white seeds. By going on the respective plate, players can trade a collection of certain seeds and collectable resources (wood, rocks, water) for one seed of the desired type in the first screen seen in 4.12. There is one listing for each of the basic seed types (green, red, orange), alongside a much higher cost white seed, which remains the most expensive.

The delivery station is also accessed by stepping on its respective plate, as seen in 4.8 as Q. This is where players can see three possible recipes and effectively send additional units to their opponent. In the delivery station screen seen in 4.12 that shows upon going inside the delivery station zone with the player avatar, recipes can be seen. These recipes, from left to right, require harder to gather plants, and with rewards varying from a pool of possible rewards. There are always two rewards per recipe card. Players can also see which wave those additional units will be sent to. If they do not like any of the available plants required/unit combos they can spend 2 moves and re-roll all of the available recipes and their costs. These recipes are generated for the first option between a pool of easier to get combo of plants and a chance at different variations of the easier types of units to deal with. The middle recipe increases the difficulty of the combo of plants, and features some of the same unit recipes from the left recipe, alongside some better unit combos, all chosen at random from a respective pool of choices. Finally, the right side recipe features the hardest to get plant combos and the best unit combos, both also chosen at random from a pool of possibilities.

Upon choosing a recipe the player will either get a message at the bottom saying they don't have enough resources or, if they do, the units will be sent, the three recipe options will reset and the player will see the additional units sent at the bottom of the delivery station menu. Here at the bottom, they can see the total amount of units they sent, as well as which they already sent specifically, in order to plan what to send next.

4.6 Thrilling Role Game

4.6.1 Game Structure - Hub, Rooms, Difficulty

In this game players are loaded into a hub scene with one training room and two possible rooms of differing difficulties can be chosen by the player by simply walking into one, as shown in 3.5. Rooms are generated on startup from a list of possibilities, depending on which a different scene will be selected. These contain difficulty, time and rewards. For each room type (easy, medium and hard) there are multiple room layout variations, and for each of these a range of time is randomly chosen for the card, alongside its possible rewards, also chosen according to the difficulty of the room. The rooms will always be two different difficulties, so there can be an easy and a medium, an easy and a hard or a hard and a medium. Additionally there is also a training room where there are the same main room layouts with other enemy positions for no costs to the player for them to train if they so wish.

In total, the player can go into 15 of the rooms that count, where upon each success 2 units will be added to the opponent, for a total of 30 possible additional units. The key difference between roles is the possibility of failure in a room which results in inability to send those additional units, where as in the calm role, although capped to the maximum number of total units to send and with a total move limit, if played correctly, the calm player can send all additional units by just considering what to plant carefully, where in the thrilling role it comes to what difficulty you choose and it you can complete it or not.

The rewards for each room is chosen at random when inside the hub scene based upon a pool of rewards based on the difficulty of that given room, so higher difficulties do provide stronger enemies as rewards.

4.6.2 Player Gameplay and Inputs

Gameplay wise, the player in this game uses only a melee sword weapon and it only hits in the direction the player faces. The players can move using WASD. They attack by using the left mouse trigger, using their sword. They can also dash by pressing "F" on the keyboard, and can hold down "SHIFT" to run faster with no loss of stamina, but it causes the players to be less accurate in general since they can still hit their sword while doing so but needing to be aimed in the correct direction. Compared to all other games, the thrilling role game was the fastest to get working due to being able to adapt a pre-existing scene from More Mountains Top Down Engine [26]

[26](More Mountains Top Down Engine, 2018)

that already had a working slashing sword. Maps, enemy types, following their AI Brain system, and the behaviour of the sword was altered, namely removing combo ability, changing the speed, area of effect, among others were all changed.

4.6.3 Map Layouts

In the final version there were 5 different square maze-like maps with one scene per difficulty.

Originally there were 4 map layouts (square, circle, triangle, X) and enemies were spawned randomly without colliding and inside the map zones based on the quantity in the room card, with that timer. Due to feedback on room layouts and pathing issues with spawned enemies the process was changed.

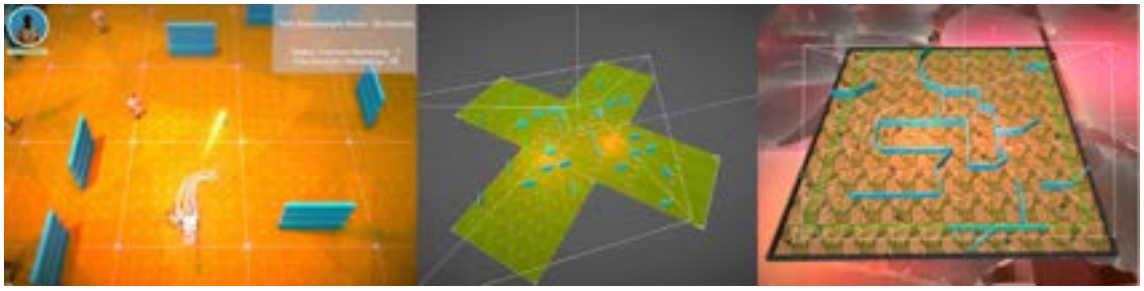

Figure 4.13: Thrilling Role early gameplay, one of the four original maps (X map), and one of the S room difficulties with its enemy placements.

For each scene for each layout and difficulty combo, there were different player spawn locations, the amount of enemy units was set and they were already in the scene. The easier scenes contain less of the shooting type enemies and more of the exploder type of enemies, the two existing enemy types in this game. One of these layouts is shown in 4.13.

4.6.4 UI in the Thrilling Role game

In the hub, the player can see the units they sent on the bottom and across him has the units they have the room options for the rooms, as shown in 4.14. In this specific picture they already spent all room attempts, so they can no longer enter the normal rooms, only the test rooms. In the rooms' UI, in the top left corner is the health bar, currently at one hit, after the player has taken two shots shown in the second image in 4.14. On the top right corner a panel can be seen with the bomber enemies remaining, in green (they are blue or green depending on if they are standing or patrolling in the final game, but to summarise them as exploders, only the green was used in the UI) accompanied by the number of those enemies remaining and the same for the shooter enemies, with their red suits displayed in the icon.

Additional screens of interest shown in 4.14 are namely the win and loss screen which detail the win condition, time spent in the room, enemies killed, coins spent and remaining, and on a win the units sent and on a loss nothing, along with the continue button whose text reads "send units" upon a win or "accept failure" on a loss.

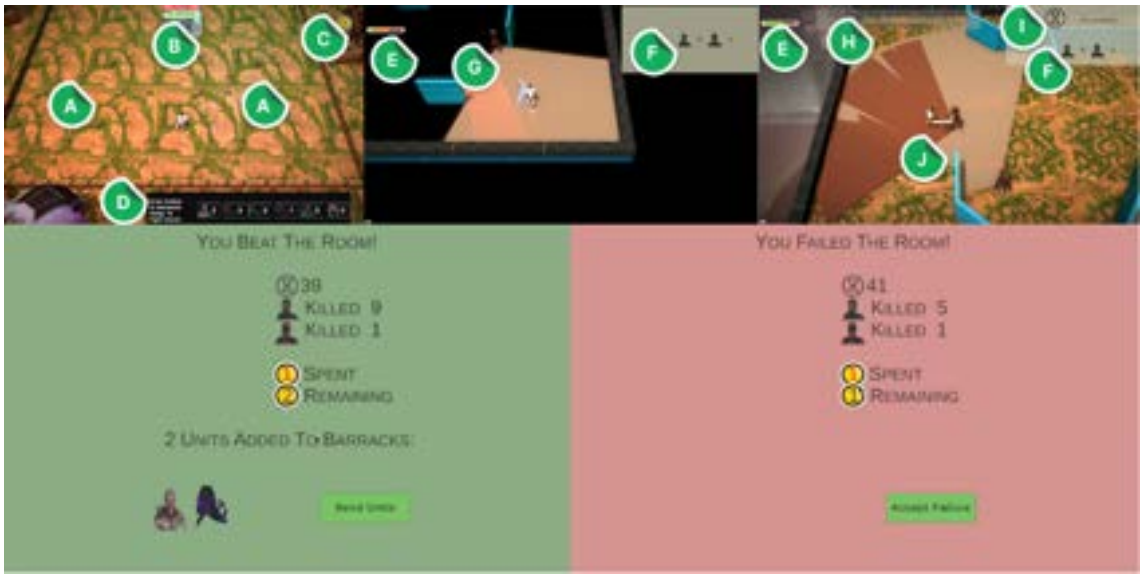

Figure 4.14: Hub UI, alongside the test room and normal rooms UI, the win screen and the loss screen. A - room entrances (disappeared in this scene since the player has no room attempts left); B - test Room Entrance; C - room attempt counter; D - units sent tab; E - player health; F - enemies remaining; G - shooter with direct line of sight to player; H - where the timer used to be in versions before the user study version; I - room timer (only in the non-test rooms); J - exploder enemy triggered (their skin turns to red like the shooters and so does their cone of vision before they explode).

4.6.5 Enemy Types and their AI

There is one type of shooter, who patrols a set path and only breaks it if they spot an enemy, where they will shoot him. If they loose sight of the player, they then go to its last known position and patrol the area trying to find him. If they do, they shoot and the cycle repeats.

Walking enemies have two varieties, those that stand waiting for a player to go into their line of sight (a larger cone of vision) and the movers which walk around with no preset path, avoiding obstacles, trying to spot an enemy (in their smaller cone of vision). In both varieties, if they do spot the player they chase him down. If they reach within a close distance they will stop and blow up within less than half a second. This explosion can be used by players to kill other enemies by luring them to that enemy before the explosion.

With medium and hard difficulties, more enemies existed in different placements in a room. In general timers are extended to allow just enough time to kill the additional enemies, but not too much in order to actually make them harder. In most rooms, the player either finishes it by the very last few seconds, dies to missing the last few enemies in the last second or dies somewhere in the run due to mistakes in gameplay.

The player takes 3 hits to die, and their health can be seen in the top left corner of the screen with the health bar. As shown in 4.15.

Every few seconds if the explosion created by an exploder enemy does one hit, meaning a single bomb can kill the player if they don't move. In 4.15, the player does move.

Figure 4.15: Sequence of an explosion occurring from a bomber enemy as well as a shooter enemy shooting their 3-shot burst.

Shooting enemies fire weapons in bursts of three shots with a few seconds in between, which can be observed in 4.15. Each bullet also does one hit. Therefore keeping a fast pace and need to focus and maintain the goal of keeping the game thrilling.

Chapter 5

User Study

5.1 Methodology

After the final prototype was built we looked at testing the game with people with different gaming preferences in terms of if they did indeed get to enjoy the game and the game fulfilled their social gaming needs.

To achieve this we used Quantic Foundry's player type questionnaire [2] to see each participant's player type before assigning them to a specific role in the game.

We decided to have two conditions where participants would play our prototype in a co-located setting not as a traditional comparative study, but as a way to compare the asymmetric game experience versus the traditional game experience (with both players experiencing the exact same game).

To measure if they enjoyed the shared play experience, we used the "mini Player Experience Inventory" [36] and the Social Presence module of the "Game Experience Questionnaire" [22] questionnaires. These serve to measure social presence [22], empathy, negative feelings, and behavioural engagement, to see if any social presence was felt between players [36].

We pondered alternatives such as the "Player Experience of Needs Satisfaction Survey" [46], the "Player Experience Inventory" [1], or the "Ubisoft Perceived Experience Questionnaire" [5], which measures things like individual player experiences of competence, autonomy, immersion, and intuitive controls, among others, but we did not find them to be needed.

Whether shared gameplay loops would be good to bring people who do not play games whatsoever was outside of our scope with this study.

In the following sections I will detail the work done during the user study, its protocol, the participants, the procedure, and the data gathered, from which the analysis will be made.

