

## **Onboarding in Cooperative Multiplayer Games, Examined Through the Design of *Vacunauts***

### **Master-Thesis**

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## Abstract

This thesis examines how effective onboarding can be designed for cooperative multiplayer games, using a tutorial prototype developed in Unreal Engine as a case study. Two playtest studies were conducted with iterative refinement between them, combining prototype development, playtesting, researcher observations, and post-session surveys. Findings reveal that clear instructions, opportunities for exploration, embedded guidance, and tasks promoting meaningful cooperation support player comprehension without diminishing engagement. Although quantitative analyses were limited by small sample sizes, qualitative observations and open-ended survey responses offered valuable insights into player learning within collaborative tutorial contexts. The research supports existing theories on clarity and timing, situated instruction, and experiential learning, while extending them by highlighting the role of embedded guidance and cooperative task structures. Key implications include the need for larger and more diverse samples, improved survey instruments, and further examination of design features that foster interdependence. Ultimately, the study provides a framework for blending theoretical principles with practical tutorial design and contributes to a deeper understanding of how players learn together in cooperative multiplayer environments.

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# 1. Introduction

Over the years, video games have increased both in scope and complexity. The need for effective onboarding has become more crucial as games have developed to contain larger worlds, richer systems, and more varied player interactions (Brown, 2021). The goal of game designers is to create experiences that teach players fundamental concepts and mechanics without disrupting the flow of the game, making the game seem dull, or overwhelming novice players (Shih, 2021).

This challenge becomes even more apparent in cooperative multiplayer games, where players are often eager to jump right into the action with their friends, making traditional tutorial approaches relying heavily on explicit instructions and passive learning less effective (Owén et al., 2025). Onboarding in multiplayer is especially difficult since it involves introducing new features while simultaneously fostering collaboration and maintaining an even playing field among players with varying levels of experience. Designers must also consider elements like coordination, communication, and team dynamics that are essential to multiplayer experiences (Voulgari & Komis, 2011). Because players often interact with a game for the first time during tutorials, these early experiences play a critical role in shaping players' initial impressions and preparing them for the rest of the game (Bycer, 2019).

This thesis aims to explore how onboarding experiences can be designed to encourage self-discovery and collaborative learning in multiplayer games. By examining established methods of teaching, the research seeks to identify design principles that can be translated into practical onboarding strategies that foster player engagement and deep understanding. The outcome of this exploration will be a set of guidelines and design insights intended to support game designers in developing tutorials for their own projects. To demonstrate and evaluate these concepts, the proposed guidelines will then be applied through the development of a prototype level for *Vacunauts*, a project created by my team (godcomplex games) that provides a suitable context for experimentation.

Although research into tutorial design in single-player games is well-established (e.g., Benvenuti et al., 2023; Andersen et al., 2012), I was unable to find as many sources addressing how these principles apply to cooperative multiplayer environments. This thesis seeks to address this gap by investigating how onboarding can support collaboration and shared learning between players.

I am particularly interested in how players learn and how onboarding experiences can create excitement and anticipation rather than merely provide instructions. Testing these ideas through the development of my own prototype allows me to combine practical experimentation with academic exploration. By conducting playtests and gathering participant feedback through surveys, I aim to evaluate which design principles most effectively support learning and engagement, while also identifying patterns in player behavior and perception that can inform future improvements to the prototype.

While many of the design principles discussed may apply broadly to games, and the prototype used for testing can also be played solo, the study primarily emphasizes pairs of players playing collaboratively. Competitive multiplayer games are outside the scope of this research, as their distinct dynamics of competition and individual performance may impact the needs of onboarding resulting in additional design challenges.

The thesis begins with a review of relevant literature on game design principles and theories of learning to establish a conceptual framework for effective onboarding. The following

chapters outline the research methodology and provide an overview of the prototype project. The results of the playtests are then presented and analyzed, leading into a discussion of the findings in relation to the proposed design guidelines. Finally, the thesis concludes with a summary of insights gained from the research and highlights opportunities for future work in this area.

## 2. Theoretical Framework

This chapter identifies relevant theories of learning and design principles that inform the design and development of tutorials in multiplayer contexts, and which serve as the basis for the later practical work.

The main purpose of onboarding in games is to introduce players to core systems and mechanics, ensuring they acquire the necessary skills needed to progress. Tutorials are essentially a learning process. Theories of learning like *cognitive load* and *scaffolding* offer useful perspectives when analysing game learning. Many designers draw on these principles when adapting traditional instructional frameworks to the interactive medium of games (Chang & Yang, 2023). Game designers face the additional challenge of balancing the need for comprehension with the demand to create engagement and excitement.

First, I will discuss what I refer to as *core teaching principles*. They focus on how players learn in general, and in social situations, when mechanics should be introduced, and the environments that best support their learning.

Then, I will briefly discuss some concepts that can be used to refine these principles in a gaming context and thus further improve knowledge retention and the overall enjoyment of the learning experience.

The chapter concludes by synthesizing these findings to highlight the most relevant ideas and principles for onboarding in multiplayer contexts and creating a list of guidelines and design insights, which will directly inform the development of my prototype.

### 2.1 Learning in General

According to Sweller's (1988) *cognitive load* theory, learning is most effective when the amount of information presented aligns with the learner's mental processing capacity. Applied to a video game context, when tutorials overwhelm players with too many instructions simultaneously, learning becomes less efficient and players are unable to focus their attention on mastering core mechanics. As such, I will first examine the details of how, when, and where people generally learn effectively to derive insight into constructing effective tutorials.

#### How Players Learn

Two key concepts to consider when it comes to *how* players acquire knowledge and skill during onboarding are *experiential learning* (Dewey, 1938/1986) and *feedback* (e.g., Schell, 2008).

Experiential learning in educational contexts as well as in games means that players are not only provided information but asked to apply said information practically. They learn by performing a task, succeeding or failing at it, rather than being told solely through tutorial messages. In his article *Learning and Games* 2008 Gee argues that people primarily think and learn through experiences they have had which prepare them for problem solving in comparable new situations. Similarly, Dewey (1986) describes experiences as an interaction between the individual and their environment. Learning should not just be passive reception of information but involve active participation and reflection. Engaging learners in experiences relevant to them arouses curiosity and creates desire that cultivates habits of self-sufficient problem solving and future learning. Each experience builds on past ones and shapes future ones, so great care should be taken to ensure that these experiences are educational and shape subsequent experiences productively.

In games, players form experiences by discovering rules through curiosity and experimentation. They learn best when they act, the game world responds, and they can reflect on the outcome. Game designers often try to create spaces that allow players to experiment and figure out mechanics on their own before escalating complexity. For example, *Portal* (Valve, 2007) teaches puzzle mechanics by letting players test their tools and explore how the game's linked portals work before increasing the difficulty of their challenges and adding more complexity. In initial rooms, the player's portal gun allows them to only shoot blue portals at first, introducing the orange portal function to create linked portals later on, after players have grown comfortable with the basic mechanics.

This explorative approach is key for optimal onboarding in games because players, like learners in Dewey's (1986) view, grow best and retain knowledge effectively when early interactions are meaningful, connected, and prepare them for future play.

To support this, many scholars and designers stress the importance of immediate feedback to effectively teach players what actions to take and to recognize their own errors (e.g., Skinner, 1965; Salen et al., 2003; Schell, 2008). For example Skinner (1965) writes that behavior is strengthened or weakened through consequences. A rewarded behavior is more likely to be repeated, while an unrewarded or punished behavior has the opposite effect and dissuades players from behaving in certain ways.

Feedback in games, the visual, auditory, or haptic signals that inform players about the outcome of their actions, can have many forms. In his book *The Art of Game Design: A Book of Lenses* (2008) Jesse Schell lists common types of rewards that fulfill his proposed players' desire to be judged favorably: positive reinforcement like praise in the form of text or via sounds and animations; points or other measurements of success as a gateway to another reward; or new powers to reach your goal more quickly or feel stronger. These can all be utilized to encourage desired player behavior. Prolonging play through giving players an extra life or more time to complete a level, presenting them with new monsters, or moving the plot forward are all rewards that should be deliberately utilised and spread out over the course of the game.

Gabe Newell (2000), lead designer on the game *Half-Life* (Valve, 1998) emphasizes the approach of programming rewards systematically in the form of a *reinforcement schedule* to make sure there are never long passages where nothing new is happening and no rewards are received. Schell (2008) agrees that rewards should be delivered strategically to avoid players getting acclimated to them. He suggests gradually increasing the value of the rewards as the game progresses and possibly making them variable instead of predictable. Similarly, punishments need to be utilized carefully and deliberately, according to Schell. Used properly, punishment can even enhance the players' enjoyment of a game. Balancing

potential rewards against risks can increase their perceived value and for players that enjoy a challenge, punishing setbacks due to failure boost the feeling of accomplishment when overcoming that hurdle.

Both Schell (2008) and Skinner (1965), however, note that a positive reward is generally a better tool for reinforcement than punishment. Skinner observes that contrary to the effect of positive reinforcement, the use of punishment produces merely a temporary suppression of the behavior, not a true reduction in the number of undesired responses. Schell also stresses the importance of the context in which negative reinforcement is received and how it is perceived by the player. He argues that punishment that feels unpredictable and inescapable creates a strong sense of helplessness in players, producing a negative experience and causing them to deem the game unfair. Additional risks of poorly implemented feedback include overwhelming players with excessive sensory input, providing ambiguous or misleading cues rather than guide, and shifting players' focus away from the intrinsic enjoyment of mastering the game to merely chasing rewards (Schell, 2008).

### **When Players Learn**

The principles of experiential learning and feedback highlight the importance of active engagement and responsive systems in onboarding. Besides the manner in which players are introduced to new information, the effectiveness of instruction also depends heavily on *when* mechanics are introduced during play.

Gee (2008) insists that support is most effective when information arrives at the exact time it is relevant and meaningful to the player, oftentimes directly connected to the learner's current goal or activity. Similarly, Merrill (2007) adds that experiential learning is most effective when instructions are problem-centered, highlighting the importance of context in facilitating learning. Teahan and Galipeau (2023) state that the sheer amount of knowledge new players need to acquire when jumping into a new game, from gameplay mechanics to story and goals, can often be overwhelming if presented at the same time and thus without context or sufficient practical application. High cognitive load again becomes an issue when too much information is provided, even if relevant.

As such I will adhere to the concept of *scaffolding* as described by Wood, Bruner, and Ross (1976) in their publication *The Role of Tutoring in Problem Solving*. They use scaffolding as a metaphor in educational contexts, describing the organization of instructions through a tutor, or even other students, to learn new skills or overcome challenges that the learner cannot yet manage alone. The tutor simplifies a task that is beyond the learner's current capacity, letting the learner focus on what is within reach and over time reducing the support as the learner's competence increases. The scaffolding is slowly dismantled until it is no longer needed. This method is meant to gradually guide the learner to independence and increase the speed and efficacy of learning compared to unassisted learning.

Wood, Bruner, and Ross's (1976) theory also shares clear conceptual parallels with the *Zone of Proximal Development* (ZPD) originally developed by Lev Vygotsky (1930s; English translation published 1978, Vygotsky, 1978). ZPD is described as the range of tasks a learner can accomplish with guidance, but not alone, and scaffolding as the temporary support provided by a tutor to help a learner bridge this gap.

To ensure that learning takes place in the learner's ZPD, the tutor needs to be aware of the learner's current level of knowledge and skill to be able to create a task that pushes that limit to an appropriate extent. In the context of games, Gee (2003) proposes that presenting

problems in carefully ordered sequence provides a foundation for tackling more complex problems as the game progresses. This gives structure to the previously explored experiential learning approach that not only facilitates learning but also accelerates it and helps learners form better strategies than trial-and-error alone would produce.

Challenges of applying scaffolding to game tutorials include excessive scaffolding, when a tutor provides too much support. This results in learners becoming bored or dependent on external help, contradicting the concept's ultimate goal, which is to gradually remove support so the learner can act independently. On the other hand, insufficient guidance when introducing complex cases too soon may lead to confusion or frustration of the learner (Wood et al., 1976).

The concept of *contextual relevance* highlights the importance of timing in onboarding design. For players to absorb and retain information more effectively it is essential to avoid front-loading instructions, present new concepts only when they become relevant and immediately actionable, and design for transfer, meaning to ensure that skills taught in one context can be reapplied in different situations (Merrill, 2007).

### **Where Players Learn**

Contextual relevance speaks to *when* learning occurs. However, the context of *where* learning takes place, the environment and game spaces in which mechanics get introduced, shapes the conditions that make well timed and meaningful learning possible. The following section therefore examines principles that aid in creating environments that encourage and assist learning.

Games offer a unique opportunity to situate tasks and challenges within the game's world and narrative context, allowing learners to adopt new roles and identities and giving players a concrete sense of purpose for their actions. Barab et al. (2007) describe this as *situatedly embodied learning*, where content and learner are embedded in a virtual world, making their interactions feel consequential and meaningful. Rather than being confronted with abstract concepts, this contextualization allows players to interact with tools that make sense within the game and understand *why* a challenge matters. Barab et al. argue this approach deepens cognitive processing and supports transfer, because knowledge is tied to a lived experience rather than intangible principles. Just as the timing of feedback affects its impact, grounding tasks in the game's world ensures that challenges are meaningfully framed and experiences are directly tied to the environment.

*Where* a player learns, in this case, means not only the location or environment the learning takes place in, but also the context it is framed in and the conditions surrounding it.

Kapur (2008) highlights the value of creating safe spaces that permit players to freely experiment with the tools available to them without the fear of harsh consequences for failure. Allowing learners to grapple with problems initially without immediate guidance, even when this leads to errors or mistakes, is not a flaw but, as Kapur describes, a cognitive launchpad. He refers to this process as *productive failure*. After learners explore strategies independently and confront their own misconceptions, Kapur argues, targeted, well-designed instruction can reorganize their understanding, ultimately leading to stronger retention and more effective transfer of learning. Gee (2008) likewise views failure as a powerful aid for guided exploration and learning. He argues that, unlike in traditional schooling, failure in games serves a fundamentally different purpose. By letting players test their own hypotheses and treating failure as a means of uncovering underlying patterns and eventually achieving success, games reinforce the behaviors designers aim to cultivate.

Examples of this can be seen in Games such as *Celeste* (Maddy Makes Games & Extremely OK Games, 2018) and *Super Meat Boy* (Team Meat, 2010), which encourage risk taking and experimentation despite their high level of difficulty by making respawns quick and easy. *Portal* (Valve, 2007) and *The Stanley Parable* (Galactic Cafe, 2011), games known for their humor, encourage experimentation by framing failure in a playful way, fitting the tone of the game.

## 2.2 Social Learning

In multiplayer games, players learn not only from game systems but also from one another. Drawing on Albert Bandura's *social learning theory* (1977), observing and imitating more experienced teammates allows players to pick up on new mechanics more quickly, often without making mistakes themselves, and with overall reduced cognitive effort since they can adopt demonstrated behaviors directly. Learners evaluate the consequences of imitating others' actions and copying behaviors based on how favorable or unfavorable those consequences are perceived. Learning in a group can also enhance motivation, as participating in shared activities fosters a sense of connection and social recognition.

Social and collaborative learning is further strengthened when knowledge is distributed across the group, enabling players to leverage each other's skills and experiences to achieve higher levels of performance (Gee, 2008).

