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Playing the Impostor: Translating Impostor Syndrome into Dynamic Game Physics

A Research-through-Design Exploration of Mechanical Metaphor in High-Intensity Games

Master's thesis in Computer science and engineering

Biting Lin, Zi Ye

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Supervisor: Pauline Belford, Department of Computer Science and Engineering
Examiner: Michael Heron, Department of Computer Science and Engineering

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Department of Computer Science and Engineering
Chalmers University of Technology and University of Gothenburg
SE-412 96 Gothenburg
Telephone +46 739121141, +46 76 004 7873

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Abstract

This thesis explores how mechanical metaphor can translate the experience of Impostor Syndrome (IS) into a playable game system. While existing research has demonstrated that game mechanics can express psychological states, few studies have achieved this by modulating core motion physics parameters in real time. This research first collected embodied descriptions of the experience from students with IS tendencies through a questionnaire, from which somatic markers were extracted as design basis. An automated parkour and track-grinding game prototype, Sugar Gloss, was then developed in Unreal Engine 5. Its core mechanic is a sugar shell that thickens continuously during skating, driving dynamic changes in steering inertia, lateral drift, and friction, forming a loop of trade-offs between "collapse caused by an overly thick mask" and "exposure caused by an overly thin mask". The prototype was evaluated through two iterative rounds of testing. The results indicate that the prototype successfully conveyed the somatic dimensions of IS, with participants generally reporting persistent feelings of pressure, loss of control, and being pushed forward. However, the symbolic dimensions of the metaphor, such as the fear of being found out and the accumulation of external success, were not adequately perceived. Based on these findings, the thesis identifies several research directions for mechanical metaphor targeting psychological states and discusses directions for future work.

Keywords: mechanical metaphor, Impostor Syndrome, embodied cognition, affective interaction, procedural rhetoric, game design.

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Biting Lin and Zi Ye, Gothenburg, 2026-06-11

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1

Introduction

1.1 Background

Video games have evolved from mere entertainment to a complex expressive medium capable of articulating intricate human experiences. In recent years, more and more design work and research have explored how games can deal with mental health issues in a meaningful way. Games like *Hellblade: Senua's Sacrifice* [1], *Celeste* [2], and *Depression Quest* [3] have shown that interactive systems can do more than just tell stories about mental illness; they can also embody it.

In this context, mechanical metaphor has become a significant design language. Through using a game's movement parameters, collision responses, and input feedback on purpose to show or act out certain mental states [4]. Instead of showing mental states through dialogue or cinematics, mechanical metaphor encodes them in the rules and resistances of the playable system itself. This enables the player to feel the condition rather than simply observing it.

To investigate the expressive potential of such metaphors, this research uses Impostor Syndrome (IS) as the main design case study. The characteristic of IS is that a persistent, internalized fear of being exposed as a fraud, which persists despite evident external success [5]. IS was selected because it presents a distinctive experiential paradox. Unlike situations where internal states align with external circumstances, IS induces increased anxiety as a result of success rather than failure. Crucially, this paradox is not a static condition but a self-perpetuating dynamic: each completed task tends to renew rather than resolve the underlying insecurity, such that continued forward momentum becomes the very source of destabilization. This cyclical structure, in which progress neither accumulates into confidence nor finds a stable resolution, is what makes IS a particularly productive case for game design research. A game's core loop - a repeating sequence of actions, consequences, and resets - offers a formal structure capable of enacting rather than merely describing such a cycle. This puts IS in a relatively unexplored area where game mechanics and psychological representation intersect, and raises the question of whether the loop-based logic of a game system can be designed to mirror the loop-based logic of the psychological experience itself.

1.2 The Problem

While lots of existing games have effectively made meaningful use of mechanical metaphors to depict psychological struggle, two significant gaps remain in the current literature and in practice.

First, prevailing design paradigms, especially in action and platformer genres, treat player mastery and avatar stability as mutually reinforcing. As the player grows more skilled, the game world responds with greater responsiveness and control [6]. This progressive stabilization is central to the logic of game mastery as theorized in flow-based game design [7], [8].

However, this logic is structurally incompatible with psychological states like IS, where external performance markers - the very signals a game would typically use to show mastery - are likely to intensify anxiety and cause loss of control. A design paradigm that rewards success with stability cannot accurately represent a condition in which success leads to instability. This incompatibility is not merely a matter of tone or narrative framing; it is structural. The conventions of the action genre are built around a trajectory in which increased competence yields greater agency, which means that the genre's own formal logic works against the representation of any state in which competence and agency move in opposite directions. Designing for IS within this genre context, therefore, requires not simply adding a layer of psychological narrative onto an existing design template, but rethinking the fundamental relationship between player performance and system response.