5.1.1 Research Goals

Our goal was to assess the viability of shared gameplay loops as an alternative to players playing games together according to their individual preferences rather than one game in which each player's preferences aren't taken into account. We aimed to answer the following questions:

- **(RQ1)** - What benefits and disadvantages do shared gameplay loops bring in comparison to traditional multiplayer games?
- **(RQ2)** - Do players feel they are playing together when playing?
  - More specifically to determine if the competition between players mattered, if players felt like they were playing together, against one another in the way they affect each other and if a shared gameplay loop succeeded in catering to different player needs and preferences, providing an engaging experience for both.

5.1.2 Participants

We did a test study session with two other participants a few days prior from which some changes were done, including interview questions and adapting the values for the thrilling and calm roles to make them faster to complete, and since this changed the end user experience, no data from this trial session was used. Then we conducted a qualitative study with 34 participants over the course of 7 and a half weeks.

Our requirement restrictions were for participants to play games regularly and be between 18 and 65 years of age. To reach volunteers, we relied on word of mouth and online posts.

From these we can observe our 34 participants were between 18 and 35 years of age, ranging from college students, to faculty members, to normal working people outside of the games industry and two of our participants being game developers for different companies. The participant' conditions, which will be detailed later, comprised 18 players in the first one and 16 participants for the second condition. In the first condition 9 players played the calm role and nine players the thrilling role, and in the second condition, 14 players played the thrilling role and 2 the calm role.

The average age between players was (M=23.89, SD=3.84), as can be seen in appendix E. The full tables with the information pertaining to the demographic and gaming habits questionnaire, alongside player's GMM [2] excitement %, role played, and times for each play session and interview can be found in the appendix, as appendix E, F and G.

In terms of how often people played 17 participants said “almost every day”, 12 “some times a week”, 3 “some times a month” and only 2 ”less than once a month”. As for how often people played multiplayer games with others, 10 participants said “almost every day”, 15 “some times a week”, 7 “some times a month” and only 2 ”less than once a month”. Regarding how long the participants' usual game sessions tended to be, 5 participants said “over four hours”, 15 “two to four hours”, 13 “one to two hours” and only 1 ”less than one hour”. As for what type of player people saw themselves as there were five options, “I don't usually play digital games”, “casual”, “between casual and hardcore”, “hardcore” and “I don't know”. From all of our responses not a single player responded “I don't usually play digital games” or “I don't know”. From all responses, 10 participants classified as ”casual”, 18 ”between casual and hardcore” and only 6 participants classified themselves as “hardcore”. These multiple data fields allow us to double check that all participants were indeed frequent gamers.

Regarding competitiveness, players were asked to grade themselves on a likert scale of 1 to 5, with 1 being “Not Competitive” and 5 “Competitive”. From these values we gathered (M=3.74, SD=0.96). The median and mode were 4. From all players, none selected 1, and only four selected 2. From this we can gather most players found themselves to be decently competitive.

As for partner familiarity, players were also asked to grade it in a 5 point likert scale going from “Stranger” to “Friend/Family”. Only four players chose 1 or two, which were our two pairs of strangers from the game sessions, meaning all others had some sort of existing relationship. Due to the small stranger sample, results for these are not meaningful to compare alone. There was only a player who chose a 3, with their partner choosing a 5 - we can see this being a perception issue with the question where between stranger and family, the participant saw him as in being in the middle, therefore being essentially a friend. All other participants chose 4 (11 participants) or 5 (18 participants), so we can assume those were already with good social bonds between them.

5.1.3 Defining the Study Conditions

With the participants recruited and their Gamer Motivation Model (GMM) [2] data available to be used to assign their roles to them. To address our research questions we decided on two conditions, split between players as equally as possible.

The first condition would take the GMM [2] excitement data, where a low percentage is closer to the calm end of the spectrum and a high percentage to the thrilling end, and use it for us to decide between players who to put in what individual role. This is the **forced asymmetric gameplay condition**.

The second condition would try to mirror the traditional game experience, with players having the choice between the calm or thrilling roles after being briefed and shown a gif of the gameplay. However, both participants had to choose the same game for both of them to play. This is the **choice-based symmetric gameplay condition**.

These two conditions allow us to see the participants’ different views of the experience based on the more traditional game experience vs the highly asymmetric shared gameplay loops we envision, allowing us to later on answer our first research question.

5.1.4 Procedure

Before the user pairs were matchmade, once we started having participants we sent applicants a registration form in which included a small briefing of the study and where they filled out a suggested partner if they already had one in mind, the standard study consent requirements, alongside the Quantic Foundry Gamer Motivation Model questionnaire [2], which would determine what player played what game between the thrilling and calm games based on their profile’s excitement percentage from the questionnaire - for the first of our two study conditions.

With our participants being recruited and being put into pairs and conditions, for each pair an in-person session was scheduled in a controlled lab setting, following the structure shown in figure 5.1. It is important to note that for the people in the asymmetric condition it was based on

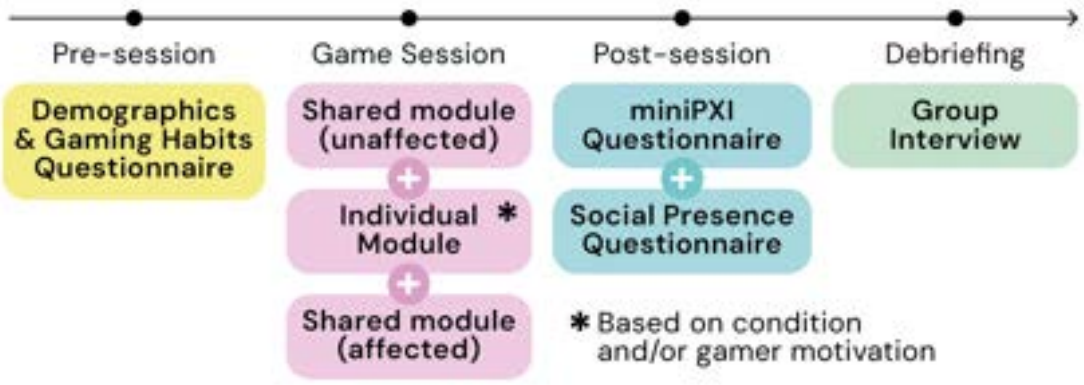

Figure 5.1: The user study protocol procedure.

comparison between participants. There were cases where one participant could be 93% on the excitement scale and another 90% - in this case the person with 90% would play the calm role, as can be seen in table 5.1 (the detailed information regarding participants can be found in appendix E). For each session we collected questionnaire data, logs during their gameplay, and conducted a semi-structured interview after everything else. The interview script is in the appendix as appendix D.

ID	Age	GF	Fm	Cnd	Exct	ID	Age	GF	Fm	Cnd	Exct	ID	Age	GF	Fm	Cnd	Exct
P1	30	D	3	A	96% (T)	P13	25	D	4	A	91% (T)	P25	24	W	5	S	45% (T)
P2	29	W	5	A	91% (C)	P14	21	D	4	A	29% (C)	P26	23	M	5	S	45% (T)
P3	27	D	4	S	72% (T)	P15	30	W	1	S	59% (T)	P27	23	D	5	A	73% (T)
P4	27	O	5	S	84% (T)	P16	35	O	2	S	29% (T)	P28	23	D	5	A	31% (C)
P5	25	W	4	A	18% (C)	P17	20	M	5	A	59% (C)	P29	23	M	5	S	5% (C)
P6	23	W	4	A	45% (T)	P18	18	W	5	A	91% (T)	P30	24	W	5	S	44% (C)
P7	21	D	4	S	84% (T)	P19	19	W	5	S	91% (T)	P31	22	D	1	A	5% (C)
P8	22	D	4	S	73% (T)	P20	19	W	5	S	96% (T)	P32	23	D	1	A	91% (T)
P9	19	D	5	A	92% (T)	P21	23	D	5	A	83% (T)	D1	29	W	5	A	10% (C)
P10	24	D	4	A	59% (C)	P22	26	D	4	A	73% (C)	D2	26	D	5	A	91% (T)
P11	19	D	4	S	11% (T)	P23	26	D	5	S	92% (T)						
P12	19	W	4	S	59% (T)	P24	25	W	5	S	85% (T)						

Table 5.1: Details about the participants, including identifier (ID); Age; Gaming frequency (GF): Ocasionally (O), Monthly (M), Weekly (W), Daily or almost (D); Pair Familiarity, from Strangers (1) to Family/Close friends (5); Condition: Asymmetric (A) or Symmetric (S); Excitement score (0%-100%) and individual module played, either Thrilling (T) or Calm (C).

Upon arrival we set up players with their peripherals, a pc, headset and mouse for each player. Then we asked the participants to fill out a questionnaire with questions mainly aimed at their gaming habits, the demographic and gaming habits questionnaire. This questionnaire can be seen in the appendix as appendix A.

Then the gameplay session started. The gameplay session consisted of simulating two days of playing in a specific role module alongside the shared module, with the players competing for the best total score across both.

In this first "day", participants were guided through and taught the essential mechanics of the tower defence module in their first playthrough of it, without any additional units from their opponent there to affect them. Following that they played their individual role, being taught its essentials and how the units sent would affect their opponent. This guidance was given at the same time for the tower defence module, but for the individual role module it was done individually from one researcher to a participant at the same time. If players were in the first condition they went directly from the tower defence to their given role, but in the case of the second condition gameplay would halt and players would be given the choice between both roles, following a small description and visual aid on how each role worked. Finally, players would play the second "day" where they would just play the tower defence, now having been impacted by their partner's additional units. It is important to note that at any time, if players ended their game session on a particular role they were invited to watch the remainder of their partner's session.

After the gameplay session participants filled the "mini Player Experience Inventory" [36] and the Social Presence module of the "Game Experience Questionnaire" [22] questionnaires, giving insight on their feelings towards the game regarding psychological and behaviour involvement, and social presence regarding the game session. These can both be found in the appendix as appendix B and C.

To conclude the study session a semi-structured interview followed. In this interview we first asked questions pertaining to previous difficulties in playing with others due to disparate preferences and motivations, then asking questions about the experience they had with our game, delving into how their gameplay was affected by their opponent's actions and vice versa, how they perceived the experience (e.g., as one single game or multiple), and if they enjoyed it. Then we went on to further explain the game's structure as a shared gameplay loop and asked the participants questions about the concept, if they perceived the game session as a social experience, and how they could see this concept evolving in the future.

After ensuring the participant's safety and well being at the end, after having completed the study session each participant was given compensation for their time in the form of a 10€ gift voucher.

5.1.5 Analysis

After all the sessions were concluded, the audio from each interview was transcribed. The interview times ranged from anywhere between around 20 minutes on the lower end to 1 hour and 9 minutes on the higher end. Following that came a coding process going through all transcriptions to inform our findings and comprise them into themes, using Taguette [1]. This coding process was a mixed inductive and deductive coding process, following the steps outlined by Braune and Clarke [14, 15], where codes were created based on the research questions. The deductive codes were the ones based on the mechanics we created and the inductive ones were the ones that kept being added according to the answers given by participants. The list of codes can be found in the

[1] (Taguette, 2022)

appendix as Appendix H.

5.1.6 Limitations

For some sessions, one of the games crashed for one of the participants, but no progress was lost, but it may have caused an impact on the perceived experience for that player.

Aside from these, there was only a log bug with one player, but it did not affect the game for said player.

Finally, less of a limitation but a note, participants were forced to be asymmetric in the first condition, however multiple times this meant having to put participants who would both fit into the thrilling role or participants who would both fit into the calm role according to the GMM [2], but only one of them (the one with the highest/lower & of excitement) playing their supposed role.

5.2 Findings

Looking at the Social Presence module of the GEQ [22] and then the miniPXI [36], we can first look at feelings of social presence and overall enjoyment within the whole participants sample.