In cooperative games such as *Overcooked* (Ghost Town Games, 2016) or *Phasmophobia* (Kinetic Games, 2020), this becomes particularly evident. Success in these games is directly linked to how effectively teammates communicate and coordinate responsibilities to reach shared goals. *Overcooked*, for example, enforces collaboration by splitting up players, thus assigning each player individual cooking tasks that can only be completed through coordinated effort, such as one player having exclusive access to the stove, while the other to specific ingredients. In *Phasmophobia* players have a limited inventory that forces them to communicate on who takes what equipment with them to be able to succeed quickly, as the game's difficulty increases with time. These scenarios promote joint problem solving, provide immediate feedback, and reward successful cooperation.

Designers can deliberately strengthen social learning by creating situations that require interdependence. Shared conflict and tasks encourage players to work together, fostering a sense of community and collective achievement. Accommodating differences in skill levels within a group further supports collaborative learning. Offering tasks of varying complexity or roles that match their individual competencies allows players to bridge gaps in knowledge and experience, while reinforcing collaboration and peer support (Schell, 2008).

## 2.3 Good Game Design

Beyond the foundational principles discussed in the previous chapters, concepts like *immersion* and *flow* can bridge the gap from a good learning environment to a good gaming environment by shaping how players emotionally experience the early stages of a game. Though the game examined in this thesis is neither narrative-driven nor dependent on immersive world-building, these concepts build on earlier themes such as contextual relevance, feedback, and scaffolding and can help create tutorials that feel more natural and tightly integrated into the game world.

## Immersion

Murray (1997) describes immersion as “the experience of being transported to an elaborately simulated place” a sensation akin to being “surrounded by a completely other reality” (p.99). Building on this idea of transporting the player *into* a game or experience, Brown and Cairns (2004) argue that immersion develops gradually through three levels of involvement: *engagement*, where players invest effort in learning controls and overcoming initial barriers; *engrossment*, where emotional investment and compelling narratives deepen their connection; and *total immersion*, where players lose awareness of the outside world and feel like a part of the game world instead. Jennett et al. (2008) similarly emphasize this absorption, describing how games can draw players in so completely that they lose themselves in play, becoming unaware of time or external stimuli. Together, these perspectives frame immersion as a state of focused presence and emotional investment that arises from seamless design and uninterrupted interaction.

## Flow

Csikszentmihalyi (1990) defines *flow* as a state of optimal experience in which people become fully absorbed in an activity. Flow arises when challenge and skill are balanced in a way, where the task is difficult enough to demand focus but not so demanding that it induces frustration. In games, flow describes those moments when the player’s skills are matched by meaningful challenges. Actions feel intuitive and rewarding, challenges build naturally alongside the player’s growing competence (Schell, 2008).

## 2.4 Final Design Insights

Reviewing the theoretical perspectives and design principles explored in this chapter, several clear insights emerge that help inform the development of my project. Effective structuring of guidance, the thoughtful use of feedback, and the creation of learning environments that support experimentation and productive failure are all foundational tools for successful onboarding. Tutorials that facilitate immersion support learning by sustaining attention and encouraging players to persist through difficult but meaningful tasks. Introducing mechanics at a manageable pace, focusing on matching rising complexity with the player’s developing skill, creates the conditions in which flow can emerge. Effective onboarding aims to preserve the momentum of play, giving players just enough challenge and support to stay engaged and motivated.

The following design insights synthesize these ideas into a set of practical guidelines and serve as reference for future iterations of the tutorial.

### Clarity & Timing of Instruction

Well-designed onboardings should distribute information into manageable chunks that match the player’s cognitive capacity. Designers must strike the delicate balance in setting tasks just beyond the learner’s current independent ability and make instructions clear and actionable.

- Organize and distribute instructions across the span of the level to reduce cognitive load.

- Deliver guidance at the moment it becomes relevant.
- Integrate instruction into gameplay wherever possible (show, don't tell) and prioritise concise cues over long explanations.
- Increase the difficulty gradually, matching challenges to the player's skill.
- Sequence learning so that new mechanics build naturally on those the player has already mastered.

### **Productive Failure & Safe Exploration**

Game environments should not only be nice to look at and make players want to explore their surroundings, they are an essential tool in guiding the player and aiding subtly in their learning processes.

Mistakes should be quick, recoverable and informative, supporting experimentation without fear of being punished for not knowing how something works yet. This does not mean that failure should have no cost at all. Trivializing failure may stop players from taking it seriously and diminish the sense of accomplishment from overcoming challenges. Safe failure should lower emotional costs of failure while still keeping mistakes meaningful and instructive.

- Allow players to experiment and test out their new abilities without fearing harsh consequences.
- Frame mistakes in a humorous way, treat them as informative feedback.
- Failure should be quickly recoverable and not set players back far.

### **Feedback & Reinforcement**

Feedback should be clear, immediate, and proportional. It needs careful balancing and must be meaningful to the player's current goal. Effective feedback not only informs players about the consequences of their actions but also supports their decision-making by reinforcing what is relevant at that moment. It should strengthen learning without overwhelming or distracting players.

- Provide immediate, unambiguous feedback to reinforce desired behavior.
- Make audiovisual cues meaningful rather than overwhelming or distracting.
- Avoid feedback that feels random or uncontrollable.

### **Communication & Teamwork**

Social learning in multiplayer games offers significant benefits such as increased motivation and accelerated learning through imitation and shared knowledge, but it also presents unique challenges. Dominant players may unintentionally overshadow others, limiting learning opportunities for some team members. Negative peer feedback or poor group dynamics can reduce motivation and confidence, especially with tasks that require precise coordination that may become frustrating. Providing guidance that supports fair participation, scaffolding cooperative tasks, or assigning complementary roles are all design strategies that can mitigate these risks and ensure that collaborative learning remains inclusive and enjoyable.

- Build scenarios that enforce cooperation.
- Include checks that prohibit players from moving forward on their own.
- Set clear goals that are community driven.

- Reward players for cooperative behavior.

### **Reducing Immersion Breaks**

Immersion plays an important role in supporting player learning as it helps focus their attention, reduces distraction, and strengthens the sense of purpose behind their actions. When players feel present in the game world, they are more willing to experiment and persist through challenges. For tutorials this means that instructions work best when they are integrated naturally into the game environment. Abrupt pop-ups, unclear controls, or intrusive user interfaces (UI) with walls of text or tonal inconsistencies can disrupt immersion and pull players out of the experience, making learning feel forced rather than intuitive.

- Minimize intrusive pop-ups and long explanations.
- Ground instructions and challenges in the logic, aesthetics, or narrative of the game world where possible.

## **3. Methodology**

To identify and test game design principles that support effective and engaging onboarding experiences in cooperative multiplayer games, a qualitative-focused, design-based research approach was chosen, combining iterative development of a tutorial prototype with empirical playtests. This approach supports both evaluating outcomes, to see whether players have understood the introduced mechanics and systems, and observing the players' interactions and perceptions during play.

### **3.1 Research Design**

The design integrates the iterative development of a small, early-stage game prototype implementing selected onboarding principles, alongside user testing sessions which evaluate its effectiveness in teaching and engaging players, and gather feedback for further refinement of the prototype.

This iteration used a cycle of planning, design, test, and analysis. Two test runs in which five pairs of blind participants — players who have never played the game before — each test the prototype and are asked to give feedback immediately after. Testing sessions take place in the players' own homes using the game's local multiplayer so the setting feels familiar, encouraging natural gameplay and authentic reactions. Based on the gathered feedback from the first group of testers, the prototype was revised before being presented to a second unrelated group of players, thus ensuring that neither group of players had any prior exposure to the game.

This iterative design process fits the exploratory nature of the study while keeping the findings grounded in both practical gameplay and design theory.

### 3.2 Prototype Development

The prototype was developed based on a review of relevant literature in game design, onboarding strategies, and educational research as well as a set of design principles that were derived from this material. These guidelines include *Clarity & Timing of Instruction*, *Productive Failure & Safe Exploration*, *Feedback & Reinforcement*, *Collaboration & Teamwork*, and *Reducing Immersion Breaks*.

The resulting prototype consists of the first level of the game *Vacunauts* which I will present in the subsequent chapter. The level introduces core mechanics to prepare players for the rest of the game while also aiming to create excitement and a sense of anticipation for what is to come.

### 3.3 Participants

The study involved 20 individuals in total, split into two groups of five pairings each. Participants were recruited in pairs. Although the game is designed for up to four players, for the main study I decided to reduce the volatility that larger groups might introduce. Different group sizes, particularly four-player teams, could lead to widely varying experiences depending on group dynamics, which makes results harder to compare. Testing in pairs provides more consistent outcomes for evaluating the onboarding design. Further examination with larger groups was carried out with a small sample to gain first impressions on different design challenges onboarding more than two players may introduce.

Participants were recruited from my personal network, which made organizing two-player teams easier. Testers range in age from 20 to 35 and have at least some interest in this type of game, aligning with the intended target audience. While a more diverse participant pool could be useful for testing in the future, this relatively uniform group was deemed sufficient for the early prototype, as the main goal for now was to determine whether the tutorial and teaching methods work as intended for the target demographic.

This study was designed in line with the DFG-Kodex ('Guidelines for Safeguarding Good Research Practice'). Further details on participant information, consent, and data handling procedures can be found in the Appendix.

### 3.4 Data Collection

Data was collected through playtest observations and post-test surveys. During each session, players received a brief introduction and I assisted with the technical setup if needed, after which they played through the tutorial level together without my interference. Whenever possible, I observed playtests in person to be able to see the players faces and hands during play. This added a new layer of information about how players play and experience the game that is only available live. Otherwise I listened and watched via Discord screenshare, asking players to turn on their camera if they felt comfortable doing so. Notes were taken on player behavior, difficulties, and interactions to capture important details and first impressions. Observations were not pre-structured, allowing flexibility to notice and focus on what seems relevant. Participants were encouraged to verbalize their thoughts during play, providing insight into their thought processes.

After completing the level, each player received a link to an online survey using Google Forms.

Five aspects were covered in the survey:

- Comprehension,
- teamwork and communication,
- ingame-character messages and guidance,
- overall experience,
- and player information.

General perceptions of mechanics, controls, and cooperation were captured through 4-point Likert scale questions. In order to discourage *safe* answers and prompt players to express more directional opinions (Lam & Green, 2019), I decided to not include a neutral midpoint. To avoid forcing guesses, I added an “I don’t know” option for mechanics or controls players did not encounter.

Participants were able to provide more details about their experiences or expand on their answers when asked open-ended questions. Finally, a short background section captured players’ overall gaming experience, familiarity with co-op gaming, and comfort with controllers, all of which may influence how quickly players pick up mechanics.

### 3.5 Data Analysis

Playtesting session observation notes were summarised into structured protocols and coded thematically after each study. I let patterns such as confusion, collaboration, or engagement surface during analysis rather than predefining all codes. Considering my close involvement in the game’s creation, this flexibility helped highlight problems I might have otherwise missed. After each round of testing, participants’ open-ended survey responses were added to the thematic coding, offering additional context and insight into their perspectives and experiences.

To find relationships, trends, and patterns in perceived comprehension, engagement, and cooperation, Likert-scale survey items were examined independently.

By combining these sources, I hoped to determine not only if players were able to learn the new concepts, but also how they felt about the process of learning, how cooperative play influenced onboarding, and how well the design principles supported engagement.

Protocols, thematic coding, and full quantitative results, including all Likert-scale item scores, comparative tables and diagrams, are available in the Appendix and digital Appendix.

### 3.6 Limitations

When analyzing the results, it is important to recognize and take into account a number of limitations. The small sample size restricts the generalizability of observations on good onboarding design, and convenience sampling may introduce bias. As a result, findings are exploratory and indicative, and should be interpreted as design insights rather than general rules. Despite efforts to create a comfortable, realistic gaming atmosphere, players’ interactions with the game may be impacted by the presence of an observer. Players used

their own equipment and space, so things like hardware performance, screen size, room arrangement, or internet connectivity might have affected how they played the game and how well I was able to observe their play. Lastly, my own perspective might influence how I perceived the findings because I am both the researcher and the designer. By using comprehensive documentation and transparent reporting, I hoped to reduce any potential prejudice.

### 3.7 Summary

This methodology assesses onboarding concepts in cooperative multiplayer games by combining iterative design with empirical playtesting. Observations, and post-test surveys offer complementary information about participants' experiences and how well the introduced mechanics were understood. The results not only inform the game prototype's iterations and enhancements, but they also help validate design principles for developing effective and engaging onboardings.

## 4. Game and Prototype Overview

This chapter aims to give an overview of the game that is subject of the playtest sessions and the development of the tutorial prototype which tests the previously established design guidelines.

### 4.1 About *Vacunauts*

*Vacunauts* (formerly known as *Stack 'Em Up*) is a game my team and I have been working on for the last 2 years alongside our studies. It has gone through many iterations and reworks in this time. In the game, players take on the role of a crew of intergalactic cleaners, tasked with maintaining planets and the company property on them. But it quickly escalates into chaotic fights against attacking alien enemies and saving the galaxy.

**Game Description** (created for internal use by the development team):

*Vacunauts* is an exhilarating on- and offline Multiplayer-Action Party-Game that combines strategic gameplay with chaotic fun. In this intergalactic adventure, players find themselves facing relentless waves of alien-robots that threaten various planets across the galaxy. The game offers both Co-Op multiplayer and PvPvE modes, allowing friends to team up against the slimy menace or compete against each other for supremacy (PvP not available yet).

At the core of the game's mechanics is the ability to absorb different types of slimes, each possessing unique abilities. As players navigate through the diverse landscapes of various planets, they must strategically choose and combine these slimes to create powerful synergies. Or just wing it and hope for the best.

Survival is key as players face multiple rounds of intense attacks, not only from enemies but also from the changing environment of each planet. Quick thinking and teamwork are

essential to overcome the challenges presented in each level. The game's progression involves traveling from one planet to another, with each location presenting new and increasingly difficult alien adversaries.

*Vacunauts* promises an engaging and laughter-filled gaming experience, combining cooperative teamwork and competitive showdowns. Whether players choose to work together to overcome the robotic onslaught or engage in fierce PvP battles, the game's vibrant visuals, creative slime combinations, and strategic depth make it a standout title in the Online-Multiplayer-Party-Game genre.

## 4.2 Prototype Goals

The main goals of the prototype are preparing and equipping the player with the tools and skills they need to progress through the game, to introduce and teach features in an intuitive way that encourages experimentation and collaboration, and to excite players for what the rest of the game holds in store for them.

## 4.3 List of Features

### Controls:

- moving
- dashing
- absorbing
- aiming
- shooting
- combining

### Gameplay:

- general game loop (absorb slimes, use their powers to defeat waves of enemies, protect the objective, and survive)
- shop and upgrades
- reviving dead players

## 4.4 Prototype Development

The prototype was developed in Unreal Engine 4 and later 5 (Epic Games, 2014/2022) and builds upon an existing project I am developing with my team. For the purpose of this thesis, I implemented the tutorial features and level design components described in this chapter. The prototype is designed to be played with Xbox controllers, and UI displaying controls will show Xbox buttons.

I began by making a list of all the features that needed to be taught and noted when and how to teach them. I then wrote a rough script of the tutorial's sequence of events and created a sketch of the level which I turned into a blockout, building the level using simple untextured placeholder geometry inside Unreal Engine to refine the layout. I developed and implemented all necessary features needed for the tutorial, including a custom game mode,

scriptable in-game events (eg., triggers and logic sequences), and interactable objects to make the level functional. Before moving forward I conducted an internal playtest session with my team to go over my ideas and validate the design choices I made. After some adjustments based on their feedback, the visual environment was refined with additional 3D assets created by the project's 3D artist.