Additionally, when games address psychological distress at the mechanical level, they typically do so through fixed conditions: discrete, invariant state changes implemented uniformly, irrespective of context. For example, in the game *Hellblade* [1], there are permanent field-of-view restrictions that make the player feel anxious. In the game *What Remains of Edith Finch* [9], the player can't move quickly during grief scenes. While they are effective, these implementations work as binary switches, either active or inactive, with a fixed intensity. They hardly change based on how well the player is doing at the moment. This limits their capacity to simulate the gradual and contingent characteristics of psychological onset, in which distress intensifies and diminishes in reaction to continuous events rather than presenting as a static condition. For a psychological state like IS, one whose intensity is driven precisely by the accumulation of performance-related events over time, static mechanical representations are particularly inadequate. What is needed instead is a design approach in which the psychological state is expressed through parameters that shift continuously and causally in response to the player's own actions, rather than through conditions that are switched on or off by a designer in advance.

1.3 Research Question and Aim

This research concentrates on the intersection of game mechanics and psychological representation, with the primary research question being:

How can mechanical metaphors be designed to convey psychological states, using Impostor Syndrome as a case study?

The project seeks to translate some representative embodied markers of IS into a playable system. Rather than deriving these markers from designer assumptions alone, the research grounds the design in empirical data: participants with varying degrees of IS experience are first asked to describe their psychological states through physical and somatic language, and these descriptions are then systematically analysed to identify concrete parameters - such as resistance, instability, and delayed recovery of control - that can be implemented within a physics engine. This empirical grounding is intended to reduce the gap between the designer's interpretation of IS and the lived experience of those who identify with it. The central objective is therefore to establish a coherent translation from psychological data to physical game parameters, and to evaluate how the dynamic modulation of those parameters shapes player emotional resonance. The research contribution lies not only in the resulting prototype but in the translation methodology itself, which is intended to offer a replicable framework for future design work at the intersection of interactive systems and psychological representation.

1.4 Scope and Outline

It is important to define the boundaries of this research. The project operates strictly within the disciplines of game design and human-computer interaction (HCI). It does not seek to provide clinical diagnoses or psychological assessments for IS; the condition serves more as an experiential reference to inform mechanical design. The expected outcome is a playable vertical slice focusing on using the core mechanical loop to validate metaphors, rather than a full game with an extensive narrative.

It is also worth noting that this research situates itself specifically within the context of high-intensity action gameplay. This genre is chosen not arbitrarily, but because it is precisely the context in which the mastery-stability paradigm identified above is most deeply embedded - and therefore most productively challenged. The design questions explored here are sharpest where the conventional expectations of player empowerment are strongest. This choice also enables comparison with alternative approaches, which is developed in detail in Section 5.1.1. High-intensity action gameplay places the player's body and reflexes in direct, continuous negotiation with the game system, making it a particularly productive site for translating the somatic dimensions of IS, such as the physical sensation of losing control under accumulating pressure, into a directly experienceable form.

With these boundaries, the structure of this research is as follows:

1. Chapter 2 establishes the theoretical foundation. Theories related to IS, procedural rhetoric, mechanical metaphors, and related works are discussed in detail, and the specific research gaps motivating this project are identified.
2. Chapter 3 includes the framework and all the methods employed throughout the project, covering the research paradigm, the mixed-methods strategy, and

the tools used for data collection and analysis.

3. Chapter 4 details the execution of the methodology. The pre-study is displayed in particular, demonstrating how the somatic markers of IS were extracted via questionnaire and how they were processed into design-relevant outputs.
4. Chapter 5 explains how the prototype is constructed, including the design rationale, the translation matrix that maps somatic markers to physics parameters, the technical framework, and the iterative implementation process.
5. Chapter 6 mainly presents how the playable slice is evaluated iteratively across two phases, a formative evaluation focused on core mechanic calibration, and a summative evaluation focused on affective and metaphorical transmission, and analyzes the findings from both.
6. Chapter 7 mainly discusses the findings and reflections, identifies the resulting research directions, and summarizes future work.

