Modular Multiplayer: Segmenting Gameplay into Autonomous Modules to Enable Catered Multiplayer Experiences

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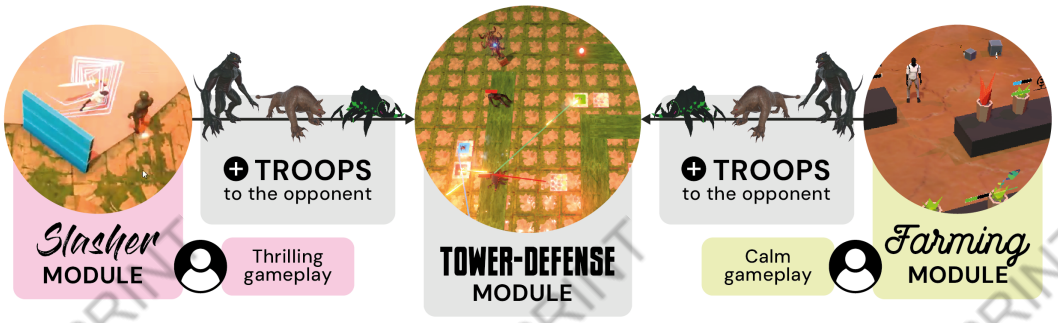

Fig. 1. Design structure of our modular game prototype. Two radically asymmetric gameplay modules (slasher and farming) offer players the choice to engage with their preferred playstyle (thrilling or calm). As players play these modules, they send additional enemy troops to a third module (tower-defense), where both players compete for the highest score by defending their base.

Groups who play digital games together often have mixed motivations and preferences. Still, personalization in these experiences is typically limited to minor gameplay choices, such as character abilities or equipment, built on top of a common mechanical base and aesthetic. In this work, we explore a modular game design approach that enables players to engage in fundamentally distinct, yet interconnected, gameplay loops, each tailored to unique play styles. We developed a proof-of-concept prototype and conducted a mixed-methods study with 32 gamers and two game developers to examine the benefits, limitations, and concerns around this type of design. Our findings suggest modular multiplayer games can be highly flexible to accommodate group and individual differences across time, but often at the cost of a cohesive shared experience. Despite this trade-off, participants identified promising opportunities, including broader audience reach and increased

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player retention. We outline key considerations for modular design, including strategies for preserving social connection and cohesive integration between modules.

CCS Concepts: • **Human-centered computing → Human computer interaction (HCI)**; **Empirical studies in HCI**.

Additional Key Words and Phrases: game design, inclusive gaming, modular design, multiplayer

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1 Introduction

Playing games with others is a common means of socializing, shown to strengthen existing relationships and foster social support for groups of friends and families [33, 64, 81, 93, 99, 101, 105]. However, prior work highlights that players within the same group often bring distinct needs and preferences to the experience [43, 76, 94, 102]. For example, a person may prefer thrilling experiences that reward them for rapid reaction times, while others favor a calmer play style that focuses on strategic decisions [102]—seldomly these co-exist in the same game. Most multiplayer games require players to conform to the same gameplay or customize their experience only through minor choices, such as selecting a specific character or equipment.

Some games with flexible structures (e.g., sandbox games) allow players to engage in different activities and pursue varied objectives [25, 102]. Yet, these are often built around a single underlying gameplay loop[1], constraining how far play styles and aesthetic experiences can truly diverge. Some multiplayer games employ asymmetric design to purposefully incorporate roles that cater to highly distinct preferences and play styles [34, 39, 41, 44, 46, 52, 63, 76]. Still, asymmetric roles and tasks are typically designed to complement one another, requiring players to fulfill each one for the experience to progress (e.g., an action-based role dependent on a strategic one [48], having to engage in mining to build with certain materials in Minecraft [90]). Asymmetric games, designed around fixed combinations of player types, offer limited flexibility for diverse groups to shape their experience.

We propose an alternative approach: one where experiences are made modular, allowing groups to combine them freely and create a compound multiplayer experience[2] that better fits the needs of the whole group. These experiences can be composed of a combination of shared modules and individual ones to attempt to have players engaging in alignment with their motivations without having to compromise for shared play. This approach is akin to how players might choose their favorite characters or loadouts in a multiplayer game, but rather than selecting minor elements of the gameplay, they would be selecting entire gameplay experiences that are prepared to intertwine. Such a design is inherently complex and comes with its own challenges—in particular ensuring that these experiences, despite being segmented and sometimes not shared by all players, still foster sociality[3] and maintain the benefits of multiplayer gaming.

We developed a proof-of-concept game prototype, where players choose between two asymmetric gameplay modules according to their preferred play style (calm or thrilling), impacting a third module where they compete. Using this prototype as our research instrument, we conducted a user

[1]The term "gameplay loop" is used to describe a recurring sequence of actions that players engage in throughout a game.
[2]We define a "multiplayer experience" as one that includes in-game interaction between multiple players.
[3]We use the term "sociality" as it has been used in previous work [45] to refer to the presence and degree of social outcomes emerging from the experience

study with 34 participants in pairs (including two game developers) to understand the benefits, limitations, and concerns around the approach, focusing on the following research questions (RQ):

- **RQ1:** What are the perceived benefits and drawbacks of making multiplayer experiences modular?
- **RQ2:** How can such an experience ensure a sense of sociality (in particular, social presence)?
- **RQ3:** How could this design approach be materialized commercially (e.g., sustainability, integration with existing platforms)?

Our results show that participants see the potential of modular design for 1) enabling more inclusive and engaging-for-all multiplayer experiences, but also for 2) improving variety and flexibility of the game to accommodate their individual changing needs. Regarding the viability of the approach, participants saw advantages in 1) diversifying the player base of a company by interconnecting existing and new games, 2) exploiting modules as expanded content to improve retention, and 3) reviving the interest in older games (with increasingly smaller player bases) by connecting them to new or popular ones.

Despite these benefits, our study identifies various challenges and trade-offs associated with the approach. Importantly, modularity can lead to a diminished feeling of sociality if the connection between modules is not designed carefully. We outline a number of factors (e.g., visibility) that affected and can affect the perceived sociality of such an experience, according to participants. We highlight other perspectives such as 1) thematic integration of the modules, 2) concerns around module combination and sharing, and 3) the various formats of modular design (e.g., collaborative vs competitive). Ultimately, we expect our work to contribute with design strategies to maximize variety and flexibility in gaming, allowing players with diverse needs and preferences to engage in a shared experience without compromising their individual gaming styles.

2 Related Work

In this section, we start by introducing gaming as a social activity. We then describe how research and industry have leveraged design strategies (e.g., asymmetric design) to build personalized experiences. Finally, we cover examples of modular game design.

2.1 Gaming as a social activity

Digital gaming has opened up new spaces for social interaction, becoming a significant aspect of social life for many individuals [23, 25, 53, 71, 73, 74, 81, 96, 101]. Prior research portrays gaming as a powerful tool for initiating, sustaining, and enhancing relationships, having positive links with quality of relationships [93, 99] and psychosocial well-being [33, 93, 105]. Research in Computer-Supported Cooperative Work (CSCW) has been examining multiplayer games as unique sites for studying social phenomena such as teamwork, community, and relationships [64]. Social gaming encompasses a range of subdimensions [45]: one key construct is social presence [5], which assesses the feeling of being "there" with other players and the degree of interpersonal connection. Research [21, 26, 45, 50, 87] also indicates that the social dimension is highly influenced by design decisions, the gaming context (e.g., co-located vs remote), as well as personal characteristics such as personality, abilities, and gaming preferences.

Despite the recognized benefits of playing with others, the way game design is aligned in current practices limits their pertinence for groups of players who have mixed needs and preferences [13, 17, 19, 43, 79, 104], such as families and groups spanning multiple generations [22, 76, 94] and abilities [13, 17, 19, 43, 79, 104]. Personal preferences play an important role, as players may simply favor different play styles, themes, and platforms [2, 60, 102]. For example, a game with highly strategic elements may not appeal to players seeking a more casual experience.

Player motivations in digital gaming can be classified based on various typologies [2, 66, 102]. One of the largest models is the Quantic Foundry Gamer Motivation Model [103], built from data of data from over 1.65 million gamers, which captures six key motivators that drive gameplay (achievement, social, immersion, creativity, mastery, and action), as well as related sub-motivators (e.g., destruction and excitement for the action motivator). These models support researchers and game designers in understanding and catering to different player preferences.

2.2 Welcoming different needs and preferences in gaming

Past research highlights the importance of approaches that accommodate a range of player needs and preferences [13, 51, 64]. Complex games, such as massively multiplayer online (MMO) and sandbox games, may offer some flexibility by providing a large array of different mechanics, play styles, and pathways [25, 102]. For instance, in these games, some players may focus on combat and questing, while others might dedicate their time to crafting items or building intricate structures [102]. However, these options remain embedded within the core gameplay, governed by the same mechanics, rules, and aesthetics. Also, they are often designed to be interdependent, meaning that players who specialize in one area may still need to engage with others to progress (e.g., a player focused on crafting might need materials obtained through combat or exploration).