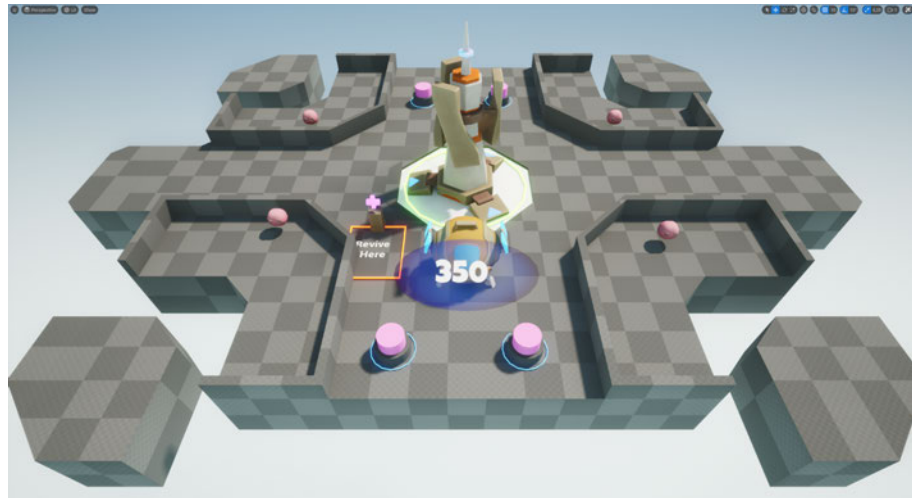


Figure 1: Screenshot of the early blockout-level inside Unreal Engine.

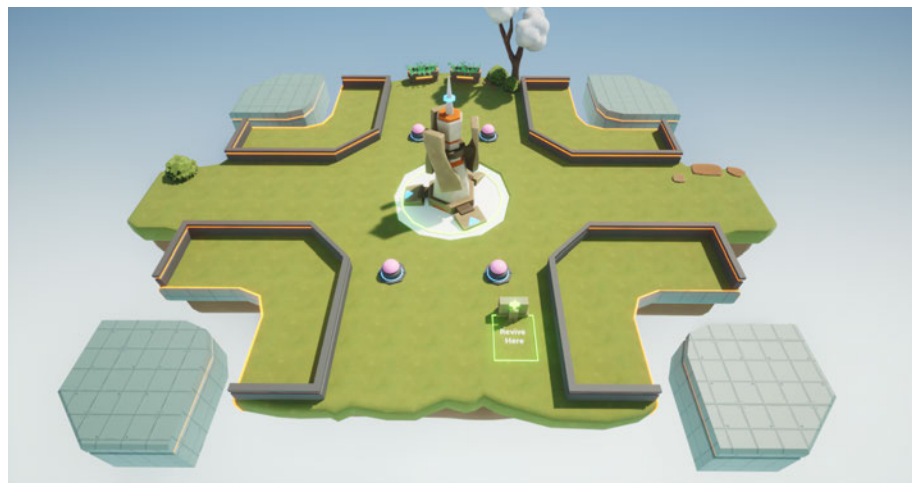


Figure 2: Screenshot of the level with some added 3D assets inside Unreal Engine.

The onboarding is designed to resemble a regular level as closely as possible, though some scripted events are unavoidable. By adhering to the original game loop and altering it only where needed, these sequences aim to feel seamless and fully integrated into the experience.

While the game is not primarily narrative-driven, it does feature a story: players are tasked with defending planets from the so-called *Rubbish Rebels*, who are wreaking havoc across the universe. To introduce this context, the game begins with a short intro sequence that uses hand-drawn illustrations and brief text to establish the setting, the threat, and the players' role.



Figure 3: Sample illustration from the introductory sequence, created by myself.

The tutorial can be divided into 3 segments, each with clear goals:

**1. Escape the Pods:** Each player spawns in their individual *pod* — a small fenced off area of the map — where players have to jump over a gap to reach the main land, absorb a slime-plushie and shoot it at a button outside to lower the fence and trigger some regular slimes to fall from the sky. Players can absorb these slimes and experiment with them while waiting for the other players to free themselves or help out their teammates.

- Goal of the player: Escape the pods.
- Goal of the tutorial segment: Teach players the basic movements and mechanics they need to play the game in a safe environment. Encourage first communications.

**2. Protect the Objective:** The *objective* — a large wind turbine — appears and any slimes that are still roaming around will start to attack it. After defending the objective from the slimes, the players are rewarded with an encouraging message from Moley, the helpful non-player character (NPC) that guides the player through the first interactions.

- Goal of the player: Defend the wind turbine from slimes.
- Goal of the tutorial segment: Teach the main goal of the game, and that slimes will attack the objective. This plays out in a relatively safe environment (the slimes will not harm the players but if left to their own devices, they will destroy the objective).

**3. The Game Begins:** This is where the game loop is fully introduced. The camera starts shaking, an alarm sounds aloud, and Moley informs the players that the Rubbish Rebels are about to appear. The actual gameplay begins. From here on out, the players will need to apply what they have learned and overcome increasingly difficult challenges in the form of more enemies, multiple enemy entry points and different enemy types, even a miniboss-like enemy. The shop and *stack wheel* get introduced in this segment but apart from that, the players are now playing the core game.

- Goal of the player: Defend the wind turbine from waves of enemies.
- Goal of the tutorial segment: Fully introduce the core gameplay loop and shift the tutorial from instruction-focused to mostly regular gameplay, as well as introduce the shop and combining mechanic.

After defeating the waves of enemies, players will be rewarded by Moley congratulating them and may choose to continue to the next level.

Structuring the tutorial in this way aims to keep players engaged and prevent frustration. Having multiple segments with individual short-term goals can help keep players motivated.

The tutorial represents the start of the game where players should get equipped with everything they need to know and learn to play the game. The overall tension should be low to avoid stressing the player but still hint at the chaos and action to come. The difficulty should be relatively low to remain accessible to novice players while respecting the player enough to not be patronizing.

The tension curve of the tutorial should roughly resemble the tension curve of the entire game: slow start, increase in intensity and difficulty, climax, and release.

Players spawn in their safe and secluded pods, where they have time to figure out the basics before entering the open level, joining their friends and facing more difficult challenges.

Tension builds as more mechanics get introduced and stakes become apparent: players need to protect the objective and survive the enemies' invasion.

A final test of skill, in the form of a miniboss-like enemy, is rewarded with a release in tension, satisfying visual effects, congratulations from Moley and the possibility to move on to the next level. This creates a sense of accomplishment and relief, and a feeling of anticipation of what challenges and rewards are waiting for them in the next level.

## 4.5 Applied Design Guidelines

Using the guidelines established in chapter 2.7 Final Design Insights, the goal of this chapter is to examine them in the context of *Vacunauts* and apply them to the prototype design.

### Clarity & Timing of Instruction

Instructions and new mechanics are introduced in a staggered sequence, each step building upon the previous one: the player starts by absorbing their first slime and using its ability; they are then presented with different kinds of slimes granting them new and diverse abilities needed to defeat the approaching enemies; to become even stronger, the shop provides the player with upgrades and the tools to combine slimes, unlocking even more powerful abilities; the player must then prove their skill and show their new strength when fighting the final miniboss-like enemy to successfully complete the level. Mechanics, like reviving teammates, are not introduced until they become relevant: in this case, when at least one player dies.

Wherever possible, instructions should be integrated into the game world so that players learn new mechanics through experimentation and actively performing them. In some cases, however, explicit explanations are necessary to ensure controls or complex features are understood. Controls, such as moving or shooting will be visualised in a UI popup at the start of the game to ensure even newcomers to games are able to control their characters on a rudimentary level.

To reflect the fun and light-hearted tone of the game within the explanations, they will be delivered by our grumpy but helpful supervisor NPC Moley.



Figure 4: Screenshot of UI showing Moley with a speech bubble.

His tone is sarcastic, he is surprised when the players do well and annoyed when they don't. Moley delivers explanations in a more entertaining and personable manner, encouraging the player without sounding overly enthusiastic or mechanical. This helps prevent instructions from feeling like chores or the onboarding process from resembling a traditional instruction menu.

### Productive Failure & Safe Exploration

The prototype is designed to support productive failure and safe exploration by allowing players to learn through action rather than passive instruction. Players are asked to apply newly acquired knowledge in order to progress. Mistakes are low-stakes. For example, an unsuccessful dash across to reach the main platform results in an instant respawn with no negative consequences beyond being placed back on the platform they started on, encouraging players to try again without frustration. Moley reinforces this framing through humorous commentary, making setbacks appear playful rather than punitive.

Enemies do not appear until players have exited their pods, giving them time to get comfortable with the controls and mechanics before facing any real threats. Even later in the game, dying or losing the objective only restarts the current wave instead of resetting the entire game, thus not erasing any substantial progress.

Players are furthermore encouraged to experiment with non-essential mechanics such as switching between abilities, ejecting slimes, or discovering which slime combination creates which effect by being given multiple slimes at once and providing the space to freely test their abilities.

### Feedback & Reinforcement

The game provides immediate and clear feedback to reinforce successful actions. For example when players manage to hit the pod-button, the game confirms the accomplished task with audio and visual feedback in the form of animations and sound effects, lowering the wall imprisoning them inside the pod and merging the floating island with the main landmass. Moley further reinforces progress by reacting to the player's actions or by advancing the narrative and gameplay.

## Communication & Teamwork

Communication and teamwork are essential to the prototype's design, as players must work together toward a shared objective. Multiple enemy entry points encourage players to split up and coordinate their positions rather than acting independently. Upgrades, like the stack wheel, become available to all players once purchased, reinforcing the idea of collective progress. While the currency is shared, most shop items are bought individually, requiring players to communicate on who should purchase which upgrade. Finally certain check points, like escaping the pods or using the stack wheel at least once, are shared across the team, preventing any single player from rushing ahead without their teammates.

## Reducing Immersion Breaks

The sarcastic NPC anchors the tutorial instructions within the narrative context of the game, helping tasks feel relevant, meaningful, and connected to the player's role in the world.

Wherever possible, challenges are framed in ways where the environment conveys the desired player action without explicit instructions. If the players take too long to understand certain mechanics, or perform specific tasks, after a certain amount of time the game will nudge the players in the right direction in the form of a small UI popup. For example right at the start of the game, players will need to shoot a slime-plushie over the wall and hit a button to progress further. This will not be explicitly explained since buttons needing to be pressed or hit are very common in games and players should be familiar with this mechanic. However, if a player fails to do so, none of the players can proceed. And if the other players are not able to help the struggling player, the game will come to an early end. That is why a hidden timer will run for these kinds of interactions and if a player has not achieved the task within this timeframe, the game will give a small hint to help the player along.



Figure 3: UI popup above button to show aim-controls.

In online multiplayer this hint will only be visible on the struggling player's screen, as it is not only unnecessary information for other players, but can also create pressure or a feeling of embarrassment for the struggling player. In local co-op the hint will be shown on the shared screen, allowing other players to help.

### **Features excluded from the tutorial:**

Some mechanics, while essential for the game later on, will be introduced after the tutorial has been completed. This long term staggering of new features and tools aims to increase the sense of discovery and progression, creating excitement to find new features in the future and simultaneously reduces the initial load put on players still learning the basics.

Examples for this are:

- enemies with elemental types (e.g., water-type enemies),
- elemental effects (e.g., electric-type abilities are strong against water-type enemies. Or setting fire to gasoline tanks will make them explode),
- more slime types (fire, rock, air),
- map mechanics (e.g., strong winds, cloud platforms, floods),
- non-slime actors you can absorb (such as exploding barrels),
- and new difficulty modes, other game modes (e.g., endless, pvp) and challenges.

An extensive list and information of features taught within the scope of the tutorial is included in the Appendix.

A recorded playthrough of both the initial and revised prototype can be found in the digital Appendix.

## **5. Results**

### **5.1 Study 1 – First Playtest**

The procedures for this first playtest followed the methodology outlined in chapter 3. Eight participants (four pairs) took part in the study, testing the first prototype under observation, followed by a post-session survey. The planned fifth session with participant nine and ten was canceled due to participants falling ill.

Survey results are organized around thematically derived categories: Comprehension, Prior Experience, Communication & Teamwork, NPC Interaction & Guidance, and Engagement. Descriptive statistics from Likert-scale items are used to illustrate general tendencies and support qualitative interpretations/findings.

Observation notes were summarised, focusing on participants' behaviors, difficulties, and visible signs of comprehension or confusion and recurring issues and behaviors were thematically coded to identify patterns across participants. Open-ended survey items were added to the coding, and Likert-scale items were summarized in Google Sheets and analyzed for reliability, discrimination, and statistical significance.

#### **Summary of the playthrough:**

Most players quickly overcame the first hurdle, a small gap separating them from the main landmass. They either recalled the UI popup showing the controls a moment earlier, experimented with buttons, or, in a few cases, asked their partner how to jump across.

However, escaping the pods proved more challenging, particularly for players with less prior gaming experience. While most players absorbed the slime-plushie quickly, sometimes deliberately, sometimes by accident, shooting it over the wall and hitting the button to lower the wall was more difficult, typically requiring multiple attempts (on average more than three).

Following the initial dialog, the first invading enemies appeared, generating observable excitement for some as the countdown ticked down. All players successfully defeated this first wave with no player losing more than a quarter of their health. Afterwards, the shop and combination wheel were introduced. While some players struggled with interpreting the shop UI, most figured out how to purchase items after a few seconds of experimentation or by trying every button on their controller.

Next, players were given a brief explanation on how to use the new combining mechanic, which was read aloud by most pairs. They received two abilities and were required to combine at least once. Almost all players needed multiple attempts to successfully use this mechanic and some required repeated assistance from their partners.

Subsequent waves of enemies were successfully defeated, with only one pair dying to the Bruiser enemy during the final encounter. After restarting the wave, this pair also managed to defeat all attackers.

All participants completed the tutorial successfully. Although continuation was optional, every player proceeded to the next level, with some requesting to play more than once.

### **Observations:**

#### **Struggles with Controls:**

Players appeared to struggle with the amount of controls and rapid succession in which they were introduced. Using the stack wheel in particular proved difficult for many players. Some had not yet mastered the use of regular abilities, and the complexity of inputs involved in opening the wheel, selecting a desired combination, and confirming it, seemed to overwhelm them.

#### **Shop Comprehension Issues:**

When the shop was first introduced, many players initially struggled to purchase the presented items, missing key UI elements such as the *gloop count* displaying currency or the on-screen confirmation button. Some tried to absorb the shop item or stood directly on top of it, obscuring the button.

#### **Slime behavior:**

A common source of confusion arose when slimes became aggressive once the level objective had appeared. Players had initially interpreted the slimes as allies rather than threats, as they were non-aggressive and their cute appearance did not align with players' expectations of enemies. This shift left very little time for experimentation with the absorb-and-shoot mechanic, since the slimes had to be eliminated swiftly before the real enemies arrived.

#### **Pacing Issues:**

Breaks between waves noticeably relaxed players. Many used this time to continue experimenting with their abilities and the combination mechanic. Players expressed the wish to have more time to familiarize themselves with these mechanics and that they felt rushed. The lack of available slimes during breaks meant players could only use what they had collected before the wave.

Enemy waves were often very quickly defeated and the tutorial level itself was completed in only a few minutes.

#### Communication and Teamwork:

Most teams communicated frequently from the start and throughout the entire testing session. Thoughts on newly discovered features were shared, excitement expressed, and mistakes laughed about together. Some players coordinated their efforts in defending the objective from the advancing enemies. A handful of players deliberated on which shop item to buy and who gets to buy it, while others complained about their partners greedily using all their currency.