2

Theory

This chapter establishes the theoretical foundation for the project. It begins by defining Impostor Syndrome and its core psychological characteristics in Section 2.1, which serve as the experiential reference for the design. Section 2.2 introduces Procedural Rhetoric as the foundational view for understanding why game mechanics can function as persuasive and expressive systems. Building on this, Section 2.3 turns to how abstract concepts can be translated into playable forms through Mechanical Metaphor and Poetic Gameplay. Section 2.4 then addresses the affective and cognitive dimensions of the design, drawing on the Circumplex Model of Affect, Affective Interactivity, and Embodied Cognition to explain how the intended emotional response can be targeted and validated. Section 2.5 reviews existing academic studies, related games, and identifies the research gaps that motivate this project. Finally, Section 2.6 summarizes how these frameworks collectively inform the subsequent stages of the project.

2.1 Defining Impostor Syndrome

This project focuses specifically on Impostor Syndrome (IS), a psychological pattern originally identified by Clance and Imes [10]. It is defined as an internal experience of intellectual phoniness, where individuals who are outwardly successful and competent remain convinced they are frauds and fear being exposed. Crucially for this design research, IS is not merely "low self-esteem" or "inability". It is characterized by a specific paradox: the coexistence of high external performance and high internal anxiety.

In later work, Clance and O'Toole further summarized this dynamic as the Impostor Cycle [11]. When confronted with an achievement-related task, individuals with IS experience anxiety and self-doubt, and often respond to that anxiety through excessive effort. Although successful task completion may bring temporary relief, they do not attribute the outcome to their own ability, but instead to luck, timing, or sheer overwork. Success therefore, fails to become evidence of competence that can be internalized. When the next task arrives, the cycle begins again, often accompanied by even greater anxiety [12], [13]. This continual forward movement paradoxically deepens the structure of insecurity, suggesting that IS may be expressed through dynamic systems in which progress does not necessarily produce stability.

It is important to note that IS has never been included in the Diagnostic and Sta-

tistical Manual of Mental Disorders, Fifth Edition (DSM-5) or the International Classification of Diseases, Eleventh Revision (ICD-11) as a formal diagnostic category [14]. It is not a mental disorder in the clinical sense, but rather a widely shared psychological experience. Clance and Imes themselves tended to use the term Impostor Phenomenon [10], which avoids the potentially pathologizing implications of the word syndrome. However, IS has become the more widely recognized term in public discourse. Given that this project is intended for non-clinical audiences, adopting the more widely understood term better suits the projects positioning. Therefore, this thesis uses Impostor Syndrome or its abbreviation IS throughout, while reserving Impostor Phenomenon or IP for specific scale names, such as the Clance Impostor Phenomenon Scale.

In recent years, IS has been widely discussed, not only in academic contexts but increasingly in public discourse, where it appears to be understood as a common experience [15]. Although this growing attention has helped validate the experiences of those with IS, it has also introduced the risk that the concept may be trivialized or oversimplified [15], [16], potentially obscuring its central paradox. Therefore, this research aims to provide a structured, experiential approach using interactive mechanisms to allow players to experience this paradox.

In addition, the reliable measurement of IS tendencies is essential to the research design of this project. Mak et al. identify the Clance Impostor Phenomenon Scale (CIPS) as a robust psychometric tool for quantifying the intensity of IS traits [17]. Unlike a clinical diagnostic tool, CIPS functions as a self-assessment questionnaire that places respondents along a continuum of IS intensity, ranging from few or no impostor characteristics to moderate, frequent, and intense impostor experiences. In this project, CIPS serves a dual methodological function: in the pre-study phase, it provides a basis for grouping participants according to the severity of their IS tendencies, allowing qualitative data analysis to remain sensitive to differences in experiential intensity (see Chapter 4.3); in the evaluation phase, it enables the study to examine whether players with different levels of IS tendency interpret the mechanical metaphor in different ways.

2.2 Procedural Rhetoric

The foundational lens for this project is Procedural Rhetoric. This framework is originally articulated by Bogost [18]. In his opinion, mechanics do not merely simulate actions; they can also make arguments by enabling and constraining particular player behaviors, rather than relying solely on text or visual narrative. Papers, Please [19] offers a clear example. At the textual level, the game contains little explicit criticism of bureaucracy. However, its mechanics require the player to repeatedly check documents under strict time pressure, make moral decisions between following rules and allowing desperate people to pass, and at the same time earn enough money to keep their family alive. This rule system gradually compels the player to adopt increasingly mechanical and utilitarian decision-making strategies. When players begin to reduce each entrant to a sample of judgment based solely on whether their documents match, they have already encountered institutional de-

humanization at the level of play. In this sense, the game can be read as showing how highly bureaucratized systems may encourage individuals to objectify others through routine procedural action.