Overall, all participants found the experience enjoyable, something they expressed during the interview (g.g., emphasizing the experience was fun and felt novel). The average score across participants was between agreeing and strongly agreeing, with players in the second condition leaning more towards strongly agreeing (M=2.5625, SD=0.81), when compared to those in the first condition (M=2.(1), SD=0.83), with all eleven constructs having a positive average score, but with some lower scores in Mastery (M=1.1(6), SD=1.38) for condition 1 and (M=0.5, SD=1.93) for condition 2. Some constructs exceeded this value, namely clarity of goals, immersion (and to a lower extent curiosity and enjoyment) in the asymmetric condition, with averages somewhere in the ballpark between “agree” and “strongly agree”. For the symmetric condition only enjoyment was in between “agree” and “strongly agree”, however it was the closest of all constructs to “strongly agree”.

Results regarding the psychosocial constructs Meaning (MEA), Curiosity (CUR), Autonomy (AUT) were all around agreeing, and the same went for the functional construct Clarity of Goals (GR). Enjoyment (ENJ) was one of the most highly rated ones, being between agreeing and strongly agreeing, with players in the second condition leaning more towards strongly agreeing (M=2.5625, SD=0.81), when compared to those in the first condition (M=2.(1), SD=0.83). The functional construct Progress Feedback (PF) was closer to slightly agreeing in both conditions. In the psychosocial construct Immersion (IMM), and the functional constructs Challenge (CH) and Ease of Control (EC), the values differed slightly between conditions, but all remaining between slightly agreeing and agreeing. For the full tables with all values, split by construct types, please refer to the one in the appendix as appendix F.

From the Social Presence module of the GEQ [22], we can see each of the values for psychological involvement, empathy and negative feelings, alongside overall behavioural involvement. This table can be found in the appendix as appendix G. In this questionnaire 17 questions were

answered, with certain sets of questions corresponding to one of our metrics. For each question participants answered from a scale of 0 to 4 (0 not at all; 1 slightly; 2 moderately; 3 fairly; 4 extremely) regarding questions surrounding their feelings towards the other players. The average of each set of questions gave us a value for each field for each participant. Then we analysed the remaining data. Empathy was within the moderate to fairly range - (M=2.34, SD=0.73) for participants in condition 1 and (M=2.11, SD=0.95) for participants in condition 2. In terms of negative feelings these were lower, and trending between slight to moderate, but more towards moderate (M=1.8, SD=0.81) for participants in condition 1 and (M=1.8, SD=0.89) for participants in condition 2. In terms of behavioural involvement, it was again moderate for both conditions, however it seemed to be overall lower for the symmetric condition (M=1.75, SD=1.0) when compared with the asymmetric one (M=2.(1), SD=0.94).

5.2.1 Player Engagement and Enjoyment

Regarding the feedback provided, players understood the game interaction inside and between roles, but many would have liked more feedback regarding other player's actions and in real time. *"I felt I had that feedback, as I was farming the bugs, the quantity of mobs that were to be spawned on his side appeared. And I had the final score, in the leaderboard" - P10.* This was also seen in the data from the miniPXI [36] values.

In terms of their tastes being met, players put in the asymmetric condition stated they felt the role catered to them when they indeed had the GMM [2] excitement percentage in line with their own role (*"It was a bit more targeted to my liking, I played the games I liked the most, she played the games she liked the most, then we could participate in the same experience and influence each-other's game (...) it has a lot of potential" - D2*), but in the cases where both players had high excitement or low excitement, they often felt they would have liked to play the other game. In the symmetric conditions the sentiments were mostly the same.

Regarding engagement, people seemed to like the overall concept and particularly liked the aspect that made them explore the map/s in the thrilling and calm roles (*"one of the things that gave me the most joy was really walking and looking around the map, even not knowing it. The difficulty, the challenge, it increased (...) and it was one of the things that made me more focused on the game" - P4*).

As for enjoyment, even though most enjoyed the session, as seen from the miniPXI [36] data, it is mostly usual for a game to be enjoyable, so not much can be gathered from that. However, some felt that the games felt dis-juncted which made it less interesting, *"It ends up with minigames that are not as interesting as the general (core game)" - P17.*

Others also made their role choice (for the symmetric condition) based on what they perceived would be most fun for the short time they would be playing for (*"In this space of time I already knew it was going to be small, I maybe want something more thrilling to make me remember the experience" - P3*). This is likely one of the reasons why all except one group chose the thrilling role in this condition. Additionally, another reason may be people who tend to prefer the more

thrilling role will naturally try to push their preferences on others more.

5.2.2 Connecting Players with different constraints - Modular Game Design overcoming conflicting preferences

Perceived Player Barriers

The first and most direct barrier related to our research was some players finding different gameplay preferences being indeed a barrier to them playing with others. For example, *P7* stated *"Sometimes ... I like action games more and have friends who like strategy games more. It is ok for us to play, but it's not always my style"*. This shows us that they are a frustration among players, but may not be strong enough to block playing together.

More barriers were identified, namely how clashing expertise in skill can cause people not to play together at all. As *P25* stated *"Nobody plays chess with me anymore, because I play too well. Nobody plays Rocket League with me, because ... "*.

Other barriers included people who did not want to play with one another due to personal differences in how competitive they were or trying to play with older relatives who did not play games being a near-impossible task. The first of these two barriers had already been identified as a limitation in our model not catering to this barrier (in our case non-competitive people) and the second was outside of the scope of our game.

There were also time barriers identified, namely friends with different availability to play and playtimes affecting the ability for shared play. Looking at a quote from *D1*, *"To me it's not so much not playing a game I don't like, but it's more, keeping up with everybody, because then there's people who play more time than others"*. This exemplifies a problem present in a lot of games with very large and extensive progression, as well as common problem with many long-running live-service games where when people who have vastly different time commitments to a game, they end up having vastly different levels and abilities and it can become a chore for the more advanced player to play lower level content, or to have to carry their lower levelled partner through a specific activity, and on the other end the lower level player can feel like the higher level content is too hard or that they would have to invest much more time than they are willing to, to reach the progression of their partner.

Some participants did not find different play preferences and constraints as barriers. This opinion shared by multiple participants, can be boiled down to people who are friends already tending to have similar tastes and preferences, so their gaming choices are already aligned from the get-go, as *P2* mentioned *"Your friends are already chosen based on common tastes ... "*. Some others did not find it to be a barrier, but did say it affected their own or others' engagement with a game, as illustrated from *P13 "There are games I detest and play ... "*, and *P6 "There are days where ... I feel like playing a bit more and she's already had enough, in the case of my sister (...) I think she ends up being more fed up with the types of games I like, she stays less time playing"*.

The potential of Shared Gameplay Loops

Barriers mentioned were due to preferences, skill, time, devices and overall enjoyment of a game session. Our "shared gameplay loops" model helps players overcome these barriers by having the ability of being more inclusive than traditional games. Everyone recognized our model as being able to be much better at catering to different player preferences due to its inclusive design, as can be seen in what *P12* said *"I think the idea is quite good and captivates all the aspects of a gamer. There are people who like strategy games more, others speed run(ning games more). I think this combines all aspects that allow the player to have the best experience possible inside a single game"*.

Given that our game was asynchronous in implementation, it would also be a way to adapt to different play times between players, but few realised this, since in the way the user study was done they played at the same time, so their perception of synchronicity may have been skewed.

Staying on the topic of inclusivity in shared gameplay loops, there were other specificities found, namely how our game can be used for people of different expertise to play together, countering the skill barrier mentioned before, as *P1* observed *"You can be inclusive in people who really don't like one of the styles (of game) and those only play the other, and multiple people could play, or if they aren't that good in one (game), they can balance the not being so good and being better in the other and be able to affect another kind of player"*.

That encompassed most of the comments regarding our model's inclusivity, however one player, *P11*, compared our model to splitting tasks in already existing cooperative games into separate roles, comparing it to minecraft's many loops *"And me being that guy, I want to play a game, the rest of the people don't play. I could play one, another, another (game), and we would all be combining for the same goal. Minecraft is a bit like that. In Minecraft there are always three people, one builds the house, another goes mining and another kills monsters. It's the same game, but the roles are different"*. This can be seen as either a positive or negative but is a fair assessment of the individual roles. Further on that same player then stated that the modularity from our model had its advantages, namely the end goal being able to be done without having to do the other roles and by doing so being better than traditional games *"This approach is better. In Minecraft (...) it is impossible for a person to finish Minecraft without killing a monster. And here things are really separate. (...) This approach is better, even for people who really want to be calm. You can be sure that there will be no monsters. In Minecraft, they will attack and you will have to kill them"*.

In summary, some barriers do exist regarding traditional games, namely time devotion to games, time of play, difference of player expertise which can lead to people not playing with one another and people playing games they don't like being a barrier to enjoyment, but not necessarily making people stop playing with others. Our model addresses the time of play issues by being asynchronous and the overall inclusivity barriers by catering to different types of players, separating the game experiences in a modular way.

5.2.3 Factors of Shared Play

Overall, the general perceptions regarding sociality and social presence from players indicated most players understood how they were affecting their opponent and how they were being affected, however many did not find it to be as impactful as they had hoped, and stating most sociality was derived from them being co-located rather than directly from the game, mainly giving suggestions regarding a want to be able to see their opponent's screen or their physical presence in a shared environment not only to better feel like they are together in the game, but also to be able to adapt and react to their opponent's actions, or as some other participants noted, a want to have more agency in how they were affecting their opponents, rather than pre-set sets of two units per wave. *P3* was one of the several who mentioned this lack of opponent visuals, *"In this specific game I maybe wouldn't feel as much because (...) what you give us visually is single player, there wasn't anything I could see, that's [P4]. In the Board Game Arena I have my board, I scroll down, and can see others' plays and I can more or less understand why each player did what they did, because I have the visual interface to understand how the player minimally works because I know him"*. In other words, having modular split experiences tends to diminish the feeling of sociality.

Visibility of players action and Player Identity

Regarding the players actions, some main suggestions that became sociality factors were formed.

First, the want for visibility of the other player and their actions came in the form of being able to have a point of view of the opponent's screen inside their own game, either through an indented window or something of the kind. This was due to the fact that some players felt more alone when playing their individual roles since they were not directly playing together at that point, as *P4* pointed out *"When you are playing the slasher, you're basically playing alone, there isn't anything that is influencing the other player"*.

One of the main reasons participants wanted to see their opponents actions was to be able to act and react accordingly. Namely, the decision on what to send to their opponent could be informed on the performance of their opponent. Picture a player in the thrilling role having failed three hard difficulty rooms in a row observing their calm counterpart sending three recipes in a row. They may adapt their strategy and start focusing on lower difficulty rooms to start having far easier attempts to try to keep up with their opponent's performance. As an example, *P22* stated *"Being able to see his board state I could react to it. And on its own that would make it so ... I would react, and he (would too) in return"*.

Others stated they wanted to actually be physically sharing a game world within their games to have the experience be more social, which tends to be lower when players don't directly see one another virtually.

Players also wished to have more personal identity, through customization and agency, which as stated we will talk about later. *P3* illustrates this when talking about Dragon 's Dogma [19] pawn system, *"It's that thing of "I see him", because he is going to draw the character in his*

image". This system allows players to create a player companion in a single player game that will accompany their friend's own single player game. This companion will have the features and abilities based on the ones the player decides, and will be able to help their friends indirectly. For example, picture an activity in the game that player B beat in the game before A. If player A goes to do that activity with player B's pawn, the pawn will already have information on that activity and be able to provide hints on what to do, based on the amount of completion of that activity from player B.