#### Mutual Help:

Some players struggled more than others and appeared to rely heavily on their partners. Without their support, those players may not have been able to complete the level on their own. The dominant partners did not seem to mind this, however, some expressing delight in helping out their teammate. In more balanced compositions, players aided each other frequently with various tasks.

#### High Engagement:

Although continuation was not required, all participants voluntarily and often visibly and audibly excited proceeded to the next level, suggesting that the tutorial successfully fostered a sense of excitement and anticipation to keep playing.

### Survey Insights: Comprehension

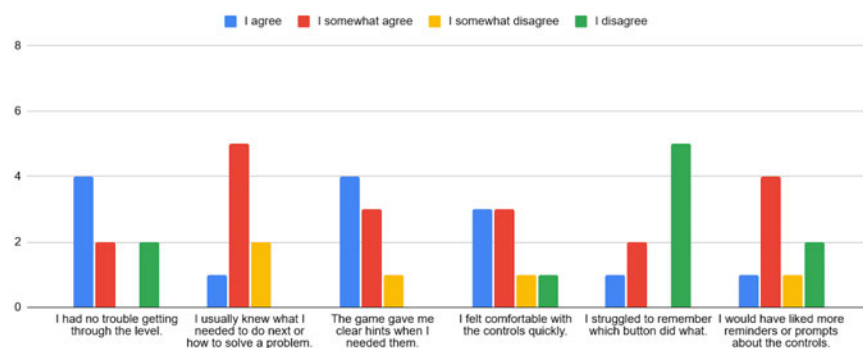


Figure 5: Graph showing Likert-scale item results for comprehension of Group 1.

Figure 5 shows that most participants of the first study indicated that they generally understood what to do during the tutorial and that they were able to play through the level without difficulties. However, more than half also agreed that they would have liked more explicit instructions about controls, suggesting that explanations of controls were insufficient. It is interesting to note, that while most answers suggest that comprehension was generally high, some players have indicated overall poor comprehension and trouble with the game.

Open-ended survey questions about comprehension support the observation that the combination system was overall not well understood. One player says that “the combining of elements is fun and inspires experimenting” but notes that it is complicated to use and the lack of space to practice and get comfortable with it made them mostly avoid using the mechanic. Seven out of eight responses to the question “Were there any specific controls or mechanics you found confusing?” included the players’ struggles with combining.

### Survey Insights: Prior Experience

Participants rated their overall gaming experience level as high, with 87.5% claiming they play games multiple times a week. Nearly two-thirds of participants (62.5%) reported playing cooperative games multiple times per week, while remaining responses ranged evenly from playing almost never to once a week (each 12.5%).

Controller comfort levels were fairly evenly distributed, with players' responses varying from occasional to frequent controller use.

### Survey Insights: Communication & Teamwork

Players reported strong communication, most notably 100% of participants answered "all the time" to the question "Did you communicate with your partner" and more than half agreed that collaborating with their partner made the level more enjoyable.

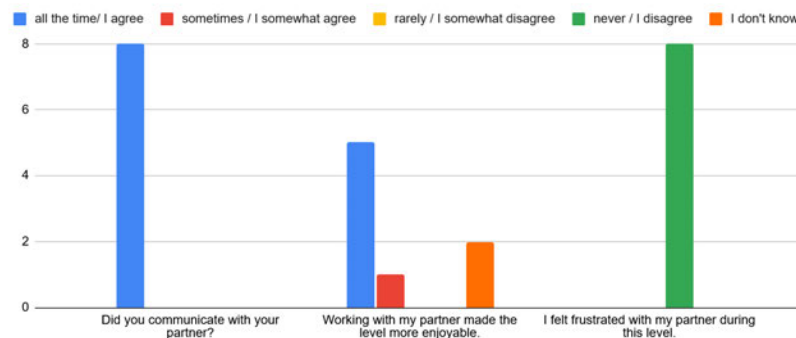


Figure 6: Graph showing sample of item results for communication and teamwork of Group 1.

Players' attitudes toward teamwork were generally positive. Open-ended survey questions support the observations that players helped each other frequently and worked together to solve problems. Overall frustration with their partner was overwhelmingly low. When asked whether they felt they held their partner back or vice versa, almost all participants disagreed. Several participants specifically enjoyed using supportive abilities, such as healing, to assist their partner, while others preferred dealing high amounts of damage, suggesting complementary play styles even if formal roles did not fully form.

### Survey Insights: NPC Interaction & Guidance

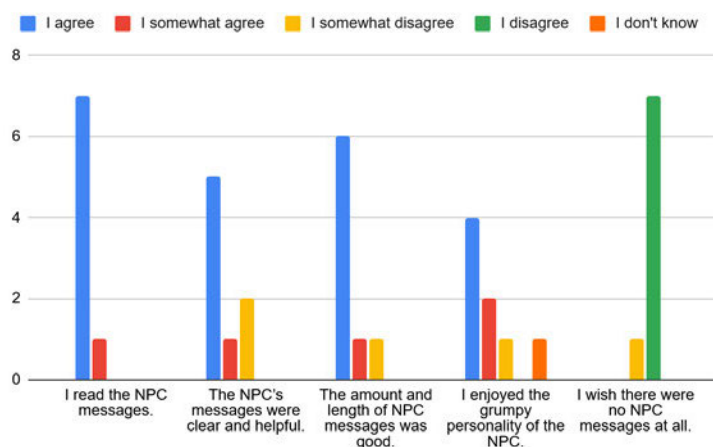


Figure 7: Graph showing Likert-scale item results for NPC guidance of Group 1.

Figure 7 shows that participants perceived the NPC messages as generally helpful, and that they enjoyed the sarcastic personality of Moley. Only two players felt that the instructions lacked clarity and almost none wished the game contained no NPC messages at all.

Most participants noted that they figured things out through experimentation, more so than through Moley's hints. Some used a combination of both. Multiple players reported the NPC did not provide enough instructions, while others emphasized that they enjoyed the independence of exploring the mechanics on their own.

### Survey Insights: Engagement

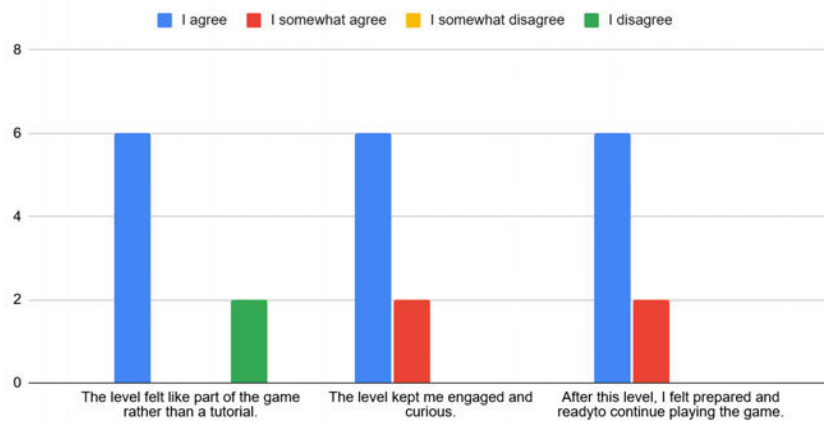


Figure 8: Graph showing Likert-scale item results for engagement of Group 1.

The graph shown in figure 8 shows that engagement was generally viewed as high. Most players indicated that they perceived the tutorial as part of the game and that it prepared them well for the rest of the game.

Participants were asked to elaborate on anything they still found confusing, what the most fun or memorable moment was for them, if they would like to change anything, or add anything else. Leftover uncertainty was mostly concerning the combination mechanic, although three participants stated that creating new abilities was their favourite aspect of the game as well as two participants mentioning they would have liked a list of the combinations that they had already found and to experiment more.

## 5.2 Design Implications

Observations and survey feedback indicate that participants struggled most with the volume and speed at which they were introduced to new mechanics. While players with a lot of prior gaming experience seemed to have less difficulties overall, inexperienced players did not understand mechanics quickly enough to keep up with the tutorials pacing. They were less open to experimentation and exploring mechanics independently.

The combination system in particular proved difficult for players to pick up initially, especially for players who hadn't yet grown comfortable with the basic movements and abilities. The timing of this features' introduction needed to be reevaluated.

Some mechanics seemed to confuse players or created false expectations for the rest of the game: the slime-plushie was only encountered once at the start of the game and had a unique visual indicator when aiming; the button that players could interact with to change the environment was also not a recurring object.

Players' feedback on how they were surprised that the slimes attacked the objective, after showing no signs of aggression toward the players, made it apparent that my team and I needed to rethink the slime behavior.

### **5.3 Prototype Improvements**

To address the issues listed in the previous section, the following changes were made to the prototype.

#### **Timing**

To improve pacing and reduce stress, the introduction of the combination wheel was delayed, giving players more time to explore and master the basic mechanics. Special attention was paid to teaching the combination system itself: while NPC messages remained the same, players were encouraged to experiment with the mechanic in a safe environment and with unlimited time. For this purpose, the electrical towers introduced at the start of the game reappeared, now with the added challenge that players needed to activate all of them simultaneously, enforcing the use of combined abilities.

#### **Removing, Changing or Replacing Confusing Features**

Mechanics that were confusing or superfluous, such as the slime-plushie, were reworked or cut entirely. The slime-plushie was removed and replaced by a regular lightning slime, simplifying the first interaction the player has with a slime and allowing them to familiarize themselves with standard abilities more quickly. The button previously associated with the slime-plushie was replaced by an electrical tower placed intentionally inside the pod to make its association with the first task more apparent. The tower glows in the same color as the wall to indicate their connection and uses the same symbol as the lightning ability in the players' tanks to hint at which ability should be used.

To fix the slime-behavior issues, my team and I agreed to change the slimes' behavior to fully non-threatening. They now roam harmlessly, spawning randomly up to a maximum limit to prevent flooding the level.

#### **Controls**

Based on player feedback regarding the difficulty of controls, NPC messages were added to provide clearer explanations for actions such as cycling through abilities or ejecting slimes. The input for switching abilities was moved from the d-pad to the shoulder buttons, which previously inhibited players from using the left stick to move their character. Opening and closing the combination wheel was mapped to the Y button.

### **Other Changes**

Minor edits were made to the NPC messages, adding new prompts at the start of the game and at key moments, with highlighted wording to emphasize important information. Adjustments were also made to ability damage numbers, shop items, upgrade strengths, and player health, and some UI elements were improved (e.g. font size, color, shop button visibility). One additional enemy wave was added to accommodate pacing changes and the delayed introduction of the combination wheel. Audio and visual feedback was added: for example, electrical towers change color when activated, and a continuous electrical charge effect signals that players need to use electricity on them.

## **5.4 Study 2 – Second Playtest**

The second playtest was conducted in the same way as the first. Ten participants (five pairs) tested the revised prototype under the same conditions.

### **Summary of the playthrough:**

After dashing onto the main island, players faced the task of absorbing a regular lightning slime and using it to activate an electrical tower that lowers the walls. There were no notable differences from Group 1 in collecting the slime. Most players absorbed it almost immediately, though, similar to the first group, some initially did not realize they were supposed to shoot with it. After a few seconds of experimentation or with partner assistance, players managed to free themselves and often went straight to absorbing additional slimes. One pair failed to recognize the roaming water slimes as absorbable, instead attacking them with lightning slimes until the NPC dialog hinted that a different ability was needed to extinguish burning leaves. All other pairs quickly figured out what to do, sometimes even before the NPC dialog had finished, although some struggled to aim the water jet accurately.

All players successfully fended off the first wave of attackers and were presented with the first break and shop. This time, the shop offered regular upgrades rather than the combination wheel. Players generally had no trouble purchasing items, although a few, like members of Group 1, still missed the gloop UI and attempted to buy upgrades after their currency was depleted.

The next wave was defeated quickly by all pairs, after which they gained access to the combination wheel. Most players successfully combined abilities within one or two attempts, though some needed multiple tries or partner assistance. Activating the newly appeared electric towers proved more challenging for many. Some players were unsure of what to do, struggled to hit multiple towers at once, or missed them entirely, questioning why the game would not progress.

The final two waves were completed quickly by most players, with only one pair dying during the last wave. As with Group 1, all participants voluntarily proceeded to the next level.

## Observations:

### Struggles with Controls:

While the difficulties with the combination controls were not entirely eliminated, fewer players struggled with controls overall. Almost none of the players used the aiming function and hitting enemies appeared difficult.

### Shop Comprehension Issues:

The shop appeared generally better understood, with less players having difficulties buying items. Recognizing the available currency and lacking funds to purchase items, remained an issue.

### Slime behavior:

While one player mistook the water slime they met after escaping their pod for an opponent at first, having only used the lightning slime previously, there was no further confusion concerning the slimes and their purpose in the game.

### Pacing Issues:

Players made use of the available time between waves and before the first enemies attacked to experiment with the roaming slimes and their abilities. Only very few players were able to combine on their first try, but most players did not struggle long and many players used the mechanic continuously from that point on.

The overall length of the tutorial seemed more appropriate and while players still appeared stressed and played chaotically at times, this did not pose an issue in most participants playthroughs.

### Communication and Teamwork:

Similarly to Group 1, most participants communicated continuously through play. Noticeably more pairs were observed strategising and coordinating. In general, however, there were very few changes in this category compared to Group 1.

### Mutual Help:

Participants were observed assisting each other frequently. Players asked their partners to explain features when they didn't understand yet or imitated their behavior. Most players happily shared their knowledge with one another.

### High Engagement:

Players expressed excitement about new features and compared their favourite abilities. All participants asked to play the subsequent level.

## Survey Insights: Comprehension

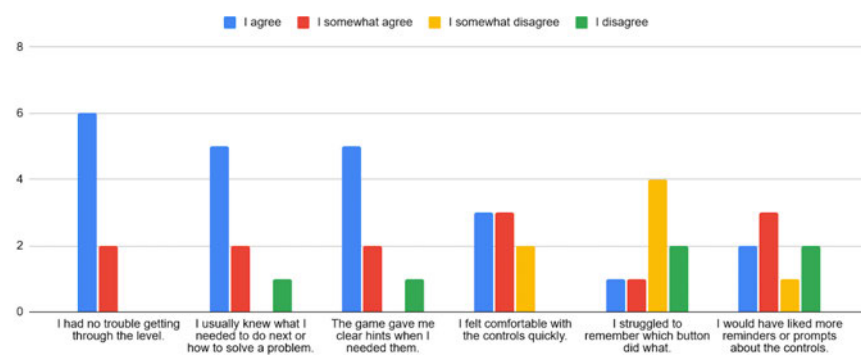


Figure 9: Graph showing Likert-scale item results for comprehension of Group 2.

Overall, the responses indicate that most players felt confident navigating the tutorial and understanding the mechanics introduced. The strong agreement in the first three items points toward effective level structure, pacing and communication of goals.

However, the final two items reveal there is still room for improvement of the teaching of controls. While most players felt comfortable, a portion of the player group would have benefited from optional or repeated reminders, especially in moments when multiple inputs are introduced close together.

Open-ended survey responses support this notion, as multiple participants noted they were confused at the start and missed some critical explanations.

### Survey Insights: Prior Experience

90% of participants indicated that they play games at least once a week. Comfortability with controllers was relatively balanced, ranging from players using controllers only sometimes, to all the time.