Multiplayer games are usually designed to be mostly symmetric, meaning all players must conform to the same gameplay rules, interactions, and aesthetics, which does not account for varying needs and preferences. Providing an extensive set of options to players can address some of the barriers, such as integrating adaptive difficulty settings [7, 42] and customizable interfaces [104]. Yet, these solutions consist of slight adjustments. For groups with high heterogeneity (e.g., multi-generational families), design approaches that embrace a strong disparity between individual experiences may be necessary.

2.2.1 Asymmetric game design. Asymmetric design in gaming refers to the intentional creation of gameplay mechanics and dynamics that provide distinct roles, views or interactions to players, resulting in experiences that are unequal by design [49]. Past work [49, 68, 69, 83] has proposed conceptual frameworks addressing asymmetries at the mechanical level and identifying some of the ways these shape gameplay dynamics. These frameworks capture asymmetry at different levels, such as ability, interface, and investment. In collaboration systems, users may interact through different input and output modalities, have varying access to content, see information presented in distinct layouts, or experience the system from different representations or perspectives [10, 97].

Games research [41, 44, 46, 52, 76] has been exploring different types of asymmetry as a strategy to create games that cater to disparate needs and preferences. For instance, in the context of mixed-ability gaming, the gameplay of one player can be entirely designed around auditory challenges to meet the needs of a blind player [44], or leverage the use of a wheelchair as a controller to embrace the abilities of a wheelchair-user [41]. Past work [76] has leveraged asymmetry of investment to accommodate family members with differing availability, with parents able to play in short bursts of time (as they usually have less free time to play [76, 94]), and children playing more time-demanding challenges. These and other asymmetric games [34, 39, 48, 63] ensure player interaction by creating dependencies or competition between the various roles. This ensures that, despite the radically different individual experiences, they foster a common shared experience where players feel connected and engaged in the same game.

Yet, in games featuring highly asymmetric roles, gameplay functions only when all roles are filled by players (e.g., in Beam Me 'Round, Scotty! 2 [48], one player must always be Kirk while the other must be Scotty). Past work [24, 48] suggests that a higher degree of interdependence (i.e. the "degree to which group members must rely on one another to perform their task effectively" [84])

in asymmetric games enhance the sense of connectedness between players. However, this limits players in choosing how they want to engage with the game, as they are forced into predefined roles [44]. Players with different needs and preferences may feel constrained or excluded if they cannot find a suitable role or if their preferred role is already taken. These limitations call for design strategies that preserve the uniqueness of asymmetric experiences while reducing the constraints imposed by their interdependence.

2.3 Modularity design and its traces in gaming

Modularity has been defined and explored in other fields, such as engineering and architecture [1, 54], computing [77], biology [98], cognitive science [30], and economics [59]. Across these fields, modularity is associated with systems and products that are built from separate, interchangeable parts or components. This characteristic is often associated with benefits such as ease of modification (by adding, removing, and recombining these parts) and reusability. Modular composition has been proposed as a way to increase flexibility in how users engage with CSCW systems [56], yet the concept remains largely underexplored.

The term "modular game design" is sometimes used to describe development practices where functionalities and components are designed separately to be implemented and maintained independently, maximizing reusability [40]. In this work, we exclusively refer to design strategies that aim to increase the modularity of a game as it is played and perceived by players, not as it is implemented. While it is not common for games to be explicitly characterized as modular, some games exhibit more modular characteristics than others. Some examples are games with: 1) **supporting roles** (e.g. Cappy in Super Mario Odyssey [70], with less demanding gameplay, and drop-in/drop-out functionality); 2) **game modes or mods** (e.g. Dota 2 [95], and its Dota Auto Chess mod [89] with complete different gameplay that eventually became a standalone game), 3) **companion apps** (e.g. consult game lore [38], interact and teach new tricks to pets from the main game [37]) **expansions** which often come with modules that can be combined into the original experience (e.g., The Sims expansions[4] adding optional elements such as pets, careers, and holidays), 5) **asymmetric roles** that are interchangeable, particularly in board games (e.g., asymmetric factions in Merchants Cove [75], which operate independently but interact on a shared board).

To the best of our knowledge, modular gameplay has never been explored academically, with one exception: Clark et al. [16] briefly explored modularity within the context of educational games to facilitate the creation of independent lessons that "plug in" into an overarching game. In this work, we aimed to explore modularity as a design strategy to enhance customizability and flexibility in multiplayer games.

3 Conceptualizing modular multiplayer

We propose modular multiplayer, where a game experience, shared by multiple players, is segmented into *distinct playable components that can be rearranged, recombined or totally removed* while the experience as a whole still functions [Figure 2]. Throughout this paper, we use the term *gameplay modules* to refer to these "playable components", which can range from basic gameplay loops (e.g., gathering resources in *Minecraft* [90]) to complex ones that could be seen as full games in their own right (e.g., Gwent card game played within *The Witcher 3* [82]). A gameplay module is meant to integrate one larger compound experience, where it can replace or be replaced by other modules, without precluding this larger experience (*interchangeability* between modules). Moreover, each gameplay module must provide a self-contained gameplay loop that functions and

[4]The Sims 4 Expansion Packs. https://www.ea.com/en/games/the-sims/the-sims-4/store/categories/expansion-packs

remains meaningful on its own, independent of other modules being played or not (*autonomy* of modules).

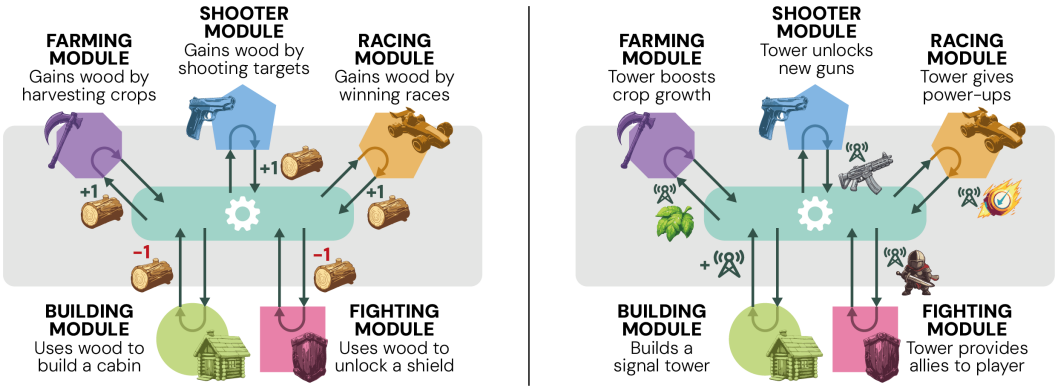

Fig. 2. Example of a modular game design structure. On the left, the modules are connected through resource exchange, where three modules provide a resource (wood) used, in different ways, by the other two. On the right, the connection is driven by an action performed in one module (building a signal tower) that unlocks new abilities and content in the others.

There are multiple possible strategies for connecting modules, without compromising their interchangeability and autonomy. One approach is to convert actions in one module into relevant resources or outcomes in another, based on the chosen combination of modules. For instance, in a modular game, players could gather resources through autonomous modules of their choice (such as a farming, shooter, or racing module, each capable of providing any needed resource) to then use them in a building module (e.g., collecting wood in the farming module to then build a cabin in the building one). Alternatively, the same gathered resources could be repurposed to unlock abilities in a fighting module (e.g., wood to craft a shield).

Modular designs should also support players who wish to participate exclusively in a single module. For example, a player who only plays the building module, without engaging in any resource-gathering, should still be able to acquire materials, either by trading with other players or have them automatically supplied by the game. Conversely, a player who only plays a resource-gathering module should be able to contribute materials to the building module without ever entering it.

Other types of modular connections are possible (e.g., shared progression, cross-module objectives)—a comprehensive list of ways to connect modules is beyond the scope of this paper. What is critical, however, is that modular connections are designed to support different module combinations, dynamically adjusting dependencies or supplying essential elements (e.g., resources, mechanics, progression paths), so that each module remains functional and meaningful regardless of how the group configures their play.

To quantify this, interchangeability and autonomy should be viewed as continuous rather than binary properties. *Interchangeability* depends on the specificity and number of dependencies between modules: modules that rely on generalized interfaces (e.g., universal resources and triggers) are more easily replaced than those requiring fixed inputs or producing module-specific outcomes. *Autonomy* depends on the extent to which a module's core loop remains functional in isolation, such that its primary goals, challenges, and rewards remain coherent without requiring participation in or from other modules.

Both properties are shaped by how modules are connected, including the tightness of coupling between mechanics, the structure of resource exchange, and the visibility of actions, state, or progress across modules. From this perspective, a system's degree of modularity can be characterized by the range of module configurations it can support without undermining the integrity of the overall experience.