Communication and Co-location

In terms of the participants' feelings and perceptions, most agreed it was a social experience, with almost every single participant acknowledging the importance of communication in order to have a social experience, however, most stated it came almost entirely from outside of the game rather than from in-game communication (*"I think that social aspect I felt more in the external part. (...) I think that part is what influenced me more in social terms" - P3*). The communication that was had in some cases, was mostly in the case of friends throwing quips at one another (*"I think it was social because of the setting, you put us together here at the table" - P29*).

Multiple participants who were friends also noted that their communication mostly came from them being friends and having fun with what they were playing than directly as a consequence of the game making them in some way need to talk to one another (*"It was social (...) because we have a good relationship" - P17*).

Additionally, some gave suggestions on how to improve the in-game communication with the solutions proposed being an in-game chat, emoji, preset message system or a voice chat.

As for the communication, it was stated that in the current prototype it obviously came from the co-location of the players and not the game (*"Because we were in the same space yes, but not during the game" - P15*), but that the chat systems suggested would solve this issue in an online remote setting.

Synchronicity

In terms of synchronicity nearly all participants agreed that for the most social impact the game would have to be a real time affair, with constant feedback on the opponent's actions, as *P15* illustrated *"Yes, knowing how the progress was. Between waves, how he is and how I am"*. This puts into question our model 's asynchronicity if we truly want to have the most social experience.

Having the related work in mind, this is not a surprise given many of our design choices such as our, more or less, full independence between players rather than interdependence, had already been shown to not be as effective in promoting social interaction between players [41, 24], and players being separated in in-game space and real-day time would logically only further this. This independence accompanied with the lack of in-game communication also goes for the previously

discussed lack of communication from inside the game.

One player did note however the main benefit of asynchronous gaming in our model as the ability to play like a turn-based game across time, *"A person leaves work, does his thing, the other person later at night, does theirs" - P5*.

Agency and Prominence of Player actions vs Scripted Interactions

Many players showed the want for more agency so they could feel more like they were fighting their opponent through their visual and gameplay representation, by being able to see their opponents perform actions that made their gameplay feel like their own and not the same between all players. This is related to the player's need to view their opponents. In other words, players expressed the wish to be more prominent in their actions, by having maybe specific types of units that could only enter their opponent's game if sent and that would never appear in standard gameplay. A common game example given by multiple participants was the Bloons Tower Defense franchise [56]. *"With (Bloons) Tower Defense Battle, (...) when in a blue balloons wave, (...) we can send pink ones to the other person, which are (the) next (wave), and don't appear normally (...), meaning, I have to prepare for the pink ones, which don't appear normally (...), meaning, I have to prepare for the pink ones even though I normally don0t need to prepare for the pink ones" - P32*.

Others suggested being able to have a more complex interaction between games with things such as performance bonuses for completing multiple rooms of a certain difficulty in the thrilling role or sets of a certain number of recipes in the calm role as a way to send either even more units or modifiers, where, for example, an opponents' tower would randomly be disabled for one of the waves.

Another mention, from *P7*, was for players to send the maps they were fighting on rather than units, which is funnily enough was similar to the original tower defence concept which started with the attacking of a player first on their map and then the defence on theirs, but with the player suggestion being just the defence on their map, with the map being the one chosen by their opponent.

Many also wished for this agency to be in the form of them being able to individually select what units from the ones they gathered would be sent to each of the opponent's waves (*"I thought we could control the order of the enemies leaving, maybe it could affect more" - P31*; *"If [25] had chosen which ones they were, there yeah, like, he would probably ... affect me (more)" - P26*), also creating more unpredictability in gameplay and giving an additional layer of strategy to the game since players could spread them out however they saw fit, flooding the player right from the get go with all its units in the first wave or just in the two last waves, or however else they decided.

All of the factors above mention suggestions to gameplay and overall game experience given by participants on how to make the experience a more social one.

The key takeaways from these are that the perceived impact was for the most part not enough

(*"In the beginning screen, (saying) that [P4] sent this (...). Only then did I maybe feel this, but in reality I didn't feel like he was obstructing me. I felt it was more like the tower defence but harder mode" - P3*), where players either did not feel they were sufficiently affected or were affected by enough to make the game experience feel too different, with seemingly the only major perception on affecting or not came from the leaderboard results. This suggests that in a follow up, more focus should be placed on having the interaction between roles be more impactful and fun rather than balanced.

In terms of the communication that happened was out of the game and not directly happening because of the game itself, with suggestions of in-game chats or voice chats being given. In order for this communication people felt that the game needed to be synchronous and that although in this experience the communication came from the players being co-located, in an online setting the in-game voice or text chat system would have been enough for them to have a similar experience.

Furthermore, although players did have a tab in the tower defence where they saw what units their opponent had sent, most felt this was not enough and needed to be complemented or added to in some way, with example given of players that came from the opponent doing slightly more damage or having more resistance or being different visually as to identify them as being the ones sent, *"They could have (...) a star saying, these were sent by him. (...) Or the others (sent by the opponent) doing more damage than normal enemies, they are special" - P1*.

Despite not being mentioned, one of the big asks from participants in this social context was for turning the shared gameplay loop example into a team game (*"You could have teams, each doing their thing, each had a role and played one. Being team-based each one could be a specialist in a type of game. Then you had the leader which would be the specialist in tower defence" - P1*), where there would be both cooperation and competition. Some players suggested doing different roles at the same time, others the same at the same time and others even suggesting for the actual shared loop to have an automatic resolution with no direct player input.

This team-based dynamic could in-fact help us better deal with players who aren't as competitive by nature and is an interesting topic to explore in the future. In a cooperative context, which can also be applied to a team-based context, another suggestion was for each role to affect the shared module in a different way (*"It can even not be the same resource, it could be something different. One could be raising troops and the other raising the resources the troops will need to stay in battle for X amount of time" - D1*), therefore changing the dynamics between players playing alongside one another.

Thinking of the prototype used, we can see how our prototype used to demonstrate our shared gameplay loops model, can be adapted to fit most of these criticisms that impact social gaming, with the addition of chats, a way to see the opponent, being able to more directly choose what to send to the opponent, and having those units be more easily identifiable as the ones sent by the opponent.

5.2.4 Reflections on Splitting Gameplay Loops affecting player's mental models of the experience

Mental Models

When giving direct feedback on our game, three separate mental models could be identified from participant answers of the interview. These were the following:

- **Viewing the game as one game**, with each role being a part of the same game. *"I'd say it was a game with steps. The final score is for everything, lile in the first phase of the tower defence and the second"- P20*;
- People who viewed the game as having **one main game and one minigame** - for the people who viewed it this way, there were different perceptions of which role was the main game and what was the minigame. *"One is a minigame and the other the main game. One is more to gather resources to then use in the main game" - P3*;
- Perceived **each role as a completely separate game**, but linked together. *"I also think I played two different games, the tower defence where I'm there killing bugs, then I'm sent to a farm, calmly doing my plants. I associated it to two different things" - P17.*

All of these different mental models can still be situated in the shared gameplay loops model, where, for the first mental model, players may have perceived it as a meta gameplay loop that builds on the individual game loop of each game, for the second mental model, as the individual gameplay loops directly linked to the "main" gameplay loop by having their main loop be based around it, and the third mental model being those who found the interaction between roles to be weak, and that the had little effect and carry over from one role to the other. Although a lot of participants perceived the games as separate, they also did acknowledge they were connected and described the model as an ecosystem (*"it's like an ecosystem of different games" - P9*).

Issues with our approach contributing to different mental models

There were two main issues described by players that may have led to the interpretations of what was played.

One issue is our **over reliance on the shared game module**, which can lead to it becoming a bottleneck for the whole approach, in the cases where people may like the individual roles but not the shared role, *"But as I'd said, the shared module would be the problem here" - P21.* On the other hand people also mentioned once again how our model had the main benefit of catering to different player preferences. *"That's the good part, you can play with your friends, you don't like shooters, you play another, you don't like farming (games) you play another" - P9.* Our model also makes people have to play different roles to interact, which some people may not want, with the bigger challenge being finding a shared module that appeals to everyone, *"The only thing I think is more difficult is finding a shared module that is appealing to everybody" - D2.*

Another is **asymmetric games being perceived as unbalanced and unfair**, because different mechanics and games can never truly be truly fully balanced. *"What can happen is like, if people see that game X gives more resources than the other game, everyone will play that game. Those as the main difficulties" - P23*. Additionally some felt the disparity of the calm role not having pressure vs the thrilling role as intrinsically being unbalanced, regardless of the move limit, *"there is that thing of balancing issues, how we make a thrilling, the same in balancing to a calm" - P19*.

Prototype and user study factors contributing to different mental models

Outside of these consequences there were also factors that could have influenced these mental models. For example, some participants felt like there was not much cohesion between roles due to their **theme**. Theming wise in one role you are an overlord defender and in the other you will either be a soldier or a farmer, which can be jarring. This was one of the major factors gathered from participants that should ensure cohesion between games, for example having all of the roles be more mediaeval themed or space themed to fit better together (*"In all (roles) everything being familiar, meaning, characters that appear in both games, have themes, art style and motifs that can connect the two games. (...) I think that would make it more ... interconnected" - D2*).

It was also pointed out that a hindrance our model will have to constantly overcome in regards to theming is how the more modules exist, the harder it will be to make them all make sense in the same theme and context, *"you need a good contextualization of the various modules in the shared module, it is quite complicated the more modules there are" - P22*.

Some also pointed out the difference in controls and gameplay itself between the games as making them feel more separate. *"It was really different in terms of ... even the way you interact with the game, and the controls" - D2*.

Out of all factors this would be the most hard to overcome directly given our goal was to have vastly different gaming experiences between the modules. However, maybe incorporating gameplay components from existing roles could help mitigate this, it would also massively restrict the design of the shared module the more roles added to it, *"if there are many things we have to do and choose, I think the game becomes more complex" - P32*.

Another factor was **aesthetic dissonance** for some players, where they felt the games were too dissimilar visually. The finalised games actually shared a lot of textures and assets, however, since the roles didn't have the same character between all of them, this was definitely a contributor in aggravating this dissonance for those who felt it. It is important to note only some players felt this way about the theme, aesthetics. And some mentioned a mix of both theming and aesthetics, *"if I had a player (character) shared between all modes, I would get more of the feeling that it is the same game, in a different environment" - P17*.

Some players also talked about the **time played** having an impact on this perception of a main game vs a minigame or separate games. In average the time played for the calm role in particular, 29.16(21) minutes, and thrilling role, 17.57 minutes, is far bigger when compared to the average

tower defence play time across two attempts, 13.86 minutes, which tended to be shorter. These differences surely played a factor in the user's perceptions of the roles.

Other shared gameplay loops envisioned by participants

Some players also took the chance to look to the future and gave suggestions of furthering the design space for them, with the most interesting idea received detailing the shared module itself not being playable (*"It would be a thing that would play on its own, we had the knowledge of the state (of the game). We would send the creatures and they would kill one another " - P21*), and being automatic akin to auto-chess, or be a shared goal in a similar way to Heldivers 2's [4] community goals, while believing it would remaining a social experience.

Others suggested having the roles intertwined more heavily, giving the following example for more frequent interaction back and forth between the tower defence and the thrilling game role, *"let's suppose there is a moment where I send the warrior (in the tower defence), it would make the transition to the slasher and give me the opportunity to destroy more enemies than the ones that were there (in the tower defence" - P3*.

Multiple players also gave several examples of existing modularity in commercial games with examples of separate games that attempt to connect to one another, with a specific feature such as trading with Pokemon Go [55] and the the mainline console games, limited time events between games or events that can be played in one game and unlock items in another, games that feature cross progression such as Call of Duty [44] with its main games and its free-to-play Warzone [45] mode and others (*"In Valorant and League of Legends two or three years ago there was an event in which you could unlock things in one game if you completed a mission in the other, and vice-versa" - P6*), games that are a sandbox having minigames inside it which are modular parts of a game such as Minecraft [53], games having gameplay aspects within an activity that rely on different sets of people completing different tasks together to advance such as raids in Lost Ark [67] and Destiny 2 [17], and games that have apps that allow for parts of games to be played outside of it, usually around management systems in games, such as the EA FIFA [27] games having an app [2] that allows players to play their ultimate team mode, where a player can open packs and build their squad outside of the game in the app if they choose to, but they can't play outside of it, or Metal Gear Solid V [48] and its base management.