Responses show a wide range of engagement with cooperative multiplayer games, though overall participation is relatively low. A majority of players reported playing only occasionally or rarely (60%), while only 30% engage weekly or more often, indicating that many participants may not be deeply experienced with the genre.

### Survey Insights: Communication & Teamwork

Overall, players reported strong communication and generally effective collaboration. Seven out of ten participants stated that they communicated with their partner “all the time,” and the remaining three communicated “sometimes.”

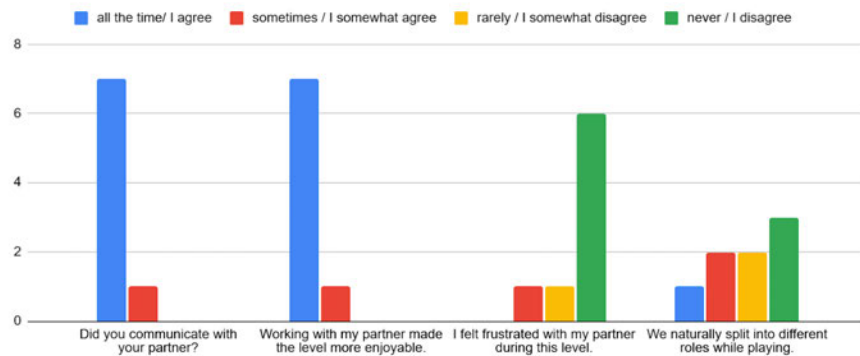


Figure 10: Graph showing sample of item results for communication and teamwork of Group 2.

Most participants agreed that working with their partner made the level more enjoyable, and frustration with teammates was rare. Role differentiation did not emerge naturally for most pairs, with only three players agreeing to some extent that the team split into different roles.

Open-ended responses reinforce the generally positive view of collaboration. Many players highlighted moments of helping each other understand controls, or overcome small challenges.

### Survey Insights: NPC Interaction & Guidance

The players responded to the guidance Moley provided generally positively. Most participants reported reading the NPC's messages, and nine out of ten found them clear and helpful. The grumpy personality of the NPC was well received, with seven players at least somewhat agreeing that they enjoyed this characterisation.

Open-ended answers indicate that players used a combination of experimentation and NPC hints to progress. While many felt the balance worked well, a few noted that they occasionally missed messages or would have appreciated clearer or more explicit instructions.

### Survey Insights: Engagement

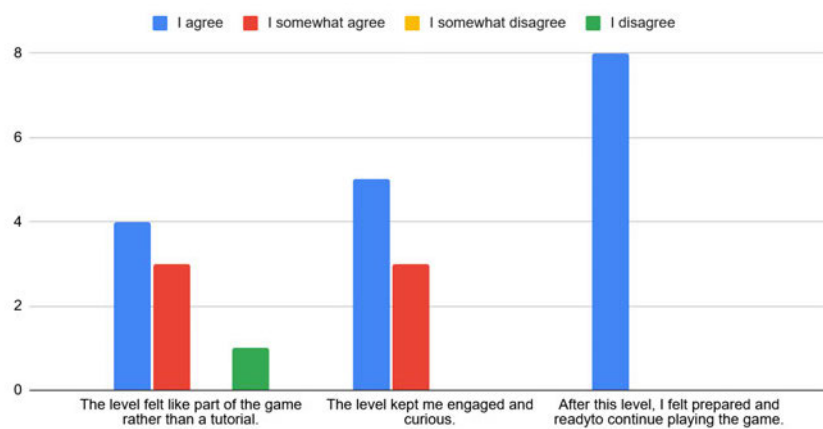


Figure 11: Graph showing Likert-scale item results for engagement of Group 2.

Participants generally responded positively to the overall experience of the tutorial level. Most players felt the level blended naturally into the game, with nine out of ten agreeing or somewhat agreeing with this statement. Eight players reported that the level kept them interested and curious throughout, indicating that engagement was high. All participants indicated they felt well-prepared to continue playing afterward, with eight agreeing and one somewhat agreeing that the tutorial equipped them with the necessary understanding to progress.

In open-ended responses most players stated that they were not left unsure about any mechanics after completing the level. Memorable moments often involved discovering combination abilities or reading the grumpy NPC's messages. Only a few participants suggested changes, such as introducing more enemy types or stretching out the tutorial slightly to allow more time to grow comfortable with the controls and mechanics.

## 5.5 Comparative Results

This chapter compares playtest observations and post-session survey data from both groups to assess whether the revised tutorial led to measurable improvements, particularly in players' comprehension. In addition, it examines how changes in other categories relate to or support these comprehension results.

### Justification for Removal of Outliers

During the analysis, two clear outliers emerged within the dataset. This pair of participants were the only individuals in the sample with professional experience as game developers, which fundamentally differentiated the way they played the prototype. Unlike the rest of the test group, they engaged with the tutorial not as typical players but as experts critically evaluating a prototype. They scrutinized details most players overlooked and gave continuous and comprehensive critique during play. While this expert perspective constitutes highly valuable feedback, it introduces bias when evaluating the onboarding experience from a player-learning perspective.

Because their approach differed substantially from those of regular players, their survey responses disproportionately skewed the results. Their ratings produced reversed trends in key measures, such as the overall comprehension score, which misleadingly suggested that the second prototype performed worse, as they rated their own comprehension poorly, despite having observably a better grasp of the mechanics than nearly everyone else. Removing the pairs' results showed the expected improvement (average Group 1 = 1.02; average Group 2 = 1.13; average Group 2 excluding outliers = 0.83; lower is better). The influence of the expert pair was also evident in the variance data across categories. Variance decreased substantially once the two participants were removed. This indicates that their responses were not only extreme but also inconsistent with the rest of the sample.

Including these cases therefore reduces the comparability between groups and undermines the internal validity of the study. For this reason, the two expert participants were treated as outliers and excluded from the comparative statistical analysis, while their feedback remains documented qualitatively.

The original spreadsheet (outliers marked orange) and the spreadsheet excluding the outlier participants can be found in the digital Appendix.

### Reliability: Cronbach's Alpha

Cronbach's Alpha calculation was used to test Likert-scale survey items' reliability. With the exception of the construct *NPC Interaction & Guidance* alpha values lie between 0.69 and 0.93 which shows a range from questionable to excellent reliability (George & Mallery, 2016).

| Construct                  | Cronbach's Alpha |
|----------------------------|------------------|
| Comprehension              | 0.69             |
| Prior Experience           | 0.84             |
| Communication              | 0.92             |
| Teamwork                   | 0.93             |
| NPC Interaction & Guidance | 0.02             |
| Engagement                 | 0.76             |

Table 1: Table showing Cronbach's alpha values of all survey constructs.

## Comprehension

Comprehension was the primary focus of the comparative analysis, as the revised tutorial was designed specifically to improve players' understanding of the game's mechanics and controls.

Average comprehension scores changed from 1.02 in Group 1 to 0.83 in Group 2, with lower values indicating better comprehension. This represents the strongest positive shift observed across all categories. Item discrimination values ranged from 0.31 to 0.69, demonstrating moderate to high success at distinguishing between participants who understood the mechanics well and those who struggled.

Despite the clear difference in average scores, the Mann-Whitney U test did not reach the threshold for statistical significance (U-value = 28, above the required 15). This is largely attributable to the small sample size and the similarity in the distribution of responses across both groups. Nevertheless, the score difference combined with the stable item performance and relatively low variance suggests that the revised tutorial likely contributed to improved comprehension.

Participants in the second group reported less difficulties overall in the open-ended survey responses. Most notably, participants mentioned struggling to use the combination mechanic in only two out of six responses compared to seven out of eight within Group 1, indicating overall improved understanding and less confusion by the player.

Comprehension shows some evidence of improvement following the tutorial revision. Although significance thresholds were not met, the average scores, effective item discrimination, and low variance align with what would be expected if the revised tutorial successfully refined clarity of instructions and improved players' understanding.

## Prior Experience

In the survey participants were asked to rate their prior experience with gaming in general, cooperative games and playing using a controller. This was included to determine whether differences in players' familiarity with games might have influenced how each group engaged with the tutorial.

Item discrimination values for this category ranged from 0.28 to 0.42, which indicates the items were moderately effective at distinguishing between players with more and less prior experience.

Average experience scores changed from 0.63 in Group 1 to 1.25 in Group 2, with lower values indicating more prior experience. This suggests that players in Group 1 were slightly more experienced. The Mann-Whitney U test yielded a value of 15, which meets the significance threshold.

However, correlation analyses show no statistically significant relationship between prior experience and comprehension improvement ( $t = 1.58$ , below the significance threshold), which might be due to the level of prior experience being generally fairly high.

One notable difference lies in the Groups' experience specifically with cooperative games (see figure 12 and figure 13 below). Compared to the first study's sample, consisting of highly active players, with a clear majority engaging in co-op play multiple times a week, the second study involved participants with relatively limited engagement in cooperative multiplayer games. This reveals a strong contrast in player familiarity with the genre and

suggests that the two groups differ substantially in prior experience, which may influence how confidently and quickly they learn new game mechanics.

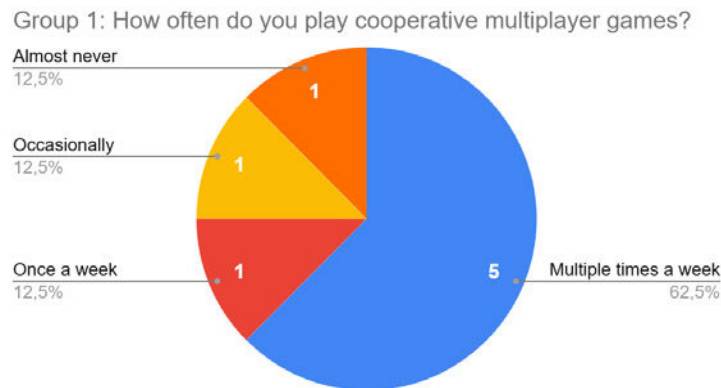


Figure 12: Chart showing results for prior experience in cooperative games of Group 1.

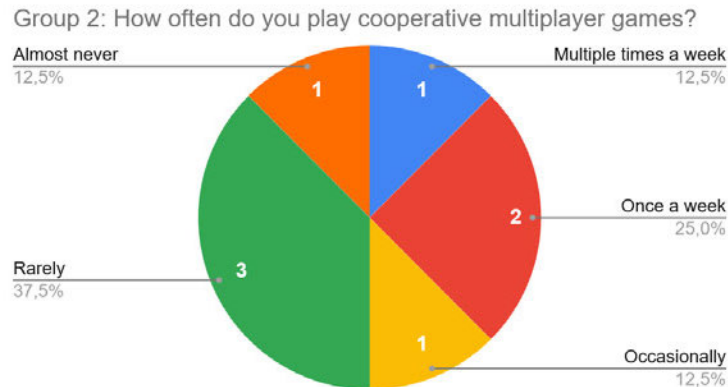


Figure 13: Chart showing results for prior experience in cooperative games of Group 2.

Prior experience appears unevenly distributed across the groups. Despite this, the category does not correlate significantly with comprehension, suggesting that the improvements overserved in Group 2 are unlikely to be attributed to differences in player experience. This supports the validity of comparing the groups' comprehension outcomes without adjusting heavily for prior experience.

### Communication & Teamwork

Item discrimination values for this category ranged from 0.07 to 0.37, which reflects weak to moderate ability of the items to differentiate between responders with high and low overall scores.

Across both test groups, communication scores were relatively similar, and the revised tutorial did not lead to a clear improvement in this category. The average communication score improved slightly from 0.63 in Group 1 to 0.54 in Group 2 (lower values indicating better communication), suggesting a minor positive trend. However, this difference was too small to reach statistical significance. The Mann-Whitney U test yielded a U-value of 27.5, well above the threshold of 15, indicating that the difference between groups is not statistically meaningful.

Correlation tests did not show meaningful relationships between communication and comprehension outcomes. This suggests that communication during the tutorial did not strongly predict how well players understood the game mechanics.

In summary, the revised tutorial did not considerably change how players communicated, nor did communication influence comprehension outcomes. Most pairs communicated sufficiently regardless of the tutorial version (see figure 14 below).

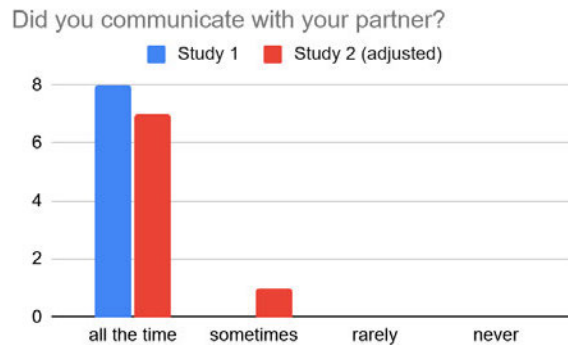


Figure 14: Graph showing results for communication of both Group 1 and Group 2.

Teamwork results presented a more complex picture. Average teamwork scores changed from 0.45 in Group 1 to 0.58 in Group 2 (lower values indicating better teamwork), which suggests a slight decline in perceived cooperation in the second prototype. However, item discrimination was poor (values were close to 0 or even negative), making confident interpretation difficult. This indicates that this construct was likely poorly framed.

Despite this, correlation with comprehension revealed a significant positive relationship between teamwork and comprehension ( $t = 3.34 > 2.145$ ). The Mann-Whitney U test again indicated no statistically significant difference between groups (U-value = 22.5, above 15).

These results suggest that teamwork may have supported comprehension in the first prototype, but the relationship weakened in the revised tutorial. Given the presence of one irregular item and the high variance, the results should be interpreted cautiously.

Open-ended responses for both groups showed broadly similar themes. In both groups, players described enjoying helping each other with controls, understanding mechanics, or healing an injured teammate. While neither group showed strong evidence of role differentiation, responses of Group 1 hinted at slightly more teamwork-focused interactions, aligning with the stronger correlation between teamwork and comprehension found in the quantitative data.

### NPC Interaction & Guidance

This category was intended to measure how effectively the grumpy quest-giver character Moley supported players in their learning process. However, this category demonstrated substantial weaknesses, making comparative results difficult to interpret reliably. Item discrimination values varied widely (0.14 to 0.72), indicating that while one or two items distinguished participants reasonably well, several others failed to do so.

The Cronbach's alpha value for the category was 0.2, indicating almost no internal consistency.

A more detailed statistical interpretation of this category would be unreliable, as the inconsistent item discrimination, and almost non-existing internal consistency indicate that the scale did not function as a coherent measure. Any deeper quantitative analysis would risk attributing meaning to patterns likely resulting from measurement error.

Open-ended responses, however, suggest that NPC guidance did play a role in comprehension. While some players noted that instructions were sometimes unclear, most participants reported benefiting from them and expressed a desire for more guidance, indicating that the issue lies with the measurement rather than the underlying gameplay experience.

### **Engagement**

Engagement was similar across both studies. Item discrimination varied considerably (0.23 to 0.70), with one item showing much higher variance than the others. This was likely due to the question focusing less directly on the players' feeling of engagement and curiosity, instead asking whether the tutorial appeared like a natural part of the game. This suggests that the outlier item may not have been as closely related to engagement as intended.

Average engagement scores indicated slightly better engagement for Group 2 (0.38, lower indicates higher engagement) compared to Group 1 (0.42). However, a Mann-Whitney U test did not find this difference statistically significant enough (U-value = 27.5, well above the threshold of 15). Similarly, correlations between engagement and comprehension were not significant.