While modularity can certainly exist in single-player experiences and possibly enhance customization in those, we exclusively focus on its application to reduce constraints in multiplayer gaming. We believe this approach can address limitations found in existing multiplayer design models, even those that emphasize variety and adaptability:

- Most multiplayer games impose **symmetric gameplay** [Figure 3-A], offering a single, uniform experience to everyone. As a result, those with different preferences must conform to a fixed play style, sometimes with limited personalization through minor gameplay choices (e.g., choosing a specific character).
- While **asymmetric design**[5] [Figure 3-B] has been employed to create highly distinct experiences tailored to different gaming profiles, seldomly can these experiences be isolated or recombined to adapt to a group's specific needs. These experiences are usually targeted to a specific combination of players, and limits choice to a limited pool of gameplay styles.
- **Complex multiplayer games** [Figure 3-C], such as MMO and sandbox games, offer a high variety of play styles within the same experience. However, these styles are often not radically distinct and dependent on each other, limiting the extent to which players engage in the gameplay styles they want.

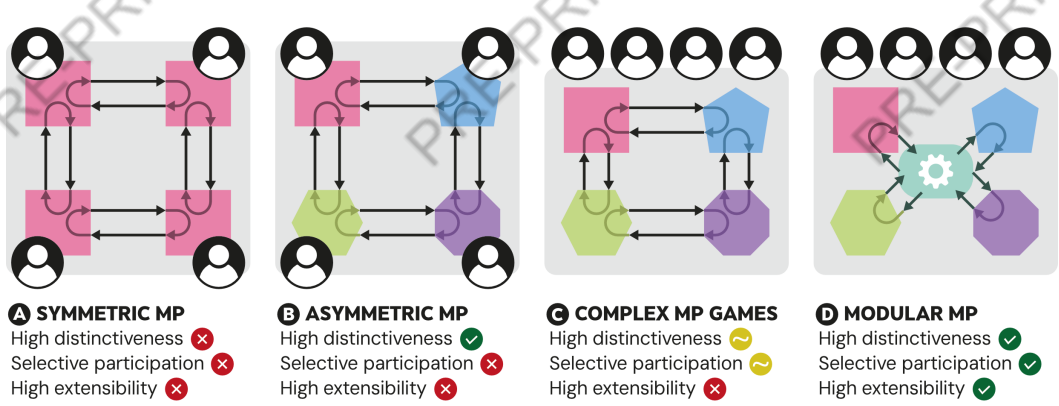

Fig. 3. Four approaches (A-D) to design multiplayer experiences, and their potential for personalization in terms of: 1) **High distinctiveness:** Can players experience fundamentally different gameplay loops while playing together?; 2) **Selective participation:** Can players play only the gameplay loops they enjoy and skip those they do not?; and 3) **High extensibility:** Can new, optional gameplay loops be added that plug into the existing experience?

We believe that by treating asymmetric roles and experiences as modular units (interchangeable and autonomous) we can offer players greater control to tailor their collective experience [Figure 3-C]. We envision three key affordances of this approach in supporting diversity and flexibility.

[5]Note this approach does not replace asymmetric game design but rather builds upon on it with modularity. This approach goes beyond traditional asymmetric game design because the asymmetric experiences (in this case, asymmetric modules) it offers are optional and not required for the game to function. While modularity can exist without asymmetry, the latter is required to offer players diverse play styles within the same game or experience, which is central to our approach.

First, within each module, mechanics are self-contained, primarily serving its own gameplay loop. This allows each module to stand on its own, mechanically and aesthetically, rather than conforming to a common base, as in sandbox or other complex multiplayer games (*high distinctiveness*). Second, modularity enables the customization of multiplayer experiences by combining or omitting modules based on group needs. A group can engage only with the parts of a game that align with their preferences, rather than being required to play all asymmetric options to progress (*selective participation*). Finally, modularity requires the game to define how outputs from one module can be converted into interactions in others, without making those outputs strictly necessary. This opens the door for expandability, allowing new modules to be added that plug into the existing ones (*high extensibility*).

Still, constructing from scratch or adapting a game to be modular is not an easy task—key challenges include ensuring meaningful player interactions and balancing gameplay across different modules. It is important to assess the actual benefits of this approach, its limitations, and how both players and developers see modularity being applied in the commercial realm.

4 Assessing the potential of modular multiplayer

Utilizing a game prototype as a testbed, we conducted a user study to assess the potential benefits of modularizing multiplayer experiences, while also identifying any associated drawbacks compared to traditional experiences (RQ1). We were particularly concerned with the potential impact of modularity on social outcomes, as modules are intentionally made decoupled and might not be shared by all players. Consequently, we sought to understand whether a modular multiplayer experience could meet players' social needs and identify critical aspects required to achieve that (RQ2). Finally, our study aimed to explore the practical application of this approach in the industry and to delineate the factors that would influence its commercial feasibility (RQ3). The study included the gathering and analysis of quantitative and qualitative data through questionnaires and interviews.

4.1 Proof-of-concept modular game prototype

We designed and developed a game prototype, featuring three modules: one designed to be shared by players and two opposing modules (i.e. thrilling and calm gameplay). The objective was to connect two distinct, interchangeable, and autonomous gameplay experiences (a thrilling hack-and-slash module and a calm farming module) to a shared competitive experience centered around a tower-defense module [Figure 1]. While players compete in the shared module (which aligns with their motivations in common), they each can play a individual module that would not be enjoyed by both. The output from the individual modules directly influences the central module, by generating additional enemies for the opponent to face.

4.1.1 Design process. We chose to focus on a scenario where two players play together but had some opposing motivations. To conceive the modules of the game, we used the Quantic Foundry's motivation model [103] to build player personas, focusing on the Excitement spectrum, which captures how much a player enjoys "games that are fast-paced, intense, and provide a constant adrenaline rush". Our personas reflect opposing motivations in this spectrum, with one player favoring a "calm" gameplay and the other a "thrilling" one. We also decided that a strong motivation of both players is to play games with high conflict. As such, our design aims to cater to *players who favor high conflict but prefer opposing amounts of excitement in games*. As described before, the game is competitive and players want to achieve the highest score in a central shared module, which balances calm and thrilling elements and emphasizes high-conflict gameplay. Each player plays an individual module, tailored to an extreme of the excitement spectrum, to affect their opponent

in the central module. We provide a detailed description[6], with the application of existing game design frameworks, and a trailer video[7] for our prototype.

4.1.2 Development. Three separate game prototypes were created using Unity [92]. Assets, including models, animations, and sounds were gathered from various sources. The prototypes were all connected to a single database (Firebase Realtime Database [29]) enabling communication across modules. All are PC games, with a mix of keyboard and mouse input, supporting two players. The game prototype was playtested by the research team and external players to balance difficulty across modules. We iteratively refined pacing, effort requirements, and other design aspects to achieve a satisfactory balance.

4.1.3 Tower-defense module (central). The central module takes the form of a tower-defense, where players defend their base from waves of incoming enemies. To avoid damage, players place turrets and use special abilities to defeat the enemies before they reach the base. This central module was designed to balance calm and thrilling elements with an emphasis on high conflict, appealing to both of our player personas. In the first phase, players can purchase and position turrets, upgrade their abilities, and prepare their defenses in a static environment, with no time constraints. Once ready, the second phase begins: the wave is launched, and the enemies begin advancing toward the base. In this phase, players must react in real-time, using abilities to target special enemies and collect coins, all to prevent enemies from breaching their defenses. There is no direct interaction between players in this module, except for the additional enemies generated by the opponent in the individual module. Also, each player defends their own base without seeing the opponent's base. After five waves, the score is calculated based on the damage taken and the coins remaining.

4.1.4 Slasher module (thrilling). Players must enter rooms where, controlling a character equipped with a sword, they must defeat all enemies in the room without being defeated and within a limited timer. By completing a room with success, the player generates two additional enemies that will appear in the corresponding wave when their opponent plays the tower-defense module. The rooms had varied difficulty (the players could select between easy, medium, and hard rooms) and the enemies sent by harder rooms were stronger. To enter a room, a player had to spend a ticket and we limited these to 15 during the study (i.e. when playing the slasher module, participants only had 15 attempts to send enemies).

4.1.5 Farming module (calm). Players explore the world, gather resources, plant, water and gather crops. There is a station where they spend a combination of gathered crops (i.e. complete a recipe) to generate two additional enemies (for each recipe) to appear in the opponent's tower-defense module. Some recipes were harder to achieve than others (based on crop rarity), with the harder ones generating stronger enemies. Players could also buy seeds in the market and build structures to help with their tasks (e.g., a well to have a closer source of water). Players were not limited by time but rather by moves (they had, in total 125 moves to spend in various actions, including collecting wood and watering plants).