5.2.5 Balancing feedback on Shared Gameplay Loops

As we have seen games with asymmetry were considered to be naturally unbalanced by many participants, therefore comes a need to solve this balancing challenge, but there isn't one answer on how to overcome this perception and barrier. Adding to this, if we look at what some players said, in terms of difficulty, engagement, balance and fairness, we can at least get some feedback directly on what we implemented, alongside some positive feedback as well, which just compounds many

[2](First EA FIFA Ultimate Team App, 2012)

of the aspects seen from the miniPXI's [36] results.

Delving further into balance and fairness, there were multiple instances of participants thinking the calm role had an advantage since there was no rush, even though it had a move limit. Aside from that most people simply emphasised that in any sort of commercial product balance and fairness would have to be achieved for it to be accepted, but most felt they would have to try out all roles to judge for themselves in how balanced they were (*"the keyword here would be fairness. But if there was another session I would want to swap so that he could also feel uncomfortable and we would play the same game, and if in the end the result was affected and in the end the person won, I'd be ok with it" - P3*).

Another mention was also how the shared module (tower defence) challenges may inherently be disadvantageous to someone who isn't as good at its components, and although that doesn't mean the game is unbalanced, it can lead to it feeling unfair, *"he focused a lot on upgrades, my shots always went to the side, his killed the characters in seconds. If the person is not good at organising their strategy, they end up losing a lot, at least in the tower defence" - P7.*

Regarding difficulty the consensus was a positive one, especially in the thrilling module, and how after a few attempts at the thrilling, the recipe loop in the calm role and the waves in the tower defence most features became apparent to players and weren't too hard to execute, *"the other one requires getting used to. Yeah, it was really hard in the beginning, but then I started getting good at it" - P1.*

Cleary there are aspects to improve upon, but it seemed the overall loops were easily understood, engaging and fun.

5.2.6 New affordances for individual players

We can also categorise the many benefits shared gameplay loops can have for each player as the following.

Greater **game variety**, allowing people to delve into different experiences based on their preferences at any given moment (*"Even if I never use the options, it is good to have the chance of like, ok, I can choose what I want to play in this day, in this moment" - P28*), given a robust SGL (Shared Gameplay Loops) model is implemented, and in this way also supporting individual needs across time. As a byproduct of this, the involving structure surrounding our model can also help **nurture interest in other game modules** due to them belonging to the SGL even for people **who would not consider playing some of them initially**, but giving them a try out of curiosity, *"and you have another advantage (...), which is . . . oh, I don't even like (...) this style of game. Oh, but it has this module, so let me try it out. And of course, I can realise that I actually like this style of game and then even explore more games of that style, that I wouldn't before" - D1.*

Greater **player retention** from the ability of having each person playing the same set of games more often, rather than diversifying their play time across multiple separate games to fill their needs (*"we never become bored with the game, when we don't wanna play one, we can go to the other and improve on the first one later" - P8*).

Fostering interest in other game roles included in the SGL by **allowing game roles to keep their relevance** by being an individual role playing a part in a connection with any given newer shared module they were implemented within. If these roles are older games, it can in a way, bring them back to the spotlight.

Allowing for an **ecosystem of multiple modules to be added over a course of time** (*"Captivate and launch new (game roles), so all the users can feel it is evolving" - P11*).

Allowing many people to play together at once, each in their own individual experience of their liking and skill level, and in this way **connecting multiple different gaming communities** (*"you can make the connection between communities and maybe there are even people in a certain game community that will like and try out that one" - D1*).

From these factors we can surmise there are indeed many benefits in games with the shared gameplay loops model.

5.2.7 Commercial Factors

Outside of the main findings there were also some discussions relating to bringing this game to the market. Although not our focus we will still share the main thoughts gathered from players and the two participating game developers.

One point that came up was the viability between adapting existing games vs creating new game roles from the ground up to support our shared gameplay loops model. The underlining conclusion was that it would depend on the company developing the game, but that both would be doable. If multiple separate games were made with the same engine it would be straightforward to, or by using a similar approach to ours using an external database it could also work (*"instead of having small modules, you have multiple completely fleshed out games that contribute also to the same approach, that would be interesting. And we would have multiple different player bases managing and interacting with one another" - D2*).

However, for companies who were looking for creating a long-running service, creating everything from the ground up seemed more of the right voice.

The main issues we would face in creating SGLs would be how to sell the idea to companies, since most tend to create a portfolio of multiple products with different target audiences. We would need to make our games be able to draw in different target audiences with each role, and a suggested approach was making the SGL be a party style game (*"Yeah, there are ways to make it happen ... There are those party games (...) Oftentime they launch new expansions that are different games, and from what I see, people tend to buy that (...) each game is independent from one another"" - D2*). We would also need to ensure companies the idea can be monetized. Another problem was then how to sell it to players, with people liking the idea of DLC packs with one or more shared modules, and multiple surrounding individual ones, however maintaining a need for balance.

People did not seem to like having individual roles sold, but some were tolerant of the idea of having additional shared modules be separate purchases given only people with the same share

modules could matchmake them. This would cause a haemorrhaging of the playerbase for the shared DLC modules, so it would have to be done with due diligence. The final problem pertained mostly for companies looking to do an SGL in a live-service format, since it would require a constant need for new content which may not be a sustaining practice.

The main benefits from our questionnaires were however, showing people would be open to DLC as an expansion method, providing both companies more ways to monetize (*"capitalising a bit more on games that are more dead and it could give them a bit more life and a bit more revenue (...) maybe (gaming companies) would be more open to hearing those ideas" - D2*) and players more experiences to play. People also mentioned they would be okay with monetization being around skins and cosmetics for the roles. However, for ease of entry some people suggested having a set of roles being free to play from the get-go and others suggested roles having trial periods of a few hours to a few days (*"That's why trials exist." - P24; "(...) That thing on steam, you buy a game (...), if you don't like it, in seven days you can refund it. You could have that" - P23*).

As mentioned before, shared gameplay loops have the potential to connect older, lesser played existing games and through a new shared module be able to bring new life to older game titles and increase retention across a company's game catalogue.

This could not only benefit companies looking to maintain older games, as well as giving existing players new reasons to play those older games and enticing new players to consider their purchase.

Chapter 6

Discussion

Our findings uncovered important insights into the use and design of modular and asymmetric games, particularly in enhancing inclusivity and fostering social connections. We now explore these findings aligned with our research questions.

6.1 The benefits of Shared Gameplay Loops (RQ1)

The key benefits identified by our participants were the following:

Inclusivity, choice and coming together. This is the main advantage of our SGL model, which we built the study on and was also recognized by the participants. Meaning that asymmetric experiences allow players to **take on roles that better suit their needs and preferences** and only engage with the content they want, **without being forced to fulfill roles they don't want**. Additionally, participants referenced how this can help join people with different genre, skills, and time of play preferences. Some also noted the benefit of **exploring new games and genres** outside the usual games played within a gaming group.

Discovery of tastes and others through role interactions. Participants mentioned how merging different gameplay across the different roles in a single game could encourage players to explore genres by being introduced to those they usually wouldn't try out through its connection between modules. This approach can increase player engagement by linking different games and player bases. Even more than thematic links between game franchises, modular multiplayer game could create **meaningful gameplay connections across genres**.

Promoting play through choice and variety. Asymmetric modular design games allows for diverse experiences within the same game, and lets players **switch between experiences and discover new content** based on their needs. Participants mentioned how having various modules could help sustain long-term play, regardless of the player's current mood or disposition.

Overall, the main benefits found from our shared gameplay loops model was the inclusivity it provided to players. It can serve as a way to bridge gaps between people, who in a given instance feel like they want to play something different. It caters to player needs across time. It can also garner interest across other games connected to it, which can, if wanted, be older games, and in this way also reigniting the playerbases of those older titles. Our concept can be a set or an

ever-evolving ecosystem for updating and adding games, and also, by doing so retaining more of a player's time given their ability for players to play what they want, while still being connected through a shared gameplay loop.

6.2 The drawbacks of Shared Gameplay Loops (RQ1)

Participants also noted multiple drawbacks with our modular approach.

Immersion interruptions. One of the players' main concerns was modular experiences having a loss of cohesion and immersion, especially without consistent shared elements, making it difficult for players to maintain a continuous sense of engagement when changing modules. Participants suggested several ways to maintain cohesion, including **shared elements**, a **consistent theme and/or narrative**, and **seamless transitions** between modules. However, this remains one of the biggest challenges of SGLs since it may compromise their uniqueness and ability to be separate (e.g., take for example an SGL incorporating 2D and 3D modules).

Perceived unbalanced asymmetric gameplay. Participants expressed perceiving asymmetric games as unfair and hard to balance taking into account the competition between modules with different mechanics and challenges.

Commercial constraints. There are also issues pertaining to how companies traditionally tend to make games to cater to a specific audience and they would **need to see a benefit in producing games connected through shared gameplay loops monetarily** compared to traditional individual experiences for it to be a viable option.

6.3 Catering to Players (RQ2)

Encompasing players. Although our calm and thrilling focus on the games do not fully encompass all gamers, we can argue that many more player motivations are encompassed in some way within our game. For example, the thrilling and tower defence games include some amount of Destruction through the shooting and explosions, and the calm the opposite, and in some form all game roles provide a certain level of Challenge, Completion, Strategy and Power - encompassing parts of all motivations from the "Mastery-Achievement" cluster of the GMM [2], alongside the calm role also having aspects of Discovery within itself. So we can understand why someone would say our games encompass all types of gamers, but in truth there are missing aspects regarding people who want a heavy focus on Community gaming through events and shared challenges where we only have the lower end of the spectrum featured, people who only want a focus on Strategy and nothing else, the ability for players to customise and express themselves within the game (Design Motivation) and both of the Immersion motivations were there in there form but barely and the case of the Fantasy motivation and fully absent when it came to the Story motivation. Since all motivations are spectrums to fully cater to all motivations we would have to have a game for each of the set of 12 core motivations with different percentage values to fully cater to everyone, in theory. However, some motivations are bigger than others so the focus on those instead does allow

us to cover a last amount of game players with less game types having to be made.

Players' sociality needs. Player's needs were met in some cases but not all, and this was due to our limited asymmetric modules. Participants' perspectives indicated that modular experiences can severely suffer from a **lack of shared awareness among players** leading to a reduced feeling of playing together. While our decisions intentionally minimized interaction, there is an inherent challenge in creating meaningful connections between modules while ensuring independent play, since being in different worlds and engaging in totally different challenges leaves players with even less frames of reference to connect over. Additionally, our approach does seem better when compared to two roles directly connected in terms of providing individual player experiences that can be adapted on a wide scale, however, if we were to have two asymmetric games directly connected with more interdependence between the games it would be a more social experience and be more enjoyable for the individual players in it.

Why catering to different player preferences matters. The individual roles also suffer from people who want to feel direct competition in every instance, which our model doesn't directly do. As players pointed out, friends who want to play together tend to already have similar player preferences, but they did see potential for games being modular and still connected from the simple fact that their motivations and in-the-moment game genre and type needs vary often and are at times different between players in a group, even if they do have similar motivations. This seems to point out that the goal of shared gameplay loops should be to join multiple different play together to allow people who already play together to play what they want, instead of trying to cater to people with different player needs overall playing together. To do this however, we would still need multiple asymmetric gaming modules that cater to different player motivations.