Open-ended responses echoed these findings as there were no meaningful differences in participants' descriptions of engagement. The only notable difference was that participants in Group 2 reported fewer remaining uncertainties after completing the level, suggesting improved comprehension rather than higher engagement per se.

In summary, the results indicate that while the revised tutorial did not significantly change self-reported engagement, qualitative feedback indicates it supported a clearer understanding of the game mechanics, aligning with the improvements observed in comprehension measures.

## **5.6 Further Examination**

To gain an initial impression of how the onboarding prototype scales beyond pairs of players, I conducted a small exploratory playtest with three groups of 3–4 participants each. Due to the very limited sample size, no statistical data was collected, instead the sessions focused purely on qualitative observations.

Tracking multiple simultaneous interactions, overlapping communication, and team dynamics proved considerably more challenging than in two-player sessions.

Overall, play with more than two participants became noticeably more chaotic and uncoordinated. This was especially true when no clear leader emerged early on, making sure the group followed instructions. Spatial constraints and enemy count also revealed balancing issues, as the level provided insufficient room and challenge for larger groups. The increased number of visual effects on screen occasionally caused confusion, and written instructions were often overlooked as players frequently distracted one another.

Despite this, the sessions were lively and players seemed to enjoy the experience. Confusion or misunderstandings often led to laughter, and players tended to support each other even when speaking over one another.

Because these observations were exploratory in nature, further systematic testing, ideally with adaptive balancing and additional observers, will be necessary to form reliable conclusions about larger-group onboarding.

## 6. Discussion

Aim of this research was to examine design principles for effective onboarding in cooperative multiplayer games by creating and evaluating a prototype tutorial. Drawing on theories of learning, and game design, a set of guidelines was developed.

Across both studies, results suggest that the revised tutorial improved comprehension of the game's mechanics. Although the quantitative data did not reach statistical significance, which was likely due to the limited sample size and inconsistent performance of certain survey items, the overall pattern of findings aligns with this interpretation. Observational notes and open-ended survey responses strongly reinforced the impression that players in the second study were able to understand key systems more quickly and with fewer lingering uncertainties.

Several relationships between the measured categories and overall comprehension were examined. Prior gaming experience did not correlate meaningfully with comprehension, indicating that the tutorial was accessible regardless of players' backgrounds, though this could be because of an overall fairly high level of familiarity with games across participants. Players all communicated with one another frequently and consistently in both groups, which might be the reason there was no observable correlation between communication on its own and improved comprehension. In contrast, differences in teamwork and coordination did show indications of a positive relationship with improved understanding. This was mirrored in the qualitative feedback, where players often referred to moments of joint problem solving and mutual support.

The survey category concerning NPC interaction and guidance proved statistically unreliable due to low variance and inconsistent item discrimination, preventing confident quantitative interpretation. Observational and qualitative data suggest that the NPC's guidance contributed meaningfully to comprehension. Many participants indicated they learned through a mix of independent experimentation and guided instruction and some expressed a desire for more explicit instructions from Moley, while also responding positively to his personality and sarcastic tone.

Finally, engagement measured no significant differences between groups and did not correlate with comprehension, a pattern reflected in open-ended responses. Players reported enjoying the experience regardless of prototype version, and engagement appeared stable and high overall.

In summary, the findings show no significant proof that the prototype's revisions following the hypothesized guidelines improved learning results, but the observations consistently lean in the expected directions. Refined surveys and more populous and representative samples would be necessary to make conclusive statements over the effects of revision, but

the tutorial itself improved players' comprehension while maintaining strong engagement and cooperative interaction.

### **Implications for Game Design**

Existing literature emphasizes the importance of clear and well-timed instruction, opportunities for safe experimentation, meaningful feedback, and integration of tutorial elements into the world of the game. The changes implemented in the revised prototype point toward the relevance of these principles, although the improvements observed were modest and did not reach statistical significance. Nonetheless, qualitative feedback and observational data suggest that the adjustments contributed to clearer understanding for some players, indicating that refinements of onboarding practices may still play a meaningful role in supporting comprehension.

A notable implication concerns the relationship between collaboration and comprehension. While communication alone did not correlate strongly with understanding, observed patterns of teamwork and coordinated action suggest that onboarding in cooperative games benefits most from situations where players must work together rather than only talk with each other. For designers, this highlights the importance of creating challenges and tutorial steps that require interdependence and enforcing meaningful collaboration in the form of shared problem solving and mutual support, rather than merely allowing parallel actions.

While quantitative measures on NPC guidance failed due to scale inconsistency, qualitative data indicates that guidance delivered by an in-world character contributed to comprehension and engagement. This supports existing recommendations to embed tutorials within the game world rather than relying on abstract instructional overlays, and suggests that character-driven guidance can strengthen both clarity and immersion.

Engagement findings offer a valuable counterpoint. Despite improvements in comprehension, engagement remained consistently high across both prototype versions. For designers, this indicates that maintaining engagement during onboarding may be less challenging than ensuring comprehension. Designers may therefore prioritize clarity of instruction and scaffolding without significant risk of diminishing early enjoyment.

Finally, the exploratory observations from the 3–4 player group playtest suggest important considerations for scalability in cooperative onboarding. Increased chaos, reduced coordination, and visual overload in larger groups imply that onboarding systems may need to account for team size as an independent variable. For practice, this suggests that adaptive balancing, clearer role differentiation, and more robust guidance systems may be necessary when designing tutorials for teams of three or more.

These implications highlight how the findings support and extend principles of onboarding design, particularly within cooperative multiplayer contexts.

### **Limitations**

While the findings of this research offer insights into onboarding design for cooperative multiplayer games, several limitations should be acknowledged to clarify what can and cannot be concluded, most notably the lack of statistical significance in the quantitative results.

A primary limitation is the small sample size. Both studies relied on a limited number of pairs (4–5) from a relatively uniform participant pool. This restricts the generalizability of the results, as the findings may not fully reflect the experiences of broader or more diverse player populations. Additionally, the exploratory test with larger groups involved only three sessions, preventing any systematic conclusions about scalability to teams of three or more players.

Methodological constraints also influenced the study. Although observation was a key component of the research design, observation conditions varied between test pairs. Whenever possible, sessions were conducted in person, allowing for close attention to players' facial expressions, body language, and controller use. These in-person sessions revealed discrepancies that the survey responses alone did not capture. For instance, some players reported high gaming experience but visibly struggled with basic controller layouts. In other cases, remote observation limited the detail available, making it more difficult to interpret certain behaviors or communication patterns. Such inconsistencies may have affected the precision of the qualitative comparison between groups.

Survey design introduced additional challenges. While most categories functioned reliably, the NPC guidance scale displayed low variance and poor internal consistency, preventing meaningful statistical interpretation.

Despite these limitations, the study provides a credible basis for evaluating the prototype tutorial. The study's purpose was not to establish universal quantitative claims about onboarding effectiveness but to evaluate a prototype tutorial and examine how specific design principles manifest in practice. The combination of observation and player feedback still allowed clear patterns to emerge, and the findings remain valid for understanding how the tested design principles function within this specific context.

## **Recommendations and Future Work**

Building on the findings of this thesis, several recommendations can be made both for the practical development of the tutorial and future research on cooperative onboarding. While the current prototype demonstrated improvements in comprehension, there are several avenues for future expansion on areas that were beyond the scope of this project.

Qualitative feedback suggests that players benefited from the NPC's guidance and even desired more explicit information. Future iterations could explore additional forms of embedded instructions, like tooltips, being able to ask Moley to repeat instructions, and a more spread out reveal of mechanics, to support players who struggle with initial comprehension.

The observed link between teamwork and comprehension highlights the potential value of onboarding steps that require coordination rather than parallel play. Future tutorial design could experiment with mechanics that necessitate synchronized actions, role-based tasks, or further shared resource management to reinforce collaborative learning.

The exploratory test with 3–4 players revealed challenges in clarity, spatial management, and coordination when more participants were present. Future studies should investigate onboarding for larger groups using adaptive enemy spawning, clearer role differentiation, or redesigned spaces that reduce noise and visual overload.

Given the limitations encountered with certain survey items, future research would benefit from comprehensive testing of measurement scales before full deployment, especially for

constructs like NPC guidance. A larger, more diverse sample would also improve the generalizability of findings and help clarify the strength of relationships observed in this thesis.

Beyond the structured study, the game was showcased at the game convention Polaris 2025 in Hamburg, where visitors were invited to play the prototype. Although these sessions do not constitute formal data, they provided interesting practical insights. The game was consistently well received, with an unexpectedly strong positive response from younger players (approximately 8–13 years old). Many children played for extended periods, some returning multiple times, and several described the game as their highlight of the event.

This enthusiastic reception shown by this age group suggests that the game may appeal more strongly to younger audiences than originally anticipated. It might therefore be useful to reevaluate the target demographic, and think about potential implications for narrative tone, visual style, onboarding clarity, marketing strategies, and long-term community management.

## 7. Conclusion

The goal of this thesis was to examine how effective onboarding in cooperative multiplayer games can be designed, using a tutorial prototype level built in Unreal Engine as a case study.

Across two studies with iterative refinement between them, the findings suggest that clear instruction, opportunities for exploration, embedded guidance, and tasks that require meaningful cooperation all contribute to improved comprehension without diminishing engagement. Although statistical tests did not reach significance, evidence from observations and open-ended responses provides coherent and actionable insights for designing tutorials that support comprehension without sacrificing engagement, guiding both the refinement of the current game project and the development of cooperative onboarding strategies more broadly.

Methodologically, this thesis adopted a design-research approach combining prototype development, playtesting, and post-session surveys. This approach was chosen because onboarding is not merely a cognitive process but one where active participation, social interaction, and contextual experience unfold during play. The iterative structure allowed early findings from Group 1 to inform revisions to the prototype, while comparison with Group 2 offered insight into how specific design changes affected comprehension. While I initially expected clearer quantitative differentiation between iterations, the results instead highlighted the value of qualitative and observational data in capturing nuances of cooperative interaction.

These implications contribute to a deeper understanding of how onboarding principles manifest in cooperative multiplayer environments. They affirm theoretical frameworks on clarity, situated instruction, and experiential learning while extending them by emphasizing the role of meaningful cooperation and embedded guidance.

Looking ahead, the findings suggest several avenues for future research, including the need for broader samples and a more thoroughly developed survey, and examining the design of game tasks that enforce interdependence. For the game project itself, the unexpectedly

positive reception from younger players during the convention showcase highlights additional design opportunities that may shape long-term development.

Despite its limitations, this thesis contributes insight into onboarding within cooperative multiplayer games. It shows how established design principles can be adapted to collaborative settings, offers empirical observations on the processes that support shared understanding, and presents a framework that connects theoretical perspectives with practical tutorial design. By framing onboarding as an interaction between clarity, cooperation, and experiential engagement, this research helps expand understanding of how players learn together and offers a basis for future work aimed at refining and cooperative game onboarding.

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## IV Declaration of Authorship

I hereby declare that I have written the presented master thesis with the title:

**Onboarding in Cooperative Multiplayer Games, Examined Through the Design of  
*Vacunauts***

without assistance and also that I have not used any other aids or resources other than those listed. Any material taken directly or indirectly from external sources are marked accordingly. Furthermore, I affirm that I have not previously submitted the thesis in another examination procedure.

---

Ober-Olm, 28.11.2025, Suzan Azakli

## V Appendix

### V.I List of Game Features

List of features that need explicit instructions:

**Basic Controls:** Which button to press to move, dash, shoot etc. will be briefly shown at the start and players will be able to look these up again if they need to. Experienced players will know to move the left stick to move the character but since *Vacunauts* aims to be an accessible game and novices may not have played video games before, I don't want to assume they will know this and risk creating confusion for them. It does not disrupt the gameplay significantly since the widget is only shown right at the start and can be skipped with a single button press.



Figure 15: Screenshot of UI showing basic controls at the beginning of the tutorial.

**Combining Slimes:** One of the main hooks of the game is the ability to combine slimes with each other. To a new player, this can be a challenging mechanic due to its complexity. It includes multiple different inputs, a UI widget that shows the available combinations needs to be navigated, and the final selection needs to be confirmed or canceled. This is by far the most complex mechanic of the game and one that I believe needs to be explained particularly well. For that reason I have decided to include a UI that is shown on the screen explaining what this feature does and how the player can use it through image and text. After the explanation is read through, the players will automatically be given two slimes and the ability to shoot or eject will be disabled momentarily, to prevent them from accidentally losing a slime. The input to open the stack wheel is now enabled and the player needs to open it and combine the slimes to re-enable all controls. Only when every player has successfully combined their slimes, will the game continue. This ensures that all players have used this feature before moving on and players who figure it out quickly are encouraged to help their teammate since they can't proceed on their own. This is a rather rigid way to teach this mechanic, however I believe it is necessary in this case. This will be one part of the tutorial I will pay close attention to during playtest sessions.

**Reviving:** In accordance with the concept of contextual relevance, the revive mechanic will only be introduced when it actually becomes relevant and actionable: when a player dies. If all players complete the level without losing their lives, the explanation for this feature will be held back for a later time in the game. If a player does die, Moley will express his disappointment and explain that a teammate can revive the dead player at the *revive station* that has now appeared on the map.

#### **List of features that don't need explicit instructions:**

Some of the following mechanics like *dashing* and *shooting* will be featured in the UI popup at the start of the tutorial, showing the corresponding controls but will not be explained any further afterwards.

**Dashing:** Players will spawn on a tiny floating island and the first thing they need to do is get across to the main platform. The platform is within dashing distance and by observing the environment and the other players' behavior they should be able to deduce how to get across. Dashing is a common mechanic most people who have played games before are familiar with and the button to dash is shown right before in the pop-up widget that is displayed after loading in.

**Absorbing:** After reaching the main platform, players will find themselves in a small, fenced off area where the only thing they find is a small squishy slime-plushie. It is not moving and non-threatening. This should signal to the players that it is safe to walk up to it and interact with it. By observing other players, remembering what mechanics were named on the pop-up widget from before, or some simple trial and error, the players should be able to quickly understand to absorb it. Another slime-plushie will spawn immediately after, supplying the player with unlimited ammunition, in case a player misses their target.

**Shooting:** Now that players have the slime in their tank, they can press shoot, which, conveniently, is the same button as absorb, just on the other side of the controller. They may shoot the slime wherever they want, but nothing will happen until they hit the button next to the fence.

**Aiming:** While players are able to shoot without aiming, they will find that hitting the button over the fence is not as easy as it looks without aligning their shot first. Only when using the right stick on their controller to aim, will a visualized arc of the projectile appear that helps them predict where the slime will land.

**Shop & Powerups:** Moley will tell the players that he has sent over something to help them out, but he will not elaborate further until the players have bought the only item available to them at that time: the stack wheel. It is priced at the exact amount of currency that players have collected defeating the first wave of enemies, so they can buy it right away. Shops and powerups are also a very common mechanic in games and should be familiar to most players.

## **V.II Survey**

Full Likert-scale data and reliability analysis provided in the digital Appendix.

#### **Comprehension**

Likert-scale items: (Please indicate how you feel about the following statements: Select 'I don't know' if you didn't notice this mechanic or didn't experience this situation.)

- 1) I had no trouble getting through the level.
- 2) I usually knew what I needed to do next or how to solve a problem.
- 3) The game gave me clear hints (environmental, NPC, or otherwise) when I needed them.
- 4) I felt comfortable with the controls quickly.
- 5) I struggled to remember which button did what.
- 6) I would have liked more reminders or prompts about the controls.