4.1.6 Module interactions. For this study, we opted to limit in-game interactions to a minimum, prioritizing module autonomy. We aimed to assess if players would still perceive the experience as social and invite player feedback on what is important to ensure interconnectedness in modular experiences. The only in-game interaction between players was the ability to send additional enemies to their opponent. By performing well in their individual modules—effectively managing resources in the farming module or successfully completing rooms in the slasher module—players

[6]Game Prototype Detailed Description. https://osf.io/fn6eg/?view_only=2f210b07cab846a3923c203955fa5f88
[7]Game Prototype Trailer. https://osf.io/h6bkz/?view_only=05de9ac8c97a4963a91ac881fa47bd30

could increase the difficulty of their opponent's gameplay in the tower-defense module as they competed for the highest score. Before each wave in the tower-defense module, players were alerted with a screen showing the additional enemies sent by their opponent. Players could compare their scores on the tower-defense leaderboard. While each module was fully autonomous and playable on its own, our study focused on how they function in combination to create a multiplayer experience.

4.2 Study details

We conducted a study where pairs of participants, assigned to one of two scenarios, played our prototype together, co-located, and expressed their perspectives through questionnaires and interviews. Pairs assigned to the first scenario (*asymmetric with pre-determined modules*) had to play different resource-gathering modules (one played the slasher while the other played the farming) alongside the tower-defense module. The resource-gathering module assigned to each participant was pre-determined by the researchers, based on their player type. Pairs assigned to the second scenario (*symmetric with choice of module*) had to play the same individual module (slasher or farming) and the tower-defense. In this scenario, participants had the opportunity to collectively choose which resource-gathering module they wanted to play, based on a short description and teaser videos. The second scenario mirrors the traditional multiplayer experience, with players having to choose the same game for both of them to play. The decision to have these two scenarios was to implant different expectations and encourage varied perspectives from participants (e.g., starting with symmetric play and then being introduced to the idea of playing different gathering modules).

The study was conducted over the course of seven weeks. All sessions happened in the same room, with a pair of participants and at least two researchers present. After setting up and welcoming participants to the room, the same procedure was followed for all sessions [Figure 4]: 1) questionnaire with demographics and gaming habits; 2) play session; 3) player experience questionnaire; 4) social presence questionnaire; and 5) semi-structured interview with the pair. Participants were compensated with a [anonymous for review] gift voucher. The study was approved by the ethics committee of our institution.

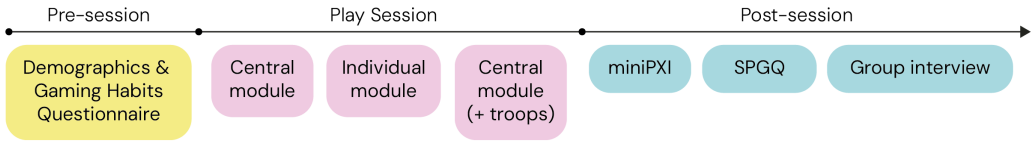

Fig. 4. Procedure followed by each pair during the study.

4.2.1 Recruiting. We relied on word of mouth and online posts to recruit participants, mainly students and staff from our institution or individuals in our broader social networks. Before being admitted to the study, every participant had to fill a form where they could read the information about the study, consent to participate, and fill the Quantic Foundry Gamer Motivation Model questionnaire[8], which determined their player type. Participants in the asymmetric scenario were assigned to their individual modules based on the results from this questionnaire—i.e. in each pair, the participant with the lower percentage in the Excitement spectrum was assigned to the calm module.

[8]Quantic Foundry Gamer Motivation Profile. https://apps.quanticfoundry.com/surveys/start/gamerprofile/

4.2.2 Participants. Our study included 34 participants (30M, 4F), aged 18-35 (M=23.9, SD=3.8). All were individuals who regularly play games (P1-P32) and two (a pair) were also game developers (D1-D2). Participants applied in pairs and had existing relationships (colleagues, friends, or partners), except for one pair, which was matchmade and did not know each other (P25-P26). At the time of the study, D1 was employed as a game developer at Funcom (for less than one year), while D2 was working also as game developer at Miniclip (for almost three years). Nine pairs (which included D1-D2) experienced the first scenario (asymmetric), while the remaining eight experienced the second (symmetric). Participant details can be consulted in Table 1.

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

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

4.2.3 Play session. The entire play session for a pair averaged 35 minutes. Participants first played the tower-defense module (five waves with no additional enemies), then their assigned individual module (until they were out of tickets/moves), and finally the tower-defense module with the additional enemies sent by the opponent. At the start of the play session, we introduced the experience to participants by briefly explaining they were going to compete in an experience consisting of two components. When playing each module for the first time, we explained all mechanics to participants and were available on their side to guide, help, or clarify any doubt. During the play session, participants were seated facing each other and were free to talk while playing, simulating a typical gaming scenario where players interact and communicate during gameplay.

4.2.4 Player experience questionnaire. We used the mini Player Experience Inventory (minPXI) [47], a validated scale designed to assess player experience across eleven constructs, each represented by a single item on a 7-point Likert scale (from -3 to 3).

4.2.5 Social presence questionnaire. We used the Social Presence module from the Game Experience Questionnaire (SPGQ) [20], which probes players' awareness of and involvement with their co-players during gameplay. It captures three key constructs: Psychological Involvement (PI) towards co-players in the form of both positive emotions (PI–Empathy) and negative emotions (PI–Negative Feelings), and Behavioral Involvement (BI), which measures how much players perceive their

actions as being dependent on those of others. The questionnaire includes 17 items (PI-Empathy and BI with 6 items each, and PI-Negative Feelings with 5). Each construct is assessed through a series of 5-point Likert scale items (from 0 to 4).

4.2.6 Interview. We conducted a semi-structured interview, following a script[9] with questions grouped into three sections: 1) experiences when playing with others who had different preferences; 2) how they perceived the modular experience (e.g., connections) and if they enjoyed it; 3) questions about the concept, its benefits and drawbacks, and how it could evolve into the future; 4) questions about perceived sociality and how this could be improved. Before advancing to the third section, we explained the game's structure, the connections between the modules, and the possibility to expand the structure with more modules and players. Interview time averaged 45 minutes.

4.3 Analysis

Given the plurality and flexibility of thematic analysis [9], we adopted elements from different approaches to fit the context and goals of our study. We followed the general six-step process outlined by Braun and Clarke [8] and implemented a structured coding procedure, informed by template analysis [55], in which multiple coders collaborated to develop a final codebook or "template" for annotating the text. This approach aligns with what Braun and Clarke [9] describe as codebook thematic analysis, combining a structured coding process with interpretive principles that emphasize meaning-making and an iterative approach to theme development.

The first and second author were involved in the coding process, first familiarizing with the data and then each independently coding three transcriptions. Using a first draft of the codebook, the second author started coding the remaining interviews, meeting twice with the first author to discuss new codes and iterate on the codebook. After reaching a final codebook[10], the first author went again through all transcriptions, finalizing the coding process. The whole team then met to discuss relationships between the codes and potential themes. After these meetings, the team reached an outline of themes[11], used to write the findings below. The coding process was inductive and deductive, with deductive codes (e.g., "perception of sociality") defined first, based on the research questions.

We explored potential patterns in our quantitative data by visually inspecting graphs and reviewing descriptive statistics. The results provide insights specific to our participants, serving to complement our qualitative analysis—the responses to the miniPXI served to confirm if participants had an enjoyable gaming session, while the SPGQ informed the findings related to sociality. We did not expect the scenarios to significantly impact these results, and comparisons with our sample size ($n = 34$) would lack the statistical power to detect anything but large generalizable trends ($d \geq 0.80$). Nonetheless, we conducted Mann-Whitney U two-tailed tests to compare player experience and social presence between participants who experienced the symmetric and the asymmetric scenarios. These tests revealed no significant differences in player experience ($Z = 0.83$, $p = .42$, $r = .14$, 95% CI $[-0.18, 0.46]$) or social presence ($Z = 0.71$, $p = .49$, $r = .18$, 95% CI $[-0.30, 0.71]$). The quantitative dataset is available in full[12] and a summary can be consulted in Table 3.

4.3.1 Positionality statement. The authors mainly involved in the analysis play digital and tabletop games, on a daily or weekly basis, having played digital games since childhood. They also have experience designing and developing games, primarily within a research context.

[9]Interview Script. https://osf.io/hnr57/?view_only=ea4da47b39ea49c1b026ce503a2ddffb
[10]Codebook. https://osf.io/jnsth/?view_only=a513edc413c149b3abb8c9bb6bd4d3f0
[11]Themes Outline. https://osf.io/c6tfq/?view_only=833e77c3d2b1410ea4f5b0ea2fe8ce80
[12]Quantitative Results. https://osf.io/jfkxh/?view_only=70e2ab4205ea414aa7572825aa568887

5 Findings

Overall, all participants found the experience enjoyable, something they expressed during the interview (e.g., emphasizing the experience was fun and felt novel). As for the miniPXI [Table 3], the average score across participants was 1.64 ($SD = 1.29$), with all eleven constructs having a positive average score (the scale goes from −3 to 3), with the lowest being Mastery ($M = 0.85$, $SD = 1.67$), and the highest being Enjoyment ($M = 2.32$, $SD = 0.84$). Below, we present our themes, supported by quotes from participants and results from the SPGQ.