Design Factors for competitive social play. Aside from what our model did and didn't do there were also some factors we could gather regarding how to provide a meaningful competitive experience. One main ones are making sure the **experiences between players need to feel similar**, especially thematically. Participants noted that it was hard to feel connected when the experiences they were playing were so different, especially across the individual modules. Players should also should be able to see their opponent at any time even if different roles, in order to give the **sense of a shared world**. Participants also wish to **see each others' actions** to be able to figure out what their opponent is trying to do and be able to adapt their own reactions accordingly. Finally, participants showed a big desire for more **real-time interactions**, as the prototype's separation of sending and reacting phases led to a sense of disconnection. They believed immediate action and reaction would enhance the feeling of playing together.

6.4 Reflections on Shared Play (RQ2)

Sociality in our experiment. Our experiment was a fully social one, and the social parts it did have did not come from the game, but rather the environment in which players were in. To make the game more social we should employ some form of in-game communication and more interdependence between roles between players cooperating in a cooperative setting. The interactions

between the games should ensure they give the player the most amount of agency, have more than one type of interaction and, regardless of it being a competitive, cooperative or team-based game, have beneficial interactions to a player and their team and negative ones for their opponents.

Needed elements for shared play. Some participants preferred cooperative gameplay over competition. This suggests that for a modular experience to be truly flexible it should offer a variety of connections between roles, some competitive, some cooperative and others both. An interesting solution to explore is therefore team-based games, where we could theoretically join together people who favor only cooperation, with cooperative-only roles, those who favor competition with competitive-only roles and those who like both with roles affecting both their own team and their opponents'.

Chapter 7

Conclusion and Future Work

7.1 Conclusion

All in all, we can say there are clear benefits from shared gameplay loops all based around their capability for massive amounts of completely separate experiences, all in one, not only being great value to a player, but a way for companies to have an interconnected system between all of them. However, balancing, theming and the overdependence on the shared game role meeting multiple player needs are the biggest weaknesses of our model. They can, for the most part, be circumvented, by having multiple selectable shared modules and having adaptable themes according to the games played. The key issue remains balancing, which is still a problem, not necessarily because the games were not balanced in our case, but because asymmetric games seemed to be generally perceived as not balanced, and this notion only adds to the problem.

Players did feel like they were playing together, but this was seemingly mostly due to them being co-located and not the game. In terms of shared play it was acceptable in terms of being there and players understanding what they were doing, but feedback was unanimous that seeing the other player's actions and in turn, being able to react accordingly would be needed for a greater sense of actually playing together. The competition between them seemed superficial by many players since they never actually saw each other, which once again pertains to feedback on being able to see, act and react to other player's actions.

Overall, the shared gameplay loop presented did seem a plausible fit for player in the moment needs, and if many more modules were added, would be a robust enough game to allow for even more preferences to be met. It was overall engaging and enjoyable from players' responses and questionnaire data. Since players mentioned they tend to already have similar preferences as their friends, but oftentimes did have different types of games they wanted to play as a ground, our future focus should still be on having multiple different modules catering to different preferences, but not to bring players with different motivations together, but rather to improve the enjoyment from playing games with others while playing the game they actually want to play individually instead of being forced to compromise on one for all people in a gaming group.

We can then conclude that shared gameplay loops are a plausible way forward with games, but a focus must be kept on game variety, balance and fun, and perhaps less on competitive experi-

ences, not only to cater to a wider range of people but also to mitigate any potential toxicity-related issues, one of the biggest downside in social gaming. Alternatively we may want to look at team-based shared gameplay loops with asymmetric game modules as a possible way to cater to both players that want cooperation and those who want competition.

7.2 Future Work

Participants found game modules to have potential, so our focus should be on if having people who already play together who like different modules have a better experience doing so through shared gameplay loops versus a traditional multiplayer game. However, in whatever part of the game they should be able to have some way to see or feel like they are playing together with another. The interactions between roles need to be diverse enough to allow for player agency and expression.

We need to further understand the implications of of social play factors so a study comparing ame experiences between co-located games and a remote games, with players with different relationships, with and without communication of different types (voice chat, text chat, preset messaging, emojis, etc) by using games that focus on social experiences but are mechanically compact.

Additionally a study involving a team-based asymmetric shared gameplay loop could be interesting to cater to the most possible player motivations possible. As we had seen (Vella et al., 2016)'s [70] work on the differences between people playing together in a competitive, cooperative and mixed play (team-based) setting had shown that team-based was seen as "the most fun and the most satisfaction", so it may give credence to that idea being a solution in a social gaming context.

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Appendix A

Study Demographic and Gaming Habits Questionnaire

1. Name (first and last)
2. Email
3. Age
4. How often do you play digital games?
    (a) Less than once a month
    (b) Some times a month
    (c) Some times a week
    (d) Every day or almost
5. How often do you play digital games with other people (multiplayer)?
    (a) Less than once a month
    (b) Some times a month
    (c) Some times a week
    (d) Every day or almost
6. On average, how long are your gaming sessions?
    (a) Less than an hour
    (b) One to two hours
    (c) Two to four hours
    (d) More than four hours
7. ”I consider myself a ... player.”
    (a) Casual

(b) Between casual and hardcore

(c) Hardcore

(d) I don't play digital games

(e) I don't know

8. "I consider myself a ... person." (1 - non-competitive, 5 - competitive)

9. How well do you know your partner in this gaming session? (1 - stranger, 5 - friend/family)

Appendix B

Mini Player Experience Inventory (miniPXI) Questionnaire

1. Name (first and last)

2. Email

For each item, choose the option that better characterises the experience:							
	Strongly disagree	Disgree	Slightly disagree	Indiferent (Neither disagree, neither agree)	Slighlty agree	Agree	Strongly agree
1. Playing the game was meaningful to me							
2. I wanted to explore how the game evolved							
3. I felt I was good at playing this game							
4. I felt free to play the game in my own way							
5. I was fully focused on the game							
6. The game gave clear feedback on my progress towards the goals							
7. I liked the look and feel of the game							
8. The game was not too easy and not too hard to play							
9. It was easy to know how to perform actions in the game							
10. The goals of the game were clear to me							
11. I had a good time playing this game							

Appendix C

Social Presence Module of the Game Experience Questionnaire

1. Name (first and last)

2. Email

Please indicate how you felt while playing the game for each of the items, on the following scale:					
	Not at all	Slightly	Moderately	Fairly	Extremely
1. I empathized with the other(s)					
2. My actions depended on the other(s) actions					
3. The other's actions were dependent on my actions					
4. I felt connected to the other(s)					
5. The other(s) paid close attention to me					
6. I paid close attention to the other(s)					
7. I felt jealous about the other(s)					
8. I found it enjoyable to be with the other(s)					
9. When I was happy, the other(s) was(were) happy					
10. When the other(s) was(were) happy, I was happy					
11. I influenced the mood of the other(s)					
12. I was influenced by the other(s) moods					
13. I admired the other(s)					
14. What the other(s) did affected what I did					
15. What I did affected what the other(s) did					
16. I felt revengeful					
17. I felt schadenfreude (malicious delight)					

Appendix D

Interview Script

D.1 Standard Version

1. Questions regarding motivations, difficulties and restrictions of social games
   (a) Do you play with friends and family?
   (b) Do those people tend to play similar games to yours?
   (c) Inside you gaming groups, is it hard to find games which everyone is interested in?
   (d) Do you see that as a barrier to playing together? How do you overcome those barriers?
   (e) Do you end up playing regardless? If so, does it tend to be you not liking the game? If so, how do you feel playing something you don't necessarily like in order to play with others?
   (f) Do you keep playing after that session? Do you enjoy the experience as a whole? Would you play the same game again or would you prefer another?
2. Questions regarding general game experience (before explaining the shared gameplay loops concept)
   (a) Can you describe what you just played?
   (b) Did you play one game or several?
   (c) How did you feel in regards to the experience? (in general, and for each role)
   (d) Do you feel you impacted your opponent's game? In what way?
   (e) Do you feel impacted by your opponent's action? In what way?
   (f) What did you like about the game components? And what didn't you like?
   (g) In the game, how did you feel in relation to your opponent? In an advantageous position? In a disadvantageous one? Elaborate.
3. (Shared Gameplay Loops Descriptions with visual aid based on study condition)
4. Questions regarding opinions about Shared Gameplay Loops

(a) Do you games of this type/style?

(b) Knowing the structure and goals of this game, what do you have to say regarding the experiment?

(c) Did you enjoy playing this game with someone else? Do you think it was a social experience?

(d) How do you envision games like this in a collaborative/competitive environment?

(e) How do you envision these games with more people?

(f) What do you think of these games compared to traditional games?

(g) How do you envision this as a way to cater to different player needs and contexts?

(h) How do you see this format evolving?

(i) Do you like the game presented in this format?

D.2 Game Developer Variant Version

1. Questions regarding motivations, difficulties and restrictions of social games

   (a) Do you two play together?

   (b) What do you play?

   (c) Do your game preferences tend to align?

   (d) Can that be a barrier? How do you overcome that barrier?

   (e) With other groups whom do you play with?

   (f) Does it tend to be hard to find games in which everyone is interested in?

   (g) Do you play with the family, as an example?

   (h) Has it ever happened where it was you not liking the game?

2. Questions regarding general game experience (before explaining the shared gameplay loops concept)

   (a) Can you describe what you just played?

   (b) Did you play one game or multiple games?

   (c) Do you feel you impacted you opponent's game? in what way?

   (d) And did you feel impacted by your opponent's actions? In what way?

3. (Shared Gameplay Loops Descriptions with visual aid based on study condition)

4. Questions regarding opinions about Shared Gameplay Loops

   (a) By chance, if we introduced you to the game like this from the start, which module would you pick?

(b) Do you games of this type/style?

(c) Knowing the structure and goals of this game, what do you have to say regarding the experiment?

(d) How do you envision games like this in a collaborative/competitive environment?

(e) How do you envision these games with more people?

(f) Do you consider this model in designing games can have a future and use?

(g) Compared to other multiplayer games, what advantages and disadvantages would stick out to you?

(h) How do you see games in this format evolving? How could they be commercialized? How could these modules be presented and how would the game acquisition be?

(i) And if the modules were already existing games? For example, what if Riot now decided to create connections between games in their catalogue, like League of Legends, Team Fight Tactics or Valorant?

(j) Did you enjoy playing this game with someone else? Do you think it was a social experience?

(k) What do you think of these games compared to traditional games?

(l) Do you like the game presented in this format?

5. Questions regarding game development experience

(a) Can you describe your experience in game development a little bit? First, maybe ask if that experience is more at the design or implementation level.

(b) And do you have experience developing multiplayer games?

(c) Then, from your experience on the field, in what ways do you see it is needed for games to cater to different player preferences? And if there are concerns in the process? Challenges?

(d) Should shared gameplay loops be created from the ground up or as different games?