Scale: I agree – I somewhat agree – I somewhat disagree – I disagree – I don't know

Open-ended questions:

- 1) Were there any specific controls or mechanics you found confusing?
- 2) Was there anything else you were confused about or overwhelmed by?

Representative anonymized excerpts from participants' responses (Group 1):

- 1) "I didn't know which button to klick [sic] when the combination of elements was first introduced. We figured [sic] it out by pressing start and reading the controls."  
 "The combining of elements is fun and inspires experimenting, but requires a lot of input"  
 "Using the d-pad to navigate between cleaning material wasn't that intuitive for me."
- 2) "we felt stuck because only one of us had opened the combination menu and equipped the healing combo and it took a while to figure out again that we both had to equip healing for the next level to begin"  
 "If the other player moved too far from me."

Representative anonymized excerpts from participants' responses (Group 2):

- 1) "I inadvertently skipped some dialogue, as I unconsciously assumed that pressing the A button would make the character jump."  
 "I did not notice the number indicating the collected resources [sic] on top of the spaceship and looked in the corners of the screen instead."  
 "At first I found the controls that were used to create the special attacks a little bit confusing and didn't quite know to switch in between them."
- 2) "The general goal/rule of the game"  
 "Visual overload and too many input options before learning the basics made it hard to get a clear picture of every layer of gameplay."  
 "I think there were a little too many things to keep track of too early on (cleaning, combining, defending the base, trying not to die). Maybe let the players adjust to them slower and step by step"

**Teamwork & Communication**

Likert-scale items (1): (Please indicate how you feel about the following questions: Select 'I don't know' if you didn't notice this mechanic or didn't experience this situation.)

- 1) Did you communicate with your partner?
- 2) Did you and your partner work together?
- 3) Did you and your partner help each other?

Scale: all the time – sometimes – rarely – never – I don't know

Likert-scale items (2): (Please indicate how you feel about the following statements: Select 'I don't know' if you didn't notice this mechanic or didn't experience this situation.)

- 1) Working with my partner made the level more enjoyable.

- 2) I felt frustrated with my partner during this level.
- 3) We naturally split into different roles while playing.
- 4) I felt I held my partner back.
- 5) I felt my partner held me back.

Scale: I agree – I somewhat agree – I somewhat disagree – I disagree – I don't know

Open-ended questions:

- 1) What was the best moment of teamwork you experienced in this level?
- 2) Did your partner help you understand any mechanics? If so, how?
- 3) What role (if any) did you feel you took in your team?

Representative anonymized excerpts from participants' responses (Group 1):

- 1) "Figuring Out combinations of elements together."  
"Healing each other, making sure we both get enough bonuses between waves"  
"supporting [each other] when one player felt overrun with enemies."
- 2) "Figuring out controls together, talking about how combining works"  
"We both figured out different mechanics of the game and instantly taught each other."  
"He explained some controls to me at the beginning"
- 3) "Pushing out to pick up enemies as soon as possible so my partner can fortify the objective"  
"Staying close to the objective to deploy turrets and build walls but also healing my partner."

Representative anonymized excerpts from participants' responses (Group 2):

- 1) "Fighting the stronger opponents together "  
"Asking about what to buy instead of just buying something."  
"Figuring out which combination did what and sharing that with my partner"
- 2) "We helped each other with things like what buttons to press or what indicators to look for several times."  
"I struggled a little to remember what each button did (especially how the combining worked while I was under attack) but my partner was able to remind me of them "
- 3) "My partner and I made fairly spontaneous decisions about which enemies to attack. Neither of us took on a specific role."  
"I started out taking up the role as the leader since I understood the mechanics of the game faster than my partner. I would try to help them figure out how to do certain things."

**Ingame-Character Message & Guidance**

Likert-scale items: (Please indicate how you feel about the following statements: Select 'I don't know' if you didn't notice this mechanic or didn't experience this situation.)

- 1) I read the NPC messages.
- 2) The NPC's messages were clear and helpful.
- 3) The amount and length of NPC messages was good.
- 4) I enjoyed the grumpy personality of the NPC.
- 5) I wish there were no NPC messages at all.

Scale: I agree – I somewhat agree – I somewhat disagree – I disagree – I don't know

Open-ended questions:

- 1) Did you rely more on experimenting or on the NPC's hints? Why?

Representative anonymized excerpts from participants' responses (Group 1):

- 1) "A Mix of both. We figured some Things [sic] out in [sic] our own and some through the NPC's. We used the information given by the NPC's and figured the rest out by ourselves."  
"I feel like I easily figured most things out simply by playing"  
"not all NPC hints were clear to me."

Representative anonymized excerpts from participants' responses (Group 2):

- 1) "Both. The hints weren't enough"  
"I love experimenting first, but I also like reading any text from NPCs in case I miss something useful about the controls or the level. Unfortunately, I skipped part of the dialogue by accident."  
"I think for my level I maybe would've needed more hints/ reminders so I experimented more but it worked out just fine"

**Overall Experience**

Likert-scale items: (Please indicate how you feel about the following statements: Select 'I don't know' if you didn't notice this mechanic or didn't experience this situation.)

- 1) The level felt like part of the game rather than a tutorial.
- 2) The level kept me engaged and curious.
- 3) After this level, I felt prepared and ready to continue playing the game.

Scale: I agree – I somewhat agree – I somewhat disagree – I disagree – I don't know

Open-ended questions:

- 1) Is there anything you were still unsure about after playing the level?
- 2) What was the most fun or memorable moment of this level?
- 3) If you could change one thing about this level, what would it be?
- 4) Would you like to add anything else?

Representative anonymized excerpts from participants' responses (Group 1):

- 1) "Only how many combinations there are and how to combine them."  
"I am not entirely sure how to best use the abilities given to me in the game. However, this may become more apparent with more play."  
"No, not really"
- 2) "When defeating the first invaders."  
"Seeing the end stat and who killed most and also who received less damage"  
"Trying out different combat options / strategies with my partner"
- 3) "Maybe a bit more time to prepare"  
"A bit more context on the goal of the level."
- 4) "I had fun and would have been eager to experiment more with the element combination mechanic :)"  
"More direct interactions between the two players"  
"We had lots of fun trying it out together and i can imaging [sic] spending more time exploring further levels."

Representative anonymized excerpts from participants' responses (Group 2):

- 1) "I wasn't quite sure how everything worked. A more throughout explanation would be nice"  
"Not really."
- 2) "That its [sic] kind of chaotic and you have to work together."  
"Seeing combination abilities"  
"I think the different Powers are very fun"  
"I loved the grumpy NPC"
- 3) "Stretching it out. Getting more familiar with the action of collecting ressources [sic] and defeating enemies, before diving into more complex mechanics."  
"I would love to have a little introduction to the character I'm playing. The character design is so cute and I wanted to know more about the little guy."
- 4) "more different Enemies"  
"More highlight [sic], vis. Feedback which ability is selected in ui"  
"For me the initial explanation of the special attacks fell a little short. I could've needed a further explanation. But I started to understand it by the end of the tutorial, so it was okay, that it was this short after all."

### **Teamwork & Communication**

#### Likert-scale items (1):

- 1) How often do you play games?
- 2) How often do you play cooperative multiplayer games?

Scale: Multiple times a week – Once a week – Occasionally – Rarely – Almost never – Prefer not to say

#### Likert-scale items (2):

- 1) How familiar are you with playing using a controller?

Scale: I play with a controller all the time – I often play with a controller – I sometimes play with a controller – I have tried a controller a few times – I have never used a controller – Prefer not to say

#### Open-ended questions:

- 1) What is your favourite co-op game and why?

#### Representative anonymized excerpts from participants' responses (Group 1):

- 1) "It Takes Two because working together is fun but you also get enough agency"  
"My favorite is probably peak, a climbing multiplayer game i [sic] love for the game mechanics. Peak provides a great multiplayer experience because every player feels actually helpful. It makes sence [sic] to look after each other and help each other out to successfully reach the top of the mountain. It does that in such a natural way that its [sic] just fun to play together."  
"Currently R.E.P.O and PEAK but aside from those my alltime favorite is Deady [sic] by Daylight. I also enjoyed Unravel, It Takes Two and Split Fiction."

#### Representative anonymized excerpts from participants' responses (Group 2):

- 1) "Overcooked, because it relies on good communication with the other players and therefore creates a true feeling of teamplay"  
"It takes two was a very fun well constructed co-op game. But the games I play the most are games that I play on an [sic] relaxing evening with friends like R.E.P.O., Blazing Beats

(very fun and addictive game)”  
“Magicka, for the unmitigated chaos.”

## V.III Observation Protocols

### Group 1

Pair ID: 1A

Date / Location: 27.09.2025, in-person

Players and prior experience: P1 (researcher’s assessment: very experienced generally), P2 (researcher’s assessment: very little gaming experience, sometimes plays cozy games)

#### Observations:

- Players join the lobby and immediately start exploring the environment. They first go into the left room and try figuring out controls by themselves before admitting that following Moley’s instructions might explain those features anyway.
- After arriving in the tutorial, both read the shown controls carefully before closing the widget.
- P1 falls off the map often and quickly at first in their haste to cross the gap.
- P1 has no trouble escaping their pod, but P2 only manages to free themselves after extensive help and explanation by P1 about controls and what to do.
- Both players get excited by the countdown announcing the first enemies. P2 is visibly overwhelmed during the encounter, still not comfortable with the controls.
- During the first break P1 tries to absorb the shop item before understanding what to do.
- P1 has to explain combining to P2 in great detail, but even after succeeding in it, P2 rarely uses the feature after. P1 has to repeatedly explain things to P2, resulting in them missing the second shop entirely.
- Both players die during the last wave to the bruiser-enemy but both are able to laugh about their failure and the mean comments by Moley. They succeed on their second try.
- Researcher notes: P2 never used the aim function and had to look at their controller repeatedly trying to find the button they wanted to use. Despite P1 having to explain so much, they were patient with their partner and seemed to strengthen their own understanding of the mechanics through explaining. Communication suffered during stressful and overwhelming situations. Being able to see how players use their controllers was useful to assess their comfortability using them independent of survey self-ratings.

---

Pair ID: 1B

Date / Location: 27.09.2025, online

Players and prior experience: P1 (researcher’s assessment: very experienced generally, especially with co-op games), P2 (researcher’s assessment: very experienced generally, especially with co-op games)

#### Observations:

- P2 reads intro sequence and NPC texts aloud with much enthusiasm
- Players spawn in the lobby and start exploring, running around and looking for environmental interactions. They wander into the left room and figure out controls by experimenting and looking at the widget in the pause menu. They spend quite some time here (~15min), trying out all abilities and even communicating about who should take which abilities into the level, assuming they would be able to keep them.
- Arriving in the tutorial, they are already quite comfortable with the controls, having played around with them in the lobby, and have no issues jumping over the gap. While they both quickly grasp what they need to do to escape the pods, P2 tries to hit the button by ejecting the slime instead of using it as an ability before they figure out what is going wrong together.
- They spend less than 10 seconds fighting against the first wave and express a feeling of superiority, having mastered the controls and even learned how to combine before entering the level and receiving instructions. They have no issues clearing the last two waves and are excited to meet a new enemy type in the last wave.
- Players only understand currency after unsuccessfully trying to buy a shop upgrade that is too expensive.
- Researcher notes: Even with learning how to combine before the level, P2 still expressed difficulties with the complicated inputs to be able to combine. Using the left room of the lobby as a playground to safely test out abilities proved extremely beneficial and engaging for both players.

---

Pair ID: 1C

Date / Location: 27.09.2025, online

Players and prior experience: P1 (researcher's assessment: very experienced generally), P2 (researcher's assessment: very experienced generally, especially with co-op games)

Observations:

- After walking around the lobby once and commenting on the cute graphics, they quickly head into the room that transports them to the tutorial level.
- P1 intentionally falls down to test how death is handled by the game. Neither player has issues crossing the gap. Both players quickly understand how to escape the pods but P2 needs several attempts to hit the button.
- During the first wave, P2 defeats the attacking enemies so quickly that P1 has barely noticed them arriving.
- P1 tries to absorb the shop item before pressing the correct button. P1 repeats instructions to P2 who needs to look at their controller because it is labeled differently to what is shown in-game.
- In the following break, both players are confused by the currency, not realising they don't have enough gloop to keep buying upgrades. This confusion is not cleared during the entirety of the tutorial.
- Players rush through following waves, more so by chaotically mashing buttons than strategic use of abilities and take some time to get comfortable with the controls before heading into the next level.
- Players ask if they can play again after playing through both the tutorial and the following level and play a total of three rounds.

- Researcher notes: P2 expressed that they were surprised about the slimes suddenly attacking the objective after they had shown no aggression toward the players. They saw them as little helpers and found their cute design not suitable for enemies. P1 is confused about aim functionality, because when they learned about it with the slime-plushie, that ability had a visual indicator but no ability after having one. Since participants replayed the game multiple times it became evident that enjoyment increased, the more comfortable they became with the controls and mechanics.

---

Pair ID: 1D

Date / Location: 28.09.2025, in-person

Players and prior experience: P1 (researcher's assessment: rather experienced generally), P2 (researcher's assessment: rather experienced generally, even with twin-stick shooter, though little with co-op games)

Observations:

- Players don't idle long in the lobby and quickly proceed to tutorial level.
- P1 reads controls UI and NPC messages aloud.
- Players quickly understand how to escape the pods but P2 especially has trouble hitting the button. Neither player struggles much with the controls but when one finds out something before the other they happily share and explain their findings (e.g. P2 figures out how to cycle through abilities early on and shares that knowledge with P1).
- Defeating wave one poses no challenge and the first break is reached swiftly.
- P1 tries to absorb the shop items and neither player understands how the currency works or how to purchase items. P2 figures it out by accident.
- Both players are excited to test out combinations and voice the wish to have more time to experiment before the next wave hits. P2 explains combining to P1 again during the following break.
- Researcher notes: Due to P2's familiarity with twin-stick shooter games, they use the aiming function frequently which seems to benefit their overall performance. P1's curiosity and will to test things out by themselves seemed to bridge the gap in skill and ease of learning new mechanics. When players struggle only little during gameplay, the tutorial goes by very quickly.

## Group 2

Pair ID: 2A

Date / Location: 04.10.2025, in-person

Players and prior experience: P1 (researcher's assessment: moderately experienced, especially with shooters using mouse and keyboard), P2 (researcher's assessment: very little gaming experience)

Observations:

- After running around the lobby for a few seconds, both players head into the room that transports them to the level.

- Both dash over the gap immediately. P1 first tries to absorb the rod after absorbing a lightning slime but quickly figures out what to do. They then explain to P2 what they did and P2 manages to free themselves too.
- P1 sometimes skips NPC messages, resulting in both players missing the instructions on how to cycle through abilities or eject slimes which causes some confusion until they figure it out how to do it by themselves.
- After acquiring the combine ability, both players quickly manage to combine at least once, P2 immediately goes to fill up their tank with heal abilities. Instead of using the combined lightning ability to activate the rods, they work together to hit all three at the same time with the normal lightning ability.
- They defeat all waves with little to no trouble.
- Researcher notes: Now that slimes don't disappear during breaks, both players use the time to experiment with the slimes and their abilities. Breaks are also used to get more comfortable with combining, which is first avoided during stressful combat situations. Even though players completed the tutorial smoothly and quickly it did not feel as rushed as the previous prototype, presumably due to the additional wave and the added time to experiment at the start and when introducing the combine mechanic.