Table 2. Summary of findings, organized into the resulting themes (T).

T1. Meeting diverse player needs through selective participation. Participants discussed how the approach offers flexibility by allowing players to engage with the parts they enjoy while still contributing to a shared experience.
T2. Preserving social connection amidst fragmented experiences. Participants noted a lack of sociality, suggesting it could be enhanced with continuous feedback, direct gameplay influence, and distinguishing player-driven actions.
T3. Diversity and expandability supporting engagement and changing needs. Participants appreciated multiple play styles in a game for boosting replayability, retention, and adapting to changing preferences.
T4. The impact of a shared module and alternative formats. Participants debated how module sharing and combination may be unfeasible for some groups. Alternatives included automatic central modules and direct interaction between modules.
T5. The importance of theme and aesthetics to ensure cohesion. The lack of connections between modules affected participants' engagement. Suggestions for improvement included consistent themes and smoother transitions between modules.
T6. Acquiring and accessing modular game content. Participants had concerns about purchase decisions and imbalance between modules. Some suggested trial periods and starter packs to test content before committing.
T7. Interconnecting existing games and player bases. Participants suggested applying the concept into existing games, like creating cross-game ecosystems, and revitalizing older games.

5.1 Meeting diverse player needs through selective participation

Participants recognized genre preferences, skill levels, availability, and device use as factors that limit group play and impact overall engagement. According to participants, even when a group agrees on a game, not everyone may genuinely enjoy it, with some playing simply to accommodate others. In those cases, individual enjoyment may be compromised: "*There are games I hate and still play them*" (P13). This may strain the overall experience, particularly when someone is playing reluctantly: "*I think she [her sister] gets tired of the types of games I like more quickly, so we spend less time playing*" (P5).

Participants emphasized the potential of the approach to bridge differing needs and preferences, thereby reducing these barriers. This was particularly highlighted in cases where participants wished to play more with certain people in their lives but were hindered by clashing preferences: "*My girlfriend doesn't like playing League of Legends or God of War, but she enjoys playing Super*

Mario [...] this could be an opportunity for us to find a middle ground and play together" (P10). D1 saw great value in the concept, both to open more opportunities for him to play with D2 but also for its broader application in the industry: "*I played the game I liked, and she played the game she liked, but then we both participated in the same experience and influenced each other's game. That was great, to have a game that appeals to different people with different tastes. [...] It's an empowering concept, and I'd love to see it applied in more scenarios*". The approach was envisioned not only to accommodate diferent genre preferences but also balance varying skill levels and time commitments.

Participants emphasized that modularity allows players to engage with the aspects of a game they truly enjoy while still being part of a shared experience: "*Having a choice is great; we can pick what we like*" (P6); "*It allows players to have the best possible experience within a single game*" (P12). Additionally, some participants (P6, P11, P18) expressed how this approach opens the opportunity for them to play a specific type of game or explore new options with their groups, even when others prefer to stick to familiar games: "*I'm that guy who wants to play a game, the rest of the group doesn't. With this approach, I could play one game, someone else another, and we'd still be combining to the same goal*" (P11). Participants compared the approach to asymmetric and sandbox games, where players can focus on different aspects of the same game (e.g., building and mining in Minecraft). However, they also noted that modular multiplayer provides greater flexibility, as players can enjoy their preferred play styles without being forced to contribute to elements they do not enjoy: "*This approach is better. In Minecraft, even though tasks can be divided, they always interconnect. A person can't finish Minecraft without killing a monster. Here, everything is truly separate*" (P11).

Table 3. Average scores (with standard deviations) for the miniPXI and SPGQ questionnaires, by construct and overall.

Mini Player Experience Inventory			**Social Presence Module from GEQ**	
Psychosocial	Meaning (MEA)	1.56 (0.82)	PI–Empathy	2.24 (1.25)
	Curiosity (CUR)	1.94 (1.04)		
	Mastery (MAS)	0.85 (1.67)		
	Autonomy (AUT)	1.74 (1.56)		
	Immersion (IMM)	2.06 (0.98)	PI–Negative Feelings	1.80 (1.47)
Functional	Progress Feedback (PF)	1.24 (1.33)		
	Audiovisual Appeal (AA)	1.18 (1.34)		
	Challenge (CH)	1.38 (1.41)		
	Ease of Control (EC)	1.56 (1.11)	Behavioural Involvement	1.94 (1.36)
	Clarity of Goals (GR)	2.24 (1.02)		
Enjoyment	Enjoyment (ENJ)	2.32 (0.84)		
Average score		1.64 (1.29)	Average score	2.00 (1.36)

5.2 Preserving social connection amidst fragmented experiences

The answers to the SPGQ [Table 3], show that participants had a moderate sense of social presence ($M = 2.0, SD = 1.36$), with moderate scores across all three scale components: PI-Empathy ($M = 2.24$, $SD = 1.25$), PI-Negative Feelings ($M = 1.80$, $SD = 1.47$), and Behavior Involvement ($M = 1.94$, $SD = 1.36$).

In the interview, most participants acknowledged that the experience was somewhat social, albeit weakly so. The sense of sociality was attributed largely to the external environment—being physically co-located and talking with a familiar person. Participants noticed there were few

connection points between their experiences, which they identified to mostly consist of the number of additional enemies and the leaderboard. The overall consensus was that the implemented interactions were insufficient to fulfill their social needs and expectations: "*I'm playing with them, but it's just for the objective; I'm not really playing with them*" (P32). One participant warned about the risk of losing at least some social connection if players engage with unconnected content: "*If one screen shows potatoes and the other shows apples, they have nothing to do with each other. We won't be able to connect and share feelings about the game we're playing*" (P11).

5.2.1 Continuous feedback and visibility of player actions. Participants provided insights into why in-game sociality felt low and suggested various improvements. Many expressed a desire for continuous feedback on the opponent's actions or their consequences, either through explicit visualizations or more subtle indicators. Suggestions included a window displaying the partner's screen or icons showing the number of enemies recruited by the opponent, their coin count, and damage taken. Some participants also suggested integrating the opponent's avatar into their own game world. P21 noted that sharing the same environment would enhance their perception of what the opponent was doing and how well they were performing: "*If we're in the same environment, I see their avatar, and we're in the same place, directly seeing what we're doing*".

Accordingly, participants highlighted the importance of this feedback for understanding their impact on the opponent's performance and adjusting their strategy accordingly. Beyond feedback, participants expressed a desire for more opportunities to "*directly challenge*" (P18) their opponents and influence each other's gameplay. They suggested creating new dynamics that increase their agency and decision-making opportunities to affect the opponent. Suggestions included allowing players to choose the order of enemy waves their opponent would face or sending specific types of enemies that could exploit the opponent's weaknesses: "*To improve the social component, maybe... maybe if we could choose the order or group the enemies for each specific wave they have to face. Maybe then I would feel more agency*" (P31). Most participants expressed a preference for synchronous interactions, where their actions would immediately trigger a response from their opponents. When asked about the potential for asynchronous gameplay, participants were generally skeptical: "*If it's not in real-time... it's difficult*" (P10); "*The connection might be lost*" (D2).

5.2.2 Differentiating player-driven interactions from standard gameplay. Participants reported that their ability to influence the opponent's gameplay was limited, often describing their actions as having a minimal impact: "*I felt like I did something, but not enough to hinder them*" (P2). The perceived impact often was consistent with each player's performance, perceiving a higher impact when one player would send a significant number of additional or particularly challenging (i.e. not affected by turrets) enemies. However, even in these cases, the impact was generally seen as merely increasing the difficulty rather than creating a meaningful interaction: "*It was just more enemies coming in my direction*" (P31); "*It was like a tower defense but in harder mode*" (P3).

To address this, participants wanted the consequences of their actions to be more pronounced and distinct from the normal gameplay experience. They suggested that enemies sent by the opponent should be clearly distinguished from regular enemies, either through visual differences (e.g., unique models or colors) or by making them significantly stronger: "*They could have a star attached to them saying, 'these were sent by the opponent.' Or the ones [sent by the opponent] could deal more damage than the normal enemies, like they're special*" (P1).

Throughout the study, participants stressed the importance of clearly conveying that their opponent was a real person rather than an AI, particularly in remote play: "*If we're far apart, not in the same place playing, we have to do something to make it clear that there's another player on the other side and not a computer*" (P5). P3 emphasized that beyond simply recognizing another player, it was important to recognize who the player was, through their unique strategies, knowledge

of the game, and customization choices. He cited Dragon's Dogma as an example, where other players' characters are represented by a companion (pawn) that encapsulate the knowledge and experience of the original player: "*It's that thing: 'I see him.' Because he'll design his character in his image*".