Appendix E

General User Data

Participant Number	**P1**	**P2**	**P3**	**P4**
Condition	1	1	2	2
Session Number	S1	S1	S2	S2
Individual Role Played	Thrilling	Calm	Thrilling	Thrilling
GMM Excitement % (less is calmer)	96%	91%	72%	84%
Age	30	29	27	27
Gaming Frequency	Every day or almost	Some times a week	Every day or almost	Less than once a month
Gaming Frequency with other people (multiplayer)	Every day or almost	Some times a week	Some times a week	Less than once a month
Average Play Session Time	Two to four hours	One to two hours	Two to four hours	One to two hours
Player Type	Hardcore	Hardcore	Casual	Casual
Personal Competitiveness Scale	5	5	3	3
Familiarity with session partner Scale	3	5	4	5
Tower Defense Part 1 Time Played	0:05:44	0:07:15	0:08:12	0:08:48
Individual Module Time Played	0:17:05	0:28:49	0:15:17	0:16:35
Tower Defense Part 2 Time Played	0:06:24	0:05:42	0:05:03	0:05:54
Total Play Session Time	0:29:13	0:41:46	0:28:32	0:31:17
Interview Time	36 min 52 sec	36 min 52 sec	1 hour 09 min 13 sec	1 hour 09 min 13 sec

Table E.1: Questionnaire Answers, Game Session Times and Interview Times Part 1

P5	P6	P7	P8
1	1	2	2
S3	S3	S4	S4
Calm	Thrilling	Thrilling	Thrilling
18%	45%	84%	73%
25	23	21	22
Some times a week	Some times a week	Every day or almost	Every day or almost
Some times a week	Some times a month	Some times a week	Every day or almost
Two to four hours	One to two hours	Two to four hours	Two to four hours
Between casual and hardcore	Between casual and hardcore	Between casual and hardcore	Between casual and hardcore
3	4	4	2
4	4	4	4
N/A	0:06:00	0:05:04	0:08:42
0:23:14	0:13:20	0:17:03	0:17:17
0:08:38	0:05:42	0:05:23	0:08:26
N/A	0:25:02	0:27:30	0:34:25
32 min 49 sec	32 min 49 sec	20 min 13 sec	20 min 13 sec

Table E.2: Questionnaire Answers, Game Session Times and Interview Times Part 2

P9	P10	P11	P12
1	1	2	2
S5	S5	S6	S6
Thrilling	Calm	Thrilling	Thrilling
92%	59%	11%	59%
19	24	19	19
Every day or almost	Every day or almost	Every day or almost	Some times a week
Every day or almost	Every day or almost	Every day or almost	Some times a week
Two to four hours	One to two hours	Two to four hours	Two to four hours
Between casual and hardcore	Between casual and hardcore	Between casual and hardcore	Casual
4	5	4	4
5	4	4	4
0:07:32	0:05:00	0:04:06	0:07:42
0:14:07	0:23:10	0:14:54	0:16:56
0:06:15	0:06:07	0:05:54	0:06:26
0:27:54	0:34:17	0:24:54	0:31:04
45 min 48 sec	45 min 48 sec	55 min 35 sec	55 min 35 sec

Table E.3: Questionnaire Answers, Game Session Times and Interview Times Part 3

P13	P14	P15	P16
1	1	2	2
S7	S7	S8	S8
Thrilling	Calm	Thrilling	Thrilling
91%	29%	59%	29%
25	21	30	35
Every day or almost	Every day or almost	Some times a week	Less than once a month
Every day or almost	Every day or almost	Some times a month	Less than once a month
Two to four hours	Two to four hours	Two to four hours	Less than an hour
Between casual and hardcore	Between casual and hardcore	Between casual and hardcore	Casual
4	3	5	3
4	4	1	2
0:06:41	0:07:10	0:07:13	0:09:31
0:28:14	0:27:41	0:16:38	0:19:52
0:06:49	0:05:28	0:12:21	0:13:00
0:41:44	0:40:19	0:36:12	0:42:23
26 min 30 sec	26 min 30 sec	38 min 00 sec	38 min 00 sec

Table E.4: Questionnaire Answers, Game Session Times and Interview Times Part 4

P17	P18	P19	P20
1	1	2	2
S9	S9	S10	S10
Calm	Thrilling	Thrilling	Thrilling
59%	91%	91%	96%
20	18	19	19
Some times a month	Some times a week	Some times a week	Some times a week
Some times a month	Some times a week	Some times a week	Some times a week
One to two hours	One to two hours	Two to four hours	More than four hours
Between casual and hardcore	Casual	Hardcore	Hardcore
3	4	4	5
5	5	5	5
0:06:36	0:06:03	0:04:48	0:06:18
0:26:30	0:14:55	0:23:02	0:16:24
0:05:30	0:08:06	0:04:40	0:09:17
0:38:36	0:29:04	0:32:30	0:31:59
42 min 58 sec	42 min 58 sec	1 h 09 min 14 sec	1 h 09 min 14 sec

Table E.5: Questionnaire Answers, Game Session Times and Interview Times Part 5

P21	P22	P23	P24
1	1	2	2
S11	S11	S12	S12
Thrilling	Calm	Thrilling	Thrilling
83%	73%	92%	85%
23	26	26	25
Every day or almost	Every day or almost	Every day or almost	Some times a week
Every day or almost	Some times a week	Every day or almost	Some times a week
More than four hours	Two to four hours	More than four hours	One to two hours
Between casual and hardcore	Between casual and hardcore	Hardcore	Casual
2	4	5	4
5	4	5	5
0:05:14	0:06:41	0:04:38	0:08:11
0:16:46	0:24:32	0:20:17	0:17:57
0:06:56	0:06:45	0:05:30	0:07:22
0:28:56	0:37:58	0:30:25	0:33:30
55 min 11 sec	55 min 11 sec	50 min 46 sec	50 min 46 sec

Table E.6: Questionnaire Answers, Game Session Times and Interview Times Part 6

P25	P26	P27	P28
2	2	1	1
S13	S13	S14	S14
Thrilling	Thrilling	Thrilling	Calm
45%	45%	73%	31%
24	23	23	23
Some times a week	Some times a month	Every day or almost	Every day or almost
Some times a week	Some times a month	Every day or almost	Some times a week
One to two hours	Two to four hours	One to two hours	One to two hours
Between casual and hardcore	Between casual and hardcore	Casual	Between casual and hardcore
5	4	4	2
5	5	5	5
0:05:51	0:07:58	0:13:17	0:08:16
0:15:42	0:15:30	0:23:41	0:25:29
0:06:40	0:07:47	0:08:33	0:06:36
0:28:13	0:31:15	0:45:31	0:40:21
52 min 44 sec	52 min 44 sec	42 min 13 sec	42 min 13 sec

Table E.7: Questionnaire Answers, Game Session Times and Interview Times Part 7

P29	**P30**	**P31**	**P32**
2	2	1	1
S15	S15	S16	S16
Calm	Calm	Calm	Thrilling
5%	44%	5%	91%
23	24	22	23
Some times a month	Some times a week	Every day or almost	Every day or almost
Some times a month	Some times a month	Some times a week	Some times a week
One to two hours	One to two hours	More than four hours	More than four hours
Casual	Casual	Between casual and hardcore	Hardcore
3	3	3	5
5	5	1	1
0:08:00	0:07:43	0:05:10	0:05:00
0:43:49	0:43:46	0:29:36	0:14:32
0:08:47	0:12:41	0:04:48	0:05:59
1:00:36	1:04:10	0:39:34	0:25:31
44 min 01 sec	44 min 01 sec	32 min 06 sec	32 min 06 sec

Table E.8: Questionnaire Answers, Game Session Times and Interview Times Part 8

D1	D2
1	1
GDS1	GDS1
Calm	Thrilling
10%	91%
29	26
Some times a week	Every day or almost
Some times a month	Some times a week
One to two hours	Two to four hours
Casual	Between casual and hardcore
2	4
5	5
0:05:11	0:04:20
0:24:11	0:18:26
0:05:14	0:05:43
0:34:36	0:28:29
1 hour 01 min 38 sec	1 hour 01 min 38 sec

Table E.9: Questionnaire Answers, Game Session Times and Interview Times Part 9

Values Obtained from the demographics and gaming habits questionnaire data		
	Average Value	**Standard Deviation**
Participant ages:	23.88	3.84
How often do you play digital games? Options: 0 Less than once a month; 1 Some times a month; 2 Some times a week; 3 Every day or almost	2.294	0.87
How often do you play digital games with other people (multiplayer)? Options: 0 Less than once a month; 1 Some times a month; 2 Some times a week; 3 Every day or almost)	1.97	0.86
On average, how long are your game sessions? Options: 0 Less than an hour; 1 One to two hours; 2 Two to four hours; 3 More than four hours	1.71	0.76
As a player I consider myself: Options: 0 I don't play digital games; 1 Casual; 2 Between casual and hardcore; 3 Hardcore; N/A I don't know	1.88	0.69
As a person I consider myself: Scale: Non-competitive 1 to 5 Competitive	3.74	0.96
How well do you know your partner in this game session? Scale: Stranger 1 to 5 Friend/Family	4.18	1.22

Table E.10: Questionnaires Metrics Table

Values Obtained from the times from the game logs		
	Average Value	**Standard Deviation**
Play Session Time	0:35:05	0:08:59
Tower Defense Part 1 Playtime	0:06:47	0:01:52
Tower Defense Part 2 Playtime	0:07:04	0:02:09
Tower Defence Summed Time	0:13:51	-
Individual Role Playtime	0:21:20	0:07:27
Thrilling Role Playtime	0:17:35	0:03:28
Calm Role Playtime	0:29:10	0:07:32
Interview Time	0:45:38	0:14:02

Table E.11: Game Session and Interview Time Values of Interest

Appendix F

miniPXI Values Tables

miniPXI - Meaning (MEA)		
Question	[Playing the game was meaningful to me]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	1.5	0.92
Condition 2 - Symmetric (16 participants, 2 strangers)	1.63	0.72
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.1: Psychosocial Construct Metric - Meaning (MEA)

miniPXI - Curiosity (CUR)		
Question	[I wanted to explore how the game evolved]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	2.2(7)	0.75
Condition 2 - Symmetric (16 participants, 2 strangers)	1.56	1.21
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.2: Psychosocial Construct Metric - Curiosity (CUR)

miniPXI - Mastery (MAS)		
Question	[I felt I was good at playing this game]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	1.1(6)	1.38
Condition 2 - Symmetric (16 participants, 2 strangers)	0.5	1.93
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.3: Psychosocial Construct Metric - Mastery (MAS)

miniPXI - Autonomy (AUT)		
Question	[I felt free to play the game in my own way]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	1.(6)	1.53
Condition 2 - Symmetric (16 participants, 2 strangers)	1.81	1.64
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.4: Psychosocial Construct Metric - Autonomy (AUT)

miniPXI - Immersion (IMM)		
Question	[I was fully focused on the game]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	2.(3)	0.84
Condition 2 - Symmetric (16 participants, 2 strangers)	1.75	1.06
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.5: Psychosocial Construct Metric - Immersion (IMM)

miniPXI - Progress Feedback (PF)		
Question	[The game gave clear feedback on my progress towards the goals]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	1.3(8)	1.2
Condition 2 - Symmetric (16 participants, 2 strangers)	1.06	1.48
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.6: Functional Construct Metric - Progress Feedback (PF)

miniPXI - Audiovisual Appeal (AA)		
Question	[I liked the look and feel of the game]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	1.0(5)	1.21
Condition 2 - Symmetric (16 participants, 2 strangers)	1.31	1.49
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.7: Functional Construct Metric - Audiovisual Appeal (AA)

miniPXI - Challenge (CH)		
Question	[The game was not too easy and not too hard to play]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	1.6(1)	1.2
Condition 2 - Symmetric (16 participants, 2 strangers)	1.13	1.63
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.8: Functional Construct Metric - Challenge (CH)

miniPXI - Ease of Control (EC)		
Question	[It was easy to know how to perform actions in the game]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	1.3(8)	1.33
Condition 2 - Symmetric (16 participants, 2 strangers)	1.75	0.77
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.9: Functional Construct Metric - Ease of Control (EC)

miniPXI - Clarity of Goals (GR)		
Question	[The goals of the game were clear to me]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	2.(4)	0.92
Condition 2 - Symmetric (16 participants, 2 strangers)	2	1.1
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.10: Functional Construct Metric - Clarity of Goals (GR)

miniPXI - Enjoyment (ENJ)		
Question	[I had a good time playing this game]	
Metrics	**Average**	**Standard Deviation**
Condition 1 - Asymmetric (18 participants, 2 strangers)	2.(1)	0.83
Condition 2 - Symmetric (16 participants, 2 strangers)	2.56	0.81
Scale: -3 Strongly disagree; -2 Disagree; -1 Slightly disagree; 0 Neither disagree, neither agree; +1 Slightly agree; +2 Agree; +3 Strongly agree		