---

Pair ID: 2B

Date / Location: 04.10.2025, in-person

Players and prior experience: P1 (researcher's assessment: rather experienced generally, though little with co-op games), P2 (researcher's assessment: very little gaming experience)

Observations:

- P1 wants to explore the lobby and despite wanting to listen to Moley's instructions, P2 follows. They try to test out the controls in the left room for a few seconds but due to the lack of instructions they decide to head back into the room indicated by Moley.
- Both dash over the gap immediately and then try to dash over the wall. After a few unsuccessful attempts they instead absorb the lightning slimes and use it on the tower to escape.
- P1 sometimes explains instructions again to P2 (e.g. cycling through abilities) as P2 usually doesn't read the NPC messages and instead asks P1 what they said. P2 generally struggles with controls, often looking down at the controller (P2 is only used to Nintendo controllers).
- P2 grasps new mechanics quickly and helps P2 defeat the bruiser enemy in the end, though they do vocalize that they find the navigation of the combine menu unintuitive (using the right stick to aim at the target ability instead of cycling through the available combinations).
- Researcher notes: Analyzing player types (Bartle) could be useful in the future to determine how teaching methods work differently for different player types. It became obvious that P2 preferred more and very explicit instructions compared to other players who enjoyed experimenting and figuring things out on their own.

---

Pair ID: 2C

Date / Location: 04.10.2025, online

Players and prior experience: P1 (researcher's assessment: moderately experienced generally), P2 (researcher's assessment: very little gaming experience)

Observations:

- After a minute of exploring the lobby, the players head into the transportation room.
- They first miss the NPC messages and take a few moments to figure out how to escape the pods. Outside they mistake the water slimes for enemies and spend some time attacking them with the lightning slimes before clicking through the dialog and realizing they needed the water slimes to extinguish the burning foliage.
- They get excited as the countdown announces the approaching enemies and have no issues defending against the first wave.
- P2 immediately notices the UI for the currency when the shop spawns and they have no trouble using the shop, except skipping the last shop accidentally.
- Both players run around chaotically during the waves and neither uses the right stick to aim which causes them to miss most of their abilities. This ultimately results in them both dying in the last wave. After quickly checking up on the controls in the pause menu, they successfully defeat the last wave.
- Researcher notes: When players miss the NPC messages, they not only miss crucial instructions but also the game sometimes doesn't continue smoothly due to events being bound to the dialog. This seriously confused players on two occasions. Communication became better and clearer as players became more comfortable with the controls and mechanics of the game.

---

Pair ID: 2D

Date / Location: 05.10.2025, online

Players and prior experience: P1 (researcher's assessment: very experienced generally, especially with co-op games), P2 (researcher's assessment: very experienced generally)

Observations:

- Players take a few minutes to explore the lobby and express the wish for more environment interactions and easter eggs before proceeding to the level.
- P1 doesn't recognize the tower as something to interact with at first, while P2 manages to escape their pod quickly by playing around with the lightning ability and accidentally hitting the tower.
- P1 misses the NPC messages but P2 manages to figure out most controls through experimenting before making P1 aware that they need to continue the dialog.
- Both players have moments where they don't remember the controls and both players seem happy to help the other.
- Despite some confusion about controls early on, they are visibly excited about the approaching enemies and use the breaks to get comfortable with the movement and abilities.
- In the end they communicate to split up to attack the enemies more effectively.
- Researcher notes: Again, communication between players and even attempts at strategizing improve alongside their growing comfortability with the game. Players did

not seem frustrated when unsure about anything and helping each other seemed to create a friendly atmosphere.

---

Pair ID: 2E

Date / Location: 06.10.2025, online

Players and prior experience: P1 (researcher's assessment: rather experienced generally, game developer), P2 (researcher's assessment: rather experienced generally, game developer)

Observations:

- Players read the instructions carefully and follow them immediately, not caring to explore the lobby.
- Inside the level, Moley's messages sometimes go unnoticed or skipped, resulting in some confusion for both players about tasks and controls. Tasks get completed more so through experimenting, since multiple essential instructions were missed.
- The currency also causes confusion, not being explained sufficiently and the UI showing the gloop balance being missed.
- The instructions about combining are read thoroughly and both combine without immediate issues. However, they don't understand what to do afterwards, not noticing the electrical towers at first. P2 finally sees them and quickly realizes what to do.
- Researcher notes: Missing or insufficient explicit instructions lead to confusion. As game developers the players seemed reluctant to experiment and play around to figure things out on their own, instead commenting on instructions or UI not being clear enough or missing feedback. P2 in particular repeatedly voiced that they were overwhelmed by the amount of introduced mechanics and complicated/unintuitive controls and gameloop in general (choosing what slime to absorb, absorbing, using and switching abilities, opening the combination wheel, choosing a combination, confirming a combination or closing the wheel, etc.). As game developers they gave very detailed feedback during play about game design features and details most players would not notice which is helpful for improving a prototype but their unusual play behavior is difficult to compare to that of regular users.

## V.IV Thematic Coding

### Group 1

| Theme                     | Evidence from Protocols                                                                                                                                                                                                                                                        | Evidence from Surveys                                                                                                                                                                                                                                                                           | Notes / Interpretation                                                                                                                                                                                                                                                                                         |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Struggles with Controls   | Most players had difficulties combining and used the mechanic only during breaks or some not at all. Most players struggled with aiming and hitting the button and enemies effectively. One player had to look at their controller repeatedly to find the buttons they needed. | 7 out of 8 participants mentioned difficulties with the combine system when asked about mechanics they found confusing "The combination wheel for combining different elements was a bit hard to use."; "Using the d-pad to navigate between cleaning materials wasn't that intuitive for me. " | Aiming was not well understood and oftentimes not used at all. This made playing the rest of the game harder. The amount of controls to memorize and learn also seemed to overwhelm some players. Combining is generally very complicated and needs better explaining. Some controls seem to feel unintuitive. |
| Shop Comprehension Issues | Participants repeatedly tried to purchase items they could not afford. Participants asked if upgrades were shared. Participants tried to absorb items or didn't notice the purchase button. Most participants missed UI explaining how to skip the break entirely.             | "The acquiring of resources and spending on upgrades could be explained better by the lil mole buddy"                                                                                                                                                                                           | Most players were confused about the shop's currency and how to purchase items and missed essential UI elements.                                                                                                                                                                                               |
| Slime Behavior            | Players perceive the slimes as cute and friendly and some were surprised when they suddenly attacked the objective.                                                                                                                                                            | "It is not entirely clear whether the little slime buddies you vacuum up pose some kind of threat to your objective."                                                                                                                                                                           | Some players were confused or surprised about the slimes attacking the objective after appearing friendly toward the player and because of their cute visual design.                                                                                                                                           |
| Pacing Issues             | Many players ran around frantically pressing random buttons instead of strategically using and aiming abilities, especially                                                                                                                                                    | "If during the gameplay you want to combine elements and assign them to certain slots, there are a lot of                                                                                                                                                                                       | Players did <b>not have enough time or a safe environment</b> to play around and familiarize                                                                                                                                                                                                                   |

| Theme                      | Evidence from Protocols                                                                                                                                                                                                                | Evidence from Surveys                                                                                                                                                                                                                                                                                  | Notes / Interpretation                                                                                                                                                                                                   |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | during the first waves. Some players avoided complicated mechanics like combining until the breaks where tensions were lowered.                                                                                                        | specific inputs in fixed order which you have to do. This took away my attention from the enemies and the combat gameplay until the „armory setup“ is finished.”                                                                                                                                       | themselves with the controls and mechanics before more got introduced. The overall stress-level seemed high especially for inexperienced players.                                                                        |
| Mutual Help                | When one player figured something out before the other they usually offered help or gladly explained after being asked about it. All test-pairs helped each other at some point or multiple times during play.                         | 7 out of 8 participants indicated they helped each other at least sometimes. 3 participants mentioned healing each other as their best moment of teamwork. Another best moment “When I showed my sister how some of the controls worked.”; All disagreed that they felt frustrated with their partner. | Players who often shared their knowledge and helped each other avoided long moments of confusion or stress and helped balance out differences in overall skill and gaming experience. Helping was overall received well. |
| Communication and Teamwork | Most teams communicated all throughout the session. Teamwork and collective strategizing increased during later waves.                                                                                                                 | 8 out of 8 participants agreed that they communicated with their partner. 5 out of 8 agreed that working with their partner made the level more enjoyable                                                                                                                                              | Almost all players communicated from the start. There were noticeable improvements in communication and teamwork as players became more comfortable with the controls and mechanics of the game.                         |
| High Engagement            | Most players talked animatedly to each other about the game, graphics and abilities. Most excitement was noticeable when the countdown for the first wave started, when new abilities were discovered, and when the bruiser enemy type | Most fun/memorable moment: “In general every moment where you find out what a specific ability or combining elements can do. Also...TORNADO ABILITY ROCKS!” “Combining the                                                                                                                             | All players expressed that they were having fun, regardless of comprehension issues.                                                                                                                                     |

| Theme | Evidence from Protocols      | Evidence from Surveys               | Notes / Interpretation |
|-------|------------------------------|-------------------------------------|------------------------|
|       | appeared for the first time. | abilities and super cute graphics." |                        |

Table 2: Table showing thematic coding of Group 1.

## Group 2

| Theme                     | Evidence from Protocols                                                                                                                                                                                                                                                | Evidence from Surveys                                                                                                                                                                                                                                                                                        | Notes / Interpretation                                                                                                                                                                                                               |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Struggles with Controls   | Some players had difficulties combining and used the mechanic only during breaks or a few not at all. Most players did not aim and struggled hitting the enemies effectively. Some players had to look at their controller repeatedly to find the buttons they needed. | 2 out of 6 participants mentioned difficulties with the combine system when asked about mechanics they found confusing: "The water aiming felt too fast and hard to aim". 4 participants answered "no / not really" to the question "Is there anything you were still unsure about after playing the level?" | Aiming was not explained at all, reducing the amount of intruded controls but making it harder to hit enemies. Combining is still mechanically complicated which made some players reluctant to use it during high-stress situations |
| Shop Comprehension Issues | Participants sometimes tried to purchase items they could not afford. Most participants missed UI explaining how to skip the break entirely.                                                                                                                           | "I did not notice the number indicating the collected resources on top of the spaceship and looked in the corners of the screen instead."                                                                                                                                                                    | Some players were confused about the shop's currency and missed essential UI elements.                                                                                                                                               |
| Slime Behavior            | One player mistook the water slimes as enemies and attacked them.                                                                                                                                                                                                      | -                                                                                                                                                                                                                                                                                                            | Most players used the slimes during breaks to play around with abilities. There was generally no confusion about the slimes' behavior.                                                                                               |
| Pacing Issues             | Some players still ran around frantically pressing random buttons instead of strategically using abilities, especially during the first waves.                                                                                                                         | Most Likert-scale items in the comprehension section improved and participants indicated being overwhelmed less than those of                                                                                                                                                                                | Players seemed to benefit from the added <b>time and safe environments</b> to play around and familiarize themselves with the                                                                                                        |

| Theme                      | Evidence from Protocols                                                  | Evidence from Surveys                                                                                                                                                                                                                                                                                                                                          | Notes / Interpretation                                                                              |
|----------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                            |                                                                          | Group 1 in open-ended items; "Visual overload and too many input options before learning the basics made it hard to get a clear picture of every layer of gameplay" About changing anything in the level: "Stretching it out. Getting more familiar with the action of collecting resources and defeating enemies, before diving into more complex mechanics." | controls and mechanics. Overall less players seemed overwhelmed and stress-levels appeared lowered. |
| Mutual Help                | there were no significant / observable differences between Group 1 and 2 | "I struggled a little to remember what each button did (especially how the combining worked while I was under attack) but my partner was able to remind me of them"; Best teamwork moments: "Fighting the stronger opponents together" "When we fought the large enemy." "Healing each other"                                                                  | there were no significant differences between Group 1 and 2                                         |
| Communication and Teamwork | there were no significant / observable differences between Group 1 and 2 | there were no significant differences between Group 1 and 2                                                                                                                                                                                                                                                                                                    | there were no significant differences between Group 1 and 2                                         |
| High Engagement            | there were no significant / observable differences between Group 1 and 2 | there were no significant differences between Group 1 and 2                                                                                                                                                                                                                                                                                                    | there were no significant differences between Group 1 and 2                                         |

Table 3: Table showing thematic coding of Group 2.

## Comparison

| Theme                               | Round 1 Findings                                                                                                 | Round 2 Findings                                                                                                                                    | Changes / Insights                                                                    |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Struggles with Controls             | Most players were confused or overwhelmed during most of the level (especially with combining and aiming)        | Players generally struggled less. Use of abilities seemed more deliberate, and less players avoided using the combination mechanic during tutorial. | Iteration improved control clarity.                                                   |
| Shop Comprehension Issues           | Frequent confusion about the currency and about how to purchase items.                                           | While some participants still did not fully understand the currency, purchasing the items posed no issue.                                           | Shop usability improved but currency still lacks clarity.                             |
| Slime Behavior                      | Players were confused and surprised about the suddenly aggressive behavior of the slimes.                        | No confusion about slime behavior.                                                                                                                  | Issue resolved.                                                                       |
| Pacing Issues                       | Frequent button-mashing and chaotic movement. Low comfortability with controls. Many players seemed overwhelmed. | Players made use of breaks in tension to practice and get used to controls. Players seemed more confident and competent overall.                    | Frequency of mechanic-introductions lowered -> improved pacing and player competence. |
| Teamwork, Communication, Engagement | -                                                                                                                | -                                                                                                                                                   | No significant difference.                                                            |

Table 4: Table comparing thematic coding of Group 1 and Group 2.

## V.V Participant Information

Prior to participation, all players received an information sheet explaining the study's purpose, procedure, data collection and analysis, and their rights. Written informed consent was obtained from all participants. To preserve participant privacy, all information gathered was anonymised. Quantitative survey findings were summarized in aggregate form, while qualitative observations and open-ended survey responses, including direct quotes, were conveyed in a manner that maintains anonymity but allows individual experiences and ideas to be highlighted.

## Participant Information and Consent Form

### Researcher and Supervisor

Suzan Azakli, Timebased Media - Games, HAW Hamburg, supervised by Prof. Ralf Hebecker

### Objective

The purpose of the testing sessions is to observe player behavior and identify relevant patterns in perception and learning to inform future iterations of the game prototype (*Vacunauts*) and test design guidelines for effective onboarding.

### Procedure

Tester pairs play at home using their own hardware and controllers. The researcher observes and listens via Discord voice call and screenshare, taking notes that will later be transcribed into protocols. If online participation is not possible, the researcher will attend in person but remain in the background. They will not assist or communicate with the testers during play, except in the case of technical difficulties or during setup. Immediately after the playtest, participants complete a short Google Forms survey, which will be evaluated once all participants in the group have submitted their responses.

### Right to Withdraw

Participation is voluntary, and participants may withdraw from, or leave, the study at any time without any negative repercussions and without needing to provide a reason for leaving. If you withdraw, all documents related to your participation will be destroyed.

### Data Protection

Only data that is necessary and relevant for evaluating the study will be collected, and it will be stored and analyzed solely for the purpose of conducting the study and presenting its results. To preserve participant privacy, all information gathered will be pseudonymized or anonymised.

If you would like your data to be removed, are interested in the studies outcomes, or have any questions, please contact [REDACTED]

### Free and Informed Consent

I, \_\_\_\_\_ (*name in capital letters*) have read and understood this form. I understand that my data will be collected for the purposes of this study, and I voluntarily agree to participate.

Participant's signature: \_\_\_\_\_

Place and date: \_\_\_\_\_