5.3 Diversity and extensibility supporting engagement and changing needs

The inclusion of multiple play styles within a single experience was seen as beneficial for catering to individual needs. Participants noted that this diversity offered more varied content, which could enhance replayability and provide new experiences each time: "*I think this can also be a way to keep the game interesting for a longer time, because we have several ways to interact with it, rather than being always the same, stuck in the same game loop*" (D1). One participant further explained how the combination of different modules could exponentially increase the variety of gameplay: "*If you have mini-games that you can choose from and face a different challenge each time, you can combine that with other games you like to play*" (P15). This led to discussions on whether, despite being advantageous for players, it would be equally beneficial for companies. Participants saw this as a potential opportunity for companies to increase player retention. Some suggested that modules could be offered as purchasable or downloadable content, similar to current industry strategies: "*What most games already try to do is to have more engagement with the main game, creating mini-branches that keep the player engaged with the main game*" (P1).

Moreover, variety was seen as an advantage in supporting individual needs over time. D1 expressed how this flexibility allows players to adapt their gaming experience to their current preferences: "*Like, today I don't really feel like playing this melee module, but there's also this other aspect that I think is cool, so I'm more in the mood to play that*" (D1). These changing needs were often associated with the different moods players may have from day to day: "*When I'm in a calmer mood, I play a calm game; when I'm more hyperactive, I play Rocket League*" (P27). Having these different options based on modules was considered beneficial for individual experiences: "*It's always good to have options. Even if I never use them, it's nice to have the choice. Like, okay, I can choose what I want to play on this day, at this moment*" (P30).

5.4 The impact of shared modules and alternative formats

In our study, we intended for each player to play two modules, an individual and a shared one. Some participants were opposed to the idea of having to engage with two different modules to participate: "*I don't want to do a triathlon of online games*" (P2). P25 argued the experience turns overly complex if each player has to play a combination of modules: "*It's just another layer of things we have to learn.*". Another participant voiced concerns about players who might resist learning new games, preferring to play only a familiar module and not a combination that include ones they do not know: "*The shared module would be the problem here. My parents don't want to learn a new game; they prefer Match-3 or Hidden Object games. I've tried [to show them] new ones, but they don't want the hassle of learning new rules*" (P21). Importantly, the sharing of the tower-defense module was a point of contention, with participants noting that group needs and interests might not intersect at all, making a shared module unfeasible. P21 noted that it would be challenging for him and his parents to share a module, as making it accessible to his parents would mean it was too simplistic for him.

Despite these concerns, participants recognized the importance of having a shared context or overarching goal that ties different modules together. In our prototype, the overarching goal was encapsulated by the tower-defense module, where players competed for high scores. However, participants identified alternative modular designs. One suggestion was to have a central module

that operated automatically—e.g., P21 suggested a central module where the enemies would automatically engage in battles, akin to an auto-battler. D1 envisioned a collaborative version of this format, where players could contribute through their individual modules to a shared score or to a battle against AI: "*You and the other players are trying to gather troops to eventually start fighting the AI's troops*" (D1). Another suggestion involved having individual modules interact directly with each other rather than feeding into a shared module: "*Having several modules converging [...] For example, saying, 'Look, I need you to perform X task so that I can do something here in my stage'*" (P29).

Participants also navigated the possibility of modular multiplayer with collaborative interactions. Suggestions included collaborative shared modules and ways to have cooperation in the individual ones. P10 proposed a game where players use individual modules to gather resources for constructing shared structures, preferring this collaborative approach over a competitive scenario: "*Have side modules to obtain specific materials to build a castle or house… I would prefer collaborating rather than competing*". Additionally, participants considered how team-based gameplay could enhance the experience: "*It could be team-based, with each player being a specialist in a type of game*" (P1). Some suggested cooperative connections could enhance sociality: "*It's a better feeling. Like, the feeling of cooperation is better... Cooperation is more social*" (P30).

5.5 The importance of theme and aesthetics to ensure cohesion

The majority of participants (n=24) perceived the experience as consisting of two separate games. Others (n=10) saw it as a single game with two parts or sections. Further, some (n=3) also described the central module as the "*main game*" and the individual module as a mini-game that supported the main one. Participants based their opinions on how well they felt the modules were integrated. For some, it was enough that the modules were connected by an overarching goal (scoring higher than the opponent) for them to see it as an integrated experience and a single game. However, for the majority, this integration was lacking.

While some participants mentioned aspects like "*mechanics*" (D1, P31) and "*controls*" (D1, P25) being too different, thematic and aesthetic elements were considered crucial: "*If the theme between the two was a bit more similar, it might help reduce that feeling*" (D1). Importantly, this sense of integration was emphasized by participants as a factor affecting engagement and immersion: "*It wouldn't feel like it was breaking the immersion*" (P28); "*It's a matter of immersion*" (P21). P1 explained the lack of thematic integration could diminish motivation to play the different modules: "*You risk the person thinking, 'Why am I doing this?' If it has nothing to do with the other game*" (P1). They suggested that common elements and consistent aesthetics between modules could help maintain a consistent theme across the experience: "*Keep a constant theme throughout the different games, with characters appearing in both, and consistent themes, art styles, and motifs that connect the two games*" (D1).

Further, participants expressed a desire for more context to explain how the modules were thematically connected, in terms of worldbuilding (e.g., how one goes from planting crops to defend a tower) and feedback (e.g., seeing the monsters "*eating [the plants] before they are sent*" – P22). Some participants also suggested that having a fluid transition between modules could enhance the experience. In the study, they had to start different game executables to play each module, which disrupted the flow. One participant referenced FPS Chess [31] as an example, where the game transitions from traditional chess to a first-person shooter view whenever a piece is about to be taken. P3 also suggested that, in the prototype, the slasher module could appear after a special troop is sent: "*Let's suppose there's a moment when I send the warrior; it could transition to the slasher and give me the opportunity to destroy more enemies than those that were already there*" (P3).

5.6 Acquiring and accessing modular game content

Participants envisioned future implementations of the modular approach as an interconnected "*ecosystem*" (P21) of modules, where each module would contribute to a broader experience. However, this vision was met with concerns about how such an ecosystem would be presented to players and how they would navigate it to find the modules that best suited their preferences. One key concern was the potential pressure players might feel when making purchase decisions: "*I feel like I would have to make a huge decision... If I saw another module I liked afterward, I'd be discouraged, thinking I made the wrong choice*" (P18).

Participants proposed several strategies to help players discover and explore modules before making a purchase. They suggested providing resources such as YouTube videos, allowing for trial periods, or offering personalized recommendations based on players' past gameplay or responses to a questionnaire. The discussion also extended to the methods of acquiring these modules. Some participants favored the idea of purchasing modules individually, giving players the freedom to customize their experience. Others proposed offering a starter pack that includes a set of basic modules, allowing players to get a taste of the ecosystem before deciding to invest in additional content. For instance, participants noted that offering a few high-quality modules for free could incentivize further purchases: "*If the first four were free and they were really good, users would think, 'These are great, there's no harm in buying one or two more just to see'*" (P11).

Many participants expressed concerns about the balance between the individual modules, arguing that one module allowed for easier sending of additional enemies: "*Hearing that there's no time limit and it's just about planting plants, it gives me the impression that this game has more advantages*" (P3). Some expressed a desire to switch and try the opposite module to ensure that the competition was balanced. Their perspectives indicated that even if they preferred the play style of a particular module, they would consider acquiring the one that was more advantageous in the competition. Despite these concerns, participants acknowledged these issues exist in every game with asymmetry (e.g., champions in League of Legends [36], fighters in Street Fighter [14]).

5.7 Interconnecting existing games and player bases

We asked participants how they envisioned this concept being applied in the real world and explored potential avenues for its feasibility. Several participants suggested that the idea of interconnected modules could be applied in existing games. P6, for instance, discussed how this format could be applied to games where players create and share their own content—in these games, different levels could function as interconnected modules, enhancing the gaming experience: "*In those mega games where players can create levels and stuff, like LittleBigPlanet, where fans can influence the game, and the library grows*" (P6).

A significant discussion point among the participants was the potential for existing companies to utilize this concept by interlinking their current games. P6 highlighted the possibility of companies with multiple games creating an interconnected ecosystem: "*A company that has several games that intersect. [P5] was talking about League of Legends, TFT, other game modes… it would be like connecting the games in a way that makes sense*". Participants saw this as an opportunity for game companies to bridge different player bases, creating new engagement strategies. D1 expanded on this idea, noting the interest in multiple fully developed games contributing to shared outcomes: "*Instead of having small modules, they could have several fully fleshed-out games that contribute to the same approach. That would be interesting. And we'd have different player bases interacting with each other. It could be an interesting idea*". In this context, P5 discussed examples of how some companies are already making these connections between their games, such as crossover events

and achievements that unlock cosmetics in other games: "*There was an event where you could unlock things in the main game [League of Legends] if you completed a mission in Valorant, or vice versa*".