Table F.11: Enjoyment Metric - Enjoyment (ENJ)

Appendix G

Social Presence Module of the GEQ Values Tables

Psychological Involvement - Empathy				
	Average Value	**Standard Deviation**	**Min. Value**	**Max. Value**
Condition 1 - Asymmetric (18 participants, 2 strangers)	2.34	0.73	0.(6)	3.(3)
Condition 2 - Symmetric (16 participants, 2 strangers)	2.11	0.95	0.5	3.8(3)
Scale: 0 not at all; 1 slightly; 2 moderately; 3 fairly; 4 extremely				

Table G.1: Social Presence Psychological Involvement – Empathy Table

Psychological Involvement - Negative Feelings				
	Average Value	**Standard Deviation**	**Min. Value**	**Max. Value**
Condition 1 - Asymmetric (18 participants, 2 strangers)	1.8	0.81	0.4	3.6
Condition 2 - Symmetric (16 participants, 2 strangers)	1.8	0.89	0.4	3.2
Scale: 0 not at all; 1 slightly; 2 moderately; 3 fairly; 4 extremely				

Table G.2: Social Presence Psychological Involvement – Negative Feelings Table

Behavioural Involvement				
	Average Value	**Standard Deviation**	**Min. Value**	**Max. Value**
Condition 1 - Asymmetric (18 participants, 2 strangers)	2.(1)	0.94	0.1(6)	3.(6)
Condition 2 - Symmetric (16 participants, 2 strangers)	1.75	1.0	0	3.5
Scale: 0 not at all; 1 slightly; 2 moderately; 3 fairly; 4 extremely				

Table G.3: Social Presence Behavioural Involvement Table

Appendix H

Mixed Inductive Deductive Codes

H.1 Deductive Codes

Codes used to create the game mechanics	
Code/Label	**Description**
1. (A)symmetry	Refers to asymmetry or symmetry and any comparison between them.
2. Benefits	Benefits of SGLs.
3. Drawbacks	Drawbacks of SGLs.
4. Perception of Sociality	How players percieve sociality.
5. Commercial viability factors	Refers to any commecial viability factors of an SGL.

H.2 Inductive Codes

Codes obtained from dialogue from the interviews Part 1	
Code/Label	**Description**
1. Assessing which module is preferred	Players specifying whether they feel they'd need to try out all the roles to decide which one to pick.
2. Barrier	Any barrier to play. Can refer to SGLs or traditional games.
2.1 Clash of expertise	A barrier referring to different levels of proficiency.
2.2 Clash of preferences	A barrier referring to diferent gameplay preferences.
2.2.1 Picky players	Players being too picky to enjoy the experience.
2.3 Competitiveness	A barrier referring to diferent competitiveness preferences.
2.4 Devices of play	A barrier referring to diferent device preferences.
2.5 Non-gamers	A barrier to playing with others who don't typically play games.
2.6 Playtime	Players still play despite differente preferences or have the same preferences as their gaming group(s).
2.7 Tastes/preferences not being a barrier	Players perceiving tastes not being a barrier to play together.
2.8 Time of Play	A barrier referring to people wanting to play at different times of day.
3. Benefits	Any mention of benefits of SGLs.
3.1 More content/More variety	Stating that SGLs can provide more content/variety than traditional games.
3.2 More inclusive	Stating that SGLs can be more inclusive than traditional games.
3.2.1 Balancing different expertises/skills	Stating that SGLs can be more inclusive regarding their way to connect people of multiple skill levels when compared to traditional games.
3.2.2 Balancing different play times	Players stating being able to play at different times through our current SGL structure.
3.3 Nurtures interest in other modules	Interest can be created that wasn't initially there in other modules.
3.4 Supporting individual needs across time	Stating that SGLs can be adaptaded to fit your "in the moment" gaming needs.
4. Commercial viability factors	Any mention that can be related to an SGL in a commercial setting.
4.1 Access to different target audiences in one game vs many	Comparing this model which tries to aim for different target audciences in one single experience versus the traditional method of a specific target audience for each game.
4.2 Adapting existing games vs creating new roles from the ground up for an SGL	Discussing strategies to adapt existing games and combine them into an SGL versus creating an SGL and its modules from the ground up.
4.3 Can increase player retention across a game catalogue	Conversation around how SGLs may promote players playing more games from a company, more often.
4.4 Future Applications of SGL	Mentions of future possibilities for SGLs.
4.5 Main issue to sell to companies is how to monetise	Discussion around the biggest hurdle to overcome in commercializing SGLs. Making them profitable.
4.5.1 Skins across modules	PLays referencing skins as a viable in-game purchase for SGLs.
4.6 Modules as DLC	Refering to how participants see the concept of modules as DLC.
4.7 Multiple People in a SGL	Suggestions or examples of how multiple people could play together in an SGL.
4.8 Need for endless new content	In a commercial settings, players that stated SGLs would need constant new content to be relevant in the long run.
4.9 Possibility to switch between modules	Players talking about how they would like to see module switches happen in practice/giving examples.
4.10 Refostering interest in old games	Discussing how SGLs can help revitalize older less-popular games by connecting them to newer popular games.

Codes obtained from dialogue from the interviews Part 2	
Code/Label	**Description**
5. Coop vs Competitive	When players compare SGLs as competitve vs cooperative games.
6. Drawbacks	Drawbacks of SGLs.
6.1 Balance issues	When participants refer to the potential balancing nightmare of having many roles.
6.2 Complexity	When participants refer to the game complexity of an SGL.
6.3 Forcing people to play different games	A drwaback of SGLs is making people play more than one game, which they may dislike.
6.4 Lack of depth	When participants mention that by having smaller modules, these modules might end up being too shallow.
6.5 Role Theme Differences	People debating how with somewhat different games the theme differences can be impactful.
6.6 Too reliant on everyone liking the shared module	With our SGL format the main module needs to be enjoyed by everyone.
7. Example of SGL	Any example that may be close to an SGL.
7.1 Different game modes	Specifying different game modes as an SGL.
8. Integration	Opinions on how the modules are/can be connected.
8.1 Aesthetic Dissonance/Harmony	Any mention of how aesthetics can affect the experience, positivelly or negativelly.
8.2 Common elements across modules	Mention of similar assets/narrative/location across modules.
8.3 Common goal	Feeling the games were connected enough due there being direct competition/goals.
8.4 Minigame vs main game	Players perceiving one part as the main game and the rest as the mini-game
8.5 Module interaction feedback	Feedback on how the roles connect.
8.5.1 UI	Specific UI feedback on how the roles connect.
8.6 Parts of the same game	Describing modules as part of the same game.
8.7 Playtime	Time dedicated to each module can impact the experience.
8.8 Separate games	Describing modules as separate games.
8.9 Shared module not being a game, but a goal/indirect gameplay	Whenever participants mention the idea of having a shared/conflicting goal or indirect gameplay instead of a shared module.
8.10 Theme	Feeling like there may/may not be cohesion between roles due to their theme. (e.g. both being medieval, instead of one a space adventure and one a medieval journey)
8.11 Transition between modules	Comments on how module transitions can/should be.
8.12 Unidirectional interaction	When participants refer to unidirectional interaction between modules.

Codes obtained from dialogue from the interviews Part 3	
Code/Label	**Description**
9. Perception	Anything regarding to how players perceived certain aspects of the actual experience they played.
9.1 Agency	Participants would like more choice regarding what they play. It can be in terms of choosing what to play or more control within an individual role.
9.2 Balance/Fairness	Mentions regarding balance and/or fairness on how the experience played out.
9.3 Competition	Mentions regarding competition on how the experience played out.
9.4 Confusion	Mentions regarding confusion on how the experience played out.
9.5 Difficulty	Mentions regarding difficulty on how the experience played out.
9.6 Engagement	Mentions regarding engagement on how the experience played out.
9.7 Frustration	Mentions regarding frustration on how the experience played out.
9.8 Sociality	Mentions regarding sociality on how the experience played out.
9.8.1 Impact of/on co-player	If the players mention they felt impacted/impacted the other player or not.
9.8.2 Sense of shared play	The players mentioning they did not feel like they were actually playing with someone else.
9.8.3 Solitary Individual modules	Players mentioning they felt like they were playing alone when playing individual modules.
10. Playing with family & friends	Description of their social play partners.
11. Sociality factors	Player mentions regarding social factors they experienced, felt were lacking or would like to see.
11.1 Action & Reaction	Would like to know the opponent's POV and strategy to adpat their own.
11.2 Communication	Would like to have other ways of communication. They feel it may affect sociality.
11.3 Performance	Seeing their opponent's performance may impact the sociality of the experience.
11.4 Player identity	Being able to identify each player based on their playstyle/choices/visuals.
11.5 Prominence	Having more drastic difference in what you can send when compared to the normal experience with that.
11.6 Remote vs co-located	Sociality coming from being together during the play session.
11.7 Sharing the virtual world	Being able to see eachother in-game.
11.8 Synchronicity	Being able to play at the same time/different times.
11.9 View of the other player	Being the other player's POV.
12. Suggestion	Various player suggestions, mostly a separate category, where mentions will be part of other categories as well.
12.1 Different Roles/Role Modifiers	Suggestions regarding new roles or changes to existing roles.
12.2 Game Role Interactions	Suggestions regarding how roles should interact.
12.2.1 Positive effects instead of only negative game role interactions	Suggestions on how interactions between games should have positive and negative effects.
12.3 Greater Perception of Sociality Suggestion	Suggestions regarding sociality factors or lack there of.

Appendix I

Firebase Structure Tables

<table>
<tr><td rowspan="6">”partnerCodes”</td><td rowspan="6">”INPUTTED PARTNER CODE”</td><td rowspan="4">”userID”
- there will only ever be one to two users inside a single partner code</td><td>”calmRole”</td></tr>
<tr><td>”enemiesToSendToDay”</td></tr>
<tr><td>”sgl”</td></tr>
<tr><td>”thrillingRole”</td></tr>
<tr><td colspan="2">...</td></tr>
<tr><td colspan="3">...</td></tr>
</table>

Table I.1: Table with the database paths for each role data and how they are stored inside a user within a partner code, alongside their partner.

<table>
<tr><td rowspan="11">”users”</td><td rowspan="11">”USER_ID”</td><td rowspan="10">”Logs”</td><td rowspan="8">”calmRole” or ”thrillingRole” depending on the role users played. If they played both, both will appear separately. Each log in these and in ”towerDefence” contains a list of ”TIMESTAMP_VALUES”</td><td rowspan="6">”TIMESTAMP_VALUE” corresponding to the timestamp the log was sent in. The log info is set as children of the timestamp they are on. Each one has the following fields:</td><td>”Action”</td></tr>
<tr><td>”Cost”</td></tr>
<tr><td>”Date”</td></tr>
<tr><td>”Reward”</td></tr>
<tr><td>...</td></tr>
<tr><td rowspan="3">”towerDefence”</td><td rowspan="2">Same ”TIMESTAMP_VALUE” as the logs for the others, but some logs have the additional field ”CurrentCoins”</td><td rowspan="2">...</td></tr>
<tr><td>...</td></tr>
<tr><td colspan="3">”email”</td></tr>
<tr><td colspan="3">”partnerCode”</td></tr>
<tr><td colspan="3">”registerTimestamp”</td></tr>
<tr><td colspan="3">”registerTimestampInDateTime”</td></tr>
<tr><td colspan="3">”username”</td></tr>
<tr><td colspan="5">...</td></tr>
</table>

Table I.2: Table with the database paths for each user data field inside “users” alongside the logs and their structure.