The participants also reflected on the broader context of the gaming industry, where the standard practice is to cater to specific target audiences. D1 described how games are often designed to appeal to particular player profiles based on extensive market research, focusing on factors like age, gender, and occupation. However, the idea of interconnected modules was seen as a way to transcend this paradigm, potentially encouraging players to explore new genres and games: "*Like, 'Maybe I don't know if I like this game style. Oh, but it has this module, so let me give it a try.' [...] Because they realize, 'Oh, if I do this here, I get more points in my game'*" (D2). D1 and D2, as industry professionals, saw great potential in this idea. They discussed how connecting player bases and encouraging players to gain interest in games they typically do not play could increase a company's revenue. D2 noted that, by connecting these older games with newer, more popular ones, players could rediscover and enrich their experiences, breathing new life into games that might otherwise be forgotten. D1 supported this idea, suggesting that such a strategy could "*capitalize on games that are a bit more dormant and give them a bit more life and revenue*".

6 Discussion

The study, though exploratory, uncovered important insights into the use of modular and asymmetric design in gaming. It also highlighted broader implications for the design of multiplayer games, particularly in enhancing customizability and fostering social connection. We now explore these implications aligned with our three research questions (RQs).

6.1 The trade-offs of modular multiplayer (RQ1)

Modularizing asymmetric experiences introduces new opportunities but also challenges that warrant careful consideration—some of these stem from the nature of asymmetric design, while others are specific to modularity. Participants in our study identified several key advantages [Table 4] of the approach:

Table 4. Potential benefits of modular multiplayer identified by participants in our study.

Benefit	Short description	Considerations specific to modularity
Increased personalization	With asymmetric experiences, players can take on roles that better suit their needs and preferences.	Players can engage only with the content they want, not being forced to fulfill roles required for the experience to work.
Cross-pollination	Diverse gameplay within the same game can introduce new players to unfamiliar genres or play styles.	Meaningful connections between modules may encourage players to try new genres and engage with other communities.
Variety content	Diverse gameplay within the same game enables players to switch experiences based on their needs.	Having content that can be combined interchangeably enables increased variety and discovery (module combinations).

6.1.1 Increased personalization. This was the main advantage we envisioned for the approach, which was recognized by the participants. All participants appreciated the idea of being able to **focus on what they enjoy, bypassing elements they do not**, all while participating in a shared experience with others. They highlighted this advantage for groups that include disparate preferences regarding game genre, skills, and availability. Some also noted the benefit for players who enjoy **exploring new games and genres** outside the usual games played by their group(s).

6.1.2 Cross-pollination of game genres and communities. Participants noted that integrating different play styles in a single experience could encourage players to explore genres they usually avoid (e.g., a player focused on a strategy module might try a combat module if it benefits their progress). This approach can enrich player experiences and engagement by linking different games and player bases. Beyond thematic links (e.g., crossover events in Fortnite [35]), modular multiplayer could create **meaningful gameplay connections across genres**, fostering **more diverse gaming communities**.

6.1.3 Promoting engagement through variety content. Asymmetric games offer diverse experiences within the same game, and modular design builds on this by letting players **switch between styles and discover new content**. Participants noted that having various modules could help sustain long-term engagement, especially when fatigue ensues or moods shift. This can also promote a sense of continuous play, where different gaming experiences contribute to a unified purpose (e.g., players can switch between different games within the same ecosystem and still contribute to a collective experience).

Despite the identified benefits, participants also recognized the approach comes with its own set of challenges and drawbacks [Table 5]:

Table 5. Potential drawbacks of modular multiplayer identified by participants in our study.

Drawback	Short description	Considerations specific to modularity
Diminished sociality	Having different views and interactions can undermine shared awareness and reduce the feeling of playing together.	Being in different worlds and engaging in totally different challenges leaves players with even fewer shared frames of reference.
Breaking immersion	Highly distinct experiences can feel disconnected, especially without consistent narrative or shared elements.	Ensuring cohesion between modules may be challenging without compromising their uniqueness and autonomy.
Imbalance in asymmetric gameplay	Differences in mechanics and difficulty between individual experiences can lead to imbalance or unfairness.	Typical solutions like fine-tuning and rotating roles between players may not be appropriate for modular design.

6.1.4 Diminished sociality. Our prototype failed to meet participants' social needs and expectations. Participants' perspectives indicated that modular multiplayer experiences can severely suffer from a **lack of connection points and awareness among players**. While our decisions intentionally minimized interaction, there is an inherent challenge in creating meaningful connections between modules while ensuring autonomous play. This tension will be explored further in the next subsections.

6.1.5 Breaking immersion. The study elicited concerns that modular experiences can suffer from a loss of cohesion and immersion, making it difficult for players to maintain a continuous sense of engagement when transitioning between modules. These findings align with prior work which emphasizes the importance of continuity and coherence across different play sessions and modalities in preserving a sense of immersion [11, 78]. Participants suggested several ways to maintain cohesion, including **shared elements** (e.g., characters), a **consistent art style and narrative**, and **fluid transitions** between modules.

6.1.6 Imbalance in asymmetric gameplay. Participants expressed concerns about the fairness of competition between modules with different mechanics and difficulty levels. While this is a challenge related to asymmetric design, typical solutions may not apply, as **fine-tuning module combinations is exponentially more complex**, and **rotating modules among players would force players to play modules they may not want**.

6.2 Factors of shared play: Opening windows between modules (RQ2)

Past research [6, 65] recognizes the inherent challenge that exists in "coupling" asymmetric experiences (i.e. sustaining awareness and involvement among players). In contrast, past work [48] also suggests that carefully designed interdependencies in asymmetric games can enhance player connectedness compared to symmetric scenarios. When designing modular multiplayer, the challenge lies in navigating the **tension between autonomy and interdependence**: creating meaningful interactions and dependencies that sustain connection, even when specific modules may not be in use.

With modular design, maintaining a sense of shared awareness and purpose is not straightforward, especially when players are not even present in the same environment [65] or timeframe. Research in CSCW has long underscored these challenges, especially in remote collaboration scenarios, where part of the shared context is lost compared to face-to-face interactions [28, 67]. Interpersonal interaction highly depends on shared context, common ground, and awareness [61, 67]—this holds true in multiplayer games. Coordination theory [61] establishes that common elements to activities, such as shared spaces and resources, constrain how each activity is performed, which creates interdependencies and promotes coordination. Yet, ensuring common elements, constant visibility and awareness may compromise the uniqueness of each module.

To address this challenge, modular multiplayer may require moving beyond conventional multiplayer dynamics centered on synchronous, direct competition or collaboration (e.g., fighting the same enemy). Instead, it invites the exploration of new interaction forms, where players contribute to each other's experiences without needing to play in the same way, within the same game environment, or at the same time, while still nurturing a sense of connection.

In this work, participants highlighted multiple **design factors** (some taken for granted in most multiplayer games) they considered relevant for preserving a social dimension in group play, especially in asymmetric designs:

6.2.1 Similarity of experiences. Research [45, 88] shows that even single-player games can evoke sociality (e.g., sharing achievements with other players). However, participants noted it was **hard to feel connected while playing widely different experiences**, especially in the individual modules. As seen in our prototype, modular multiplayer does not mean players are always in separate modules, allowing for shared experiences in overlapping ones. Additionally, while increasing similarity between modules may conflict with the main purpose of the approach, using common thematic elements can foster a stronger sense of unity between modules and players.

6.2.2 Player embodiment and shared space. Participants felt that representing the opponent on their screen would strengthen player coupling, especially if this representation interacted within their world. Shared spaces in multiplayer environments have long been recognized as a crucial element for social interaction [25, 100]. User representations (avatars) are widely seen as important for fostering social presence [3, 57]. Recent work in social VR [32, 57] further shows that avatars can amplify this effect when they replicate nonverbal cues from shared physical spaces or share recognizable characteristics. Even without the high-fidelity embodiment found in VR, the perception of human personality and agency 'behind' a representation can be as important for the sense of co-presence [86]. Future designs that prioritize social connection may benefit from **shared spaces and cross-module representations**, even if they are viewed differently by each player (e.g., a player in a flight simulation module could appear as an aircraft in a ground-based strategy module, while the ground units are visible through the aircraft's systems). Alternatively, there is an opportunity to explore alternative cues that represent players without rely on "physical" embodiment [62, 100].

6.2.3 Visibility, impact, and intention. Participants highlighted the importance of clearly perceiving **how others' actions affect their gameplay**, enabling **meaningful reactions**. Participants wanted more noticeable feedback, such as visual cues marking the additional enemies or damage taken by the opponent. Some even suggested a live feed of the opponent's screen for full awareness. They also wanted interactions to disrupt gameplay more significantly, making the presence of other players more prominent. Participants sought more agency over sending enemies (e.g., choosing enemy types), making it evident that these actions are **driven by a human mind rather than predictable or scripted behavior**. Participants also emphasized the importance of **player identity**, which could be expressed through personalized actions, strategies, and avatar customization, intended to enhance the sense of connection and presence.

6.2.4 Synchronicity and Timing. Participants expressed a 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**. CSCW research has outlined the defining characteristics of synchronous interaction [72] and proposed strategies for weaving together synch- and asynchronous modes of collaboration [85]. In modular game design, a central concern is *change awareness* [15, 91], since players must be able to notice and track changes in their modules, even when these originate in other modules. Moreover, while prior work shows that asynchronous interactions can support sociality beyond the game itself [76, 80], more research is needed to design meaningful and social asynchronous gaming experiences.

6.2.5 Goal structure. Some participants favored collaborative gameplay over pure competition. Games research suggests collaboration may foster a stronger sense of closeness [24]. This suggests that for a modular experience to be truly flexible, there may be value in offering a **variety of module connections**: some competitive, some collaborative, and others blending both elements. Moreover, allowing players to choose whether the same modules interact in a competitive or cooperative manner could further enhance the game's adaptability.

While our study gathered rich perspectives on how these design factors were perceived within our prototype, further research is needed to understand how such design levers impact sociality in practice.

6.3 From concept to the industry: Feasibility, presentation, and formats (RQ3)

Many participants, especially game developers, discussed the practical aspects of implementing modular design in gaming:

6.3.1 Commercial benefits. Modular design was seen as a way to **increase player retention** by offering varied experiences and adaptability that keep players engaged over time. Participants also identified the potential for modularity to **revitalize older games** and **attract new audiences**. By connecting established titles with newer content or integrating them into a broader ecosystem, developers can breathe new life into their games and stimulate renewed interest. This idea may be especially relevant in the context of large game portfolios, game platforms (e.g., Roblox [18]) and live-service games [27, 35], where new content is constantly added or user-generated. This strategy can also lead to **increased revenue streams** by encouraging players to explore and invest in a range of interconnected content.

6.3.2 Acquisition and presentation. Participants suggested various methods for acquiring and accessing modular content, emphasizing the importance of **reducing the pressure associated with purchasing decisions**. Mismatched expectations in purchased content may trigger player frustration and eventual abandonment [12]. Strategies such as offering trial periods, providing personalized recommendations, or including free high-quality modules can help players explore and invest in modular content with confidence. It is also important to note many participants expressed concerns about **feeling overwhelmed or pressured to engage with all modules**. Balancing the appeal of new content with the risk of overload and "fear of missing out" [58] is key to maintaining player satisfaction.

6.3.3 Format and 'anchoring' modules. Digital games often target specific audiences. When designing a modular experience, one can expand the target to multiple audiences and start to define whether and where we expect them to overlap. For audiences with shared needs and interests, **overlapping experiences in shared modules** can enhance connection. For audiences without common ground, **direct connection points between modules** are necessary. Regardless, meaningful 'anchors', whether mechanical or thematic, are essential to ensure cohesion and sociality. Determining the right level of interconnection between modules is challenging—designers can choose between a highly cohesive ecosystem (e.g., a starfighter game directly impacting a ground combat game in the Star Wars universe), and a more loosely connected one (e.g., games in different universes linked only by a ranking system). Importantly, designers must consider **the connections themselves can be a point of contention** for some groups—for instance, players who prefer cooperative gameplay might dislike a competitive connection, and those who are not interested in medieval settings may not engage with an ecosystem tied by a medieval theme.

6.4 Envisioning a future for modular design

Modular gameplay defies the notion of uniformity in multiplayer experiences, where gameplay options are often restricted to ensure a level playing field (e.g., difficulty and accessibility options not available in multiplayer settings). A recent systematic review of how digital games have been studied within CSCW [64] highlights the need to further investigate inclusive approaches to game design. We believe modular designs can contribute to foster **more inclusive and welcoming gaming communities**, accommodating a wider range of players, including those often overlooked by the gaming industry (e.g., families, people with disabilities). **Modular roles in multiplayer games** can address specific needs and preferences—e.g., a pit-managing role in a racing game for players who favor a strategic focus, which could be included or excluded based on the group's choice.

We also believe some of the principles outlined in this work may extend beyond game design and be applicable to other types of CSCW and leisure platforms. For instance, distributed work systems could be reimagined as modular environments, where each role (e.g., project manager, designer, developer) has a specialized workspace tailored to their tasks, but these modules dynamically

Table 6. Summary of design considerations and implications derived from our results.

To promote flexibility in group play, designers should consider modularizing the gameplay by allowing players to skip entire gameplay loops or freely combine them.
However, modularizing the gameplay can fragment the experience and isolate its parts, potentially disrupting immersion and weakening players' sense of social presence and connection.
To maximize sociality in modular gaming, it is important to focus on shared spaces, elements (e.g., characters), and visible, impactful, synchronous interactions between modules—yet, this may come at the cost of flexibility and diversity.
To maximize immersion and a sense of cohesion, it is important to ensure thematic and aesthetic consistency between modules, as well as seamless transitions between them.
When designing modular gameplay, we need to reconsider what constitutes balance and fairness in gaming and whether these qualities are always desirable, as intentionally unequal or unbalanced experiences can also hold value.
Interconnecting games and play styles can foster the cross-pollination of games, genres, and communities, helping companies expand their player bases and revive interest in less popular games.
When presenting modular content, it is important to reduce the pressure of selection and acquisition decisions (e.g., by offering trial periods) and allow players to explore this content at their own pace without feeling overwhelmed.

intertwine when collaboration is needed (e.g., sharing updates, coordinating on joint deliverables). Interaction asymmetries have traditionally been seen as a barrier—or a challenge to be tackled—in achieving harmonious collaboration [4]. Recent work [10, 97] shows these asymmetries naturally occur in collaborative systems and everyday social interactions, and may be leveraged as a design opportunity. In line with this, our work explores how the distinctive capabilities of asymmetric interactions can be exploited while still creating shared points of reference to maintain awareness and connection.

This work investigated modular design within a specific context (gaming), setting (e.g., co-located), and with a limited sample. We identified a set of considerations primarily related to maintaining sociality, cohesion, and sustainability [Table 6]. Further research is needed to identify additional trade-offs, concerns, and to develop appropriate **vocabulary** and **design patterns**. Implementing modular gameplay is no simple task, requiring careful integration and adaptability across multiple modules (which may consist of entirely different games). We may benefit from collaborative efforts within the research community, such as different labs or game design programs creating modules that can 'plug into' each other. These collaborations may be essential to fully understand the trade-offs and feasibility of the approach and to extend these principles to broader contexts.

6.5 Limitations

Our participants predominantly include younger, male, regular gamers, which may limit the generalizability of our findings to other demographics. Further, the specific setting of our study, where participants were co-located and free to talk while playing, limits the applicability of our findings to other contexts and our capacity to assess the game's potential to foster social connection

purely through in-game actions. Future research should examine how modularity is perceived across different demographics and contexts (e.g., within families), and investigate how specific choices influence the perceived sense of sociality, especially when the co-location factor is removed.

The results are also specific to this particular implementation of the approach. The modules used in this study are relatively simple and designed with limited resources, providing only the necessary progression for the study. Interaction between modules relied on a single mechanic (enemy injection) and further work is needed to determine how specific design choices support cross-module connections. Another potential confound is imbalance in module difficulty which, despite repeated playtesting, may have led participants to question fairness. Importantly, the prototype and study do not cover all that modular design is capable of—modules were not rearranged (i.e. only two modules were interchangeable), added, or played independently—but rather followed a structure aligned with the study's goals. Other design choices (e.g., choosing a competitive game over a cooperative one) inherently limit generalizability.

We did not include a scenario where participants could freely choose their preferred module or combination of modules, as the design of the first scenario aimed to ensure the modules aligned with participants motivations (allowing free choice could lead participants to select based on factors like aesthetics or curiosity). In some cases, participants had similar motivations but were still assigned to the asymmetric scenario (to balance assignment to scenarios), resulting in, for instance, participants with high excitement scores assigned to a calm module (e.g., P2). While this certainly had an impact on enjoyment, we believe it did not compromise our primary objective: to explore players' perspectives on the approach. In the first (asymmetric) scenario, the average variation in Excitement scores between paired participants was 42% (SD= 0.29), with minimum being 5% (P1-P2) and the maximum 86% (P25-P26).

Also, most pairs in the second (symmetric) scenario chose to play the thrilling module. Beyond having a sample tending toward high excitement (M=62%, SD=0.30), some pairs justified they found the thrilling gameplay would be more fun from the teaser gameplay video.

7 Conclusion

This paper examines modular, asymmetric game design toward customizable multiplayer experiences by letting players choose gameplay segments suited to their preferences while still engaging in a shared experience. We developed a game prototype where players select between individual modules, influencing a third one, where they compete. A study with 34 participants found modular design can promote personalization, flexibility, and commercial potential. However, poorly connected modules can reduce social interaction and engagement. We offer strategies to balance individual preferences with shared engagement in multiplayer games, offering insights that can guide future research and practical applications in game design.

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