Furthermore, Harper argues that game rules function as a form of rhetoric [20]. In this context, those constraints placed on players are as communicative as the actions they can perform. This means that what a game chooses not to let the player do conveys meaning just as much as what it allows them to do. However, a question remains as to how such rule-based constraints can effectively represent psychological states rather than being perceived as arbitrary restrictions.

Grimwood argues that psychological states in games are not expressed solely through narrative or visual representation, nor can they be reduced to rule-based constraints alone [21]. Rather, such expression typically emerges through the interplay between procedural systems and culturally familiar commonplaces, metaphors, and rhetorical motifs. Grimwood calls this process "reobjectification", which involves reorganizing existing cultural expressions of psychological states into an operational and experiential form through game mechanics, thus creating a persuasive expression. In other words, players can experience a certain psychological state not only because the game limits what they can do, but also because these limitations are connected to familiar cultural expressions. For example, images such as the divided self or the abyss already carry cultural associations of loss of control and mental instability. When such images are combined with procedural conditions such as impaired control or unstable action, psychological states can be reorganized into an interactive form that players can experience.

Building on this foundation, a further theoretical challenge arises in the context of action games, where the core promise of the genre is typically one of empowerment and mastery. Fizek critiques the "fantasies of mastery" and the "ideology of interactivity" prevalent in mainstream games, and introduces the concept of Interpassivity to challenge the assumption that gameplay must always be active and empowering [22]. Her idea is that meaningful play also occurs in moments where player agency is compromised, delegated, or distanced. This offers a theoretical basis for analysing mechanics that involve a loss of control not as a design failure, but as a deliberate rhetorical device regarding powerlessness.

In addition, Jiang and Tham explore game rhetoric from the angle of New Materialism, drawing on Bennett's concept of "thing-power" [23] to analyse how the material properties of a gaming assemblage actively shape the player's embodied experience [24]. Through their analysis of Ring Fit Adventure, they demonstrate that game hardware and software do not function as neutral input interfaces. The physical resistance of a controller, the weight of a peripheral device, and the bodily effort demanded by an interaction scheme themselves constitute rhetorical agents with material agency. These material forces act directly on the player's body, enforcing constraints and producing sensations of limitation or struggle that are not communicated through narrative or visual cues but experienced directly through embodied interaction. This framework extends the scope of procedural rhetoric from abstract rule systems to the tangible, physical layer of play, suggesting that materiality itself,

that is, the felt properties of resistance and momentum within a game system, can serve as a persuasive rhetorical device for conveying particular experiential states, and may potentially disrupt the dominant rhetoric of control that has long prevailed in action game genres.

2.3 Mechanical Metaphor and Poetic Gameplay

While Procedural Rhetoric aims to prove why mechanics matter, Mechanical Metaphors and Poetic Gameplay help explain how to translate abstract concepts into playable forms.

Rusch and Weise argue that complex abstract concepts such as love or trust can be modelled through rules and interaction rather than narrative alone [25]. Narrative elements such as cut-scenes risk creating a disconnect when the concept depicted fails to align with what the player actually does, whereas they argue that rules can directly convey the essential qualities of an experience. The game *Passage* [26] exemplifies this approach: rather than narrating a story about life, it models life as a journey through spatial mechanics and visual metaphor, including unidirectional and irreversible movement, a restricted field of view, and the necessity of finding wider paths when travelling with a companion, at the cost of forgoing certain experiences along the way.

Furthermore, Mitchell views game mechanics as a narrative mode and proposes the concept of poetic gameplay [27], which can complement the experiential metaphors mentioned by Rusch and Weise [25]. Poetic gameplay deliberately breaks players established expectations for gameplay, for instance, through sudden changes in controls, thereby disrupting players automatic responses and slowing down their perceptual processes. This sense of disruption or unfamiliarity forces players to pause and reflect: "Why was the game designed this way?" This, in turn, encourages them to connect the unusual operational experience to the game's narrative. A case in point is *Brothers: A Tale of Two Sons* [28], in which the player initially uses both the left and right joysticks on a controller to simultaneously control the two brothers, but after the elder brother dies later in the game, the player only needs to use one joystick to control the younger brother. This game employs both experiential metaphor and poetic gameplay. The dual-joystick control scheme itself functions as an experiential metaphor, mapping the interdependence between the two brothers, while the sudden change in controls after the elder brother's death breaks the player's established operational habits, producing a defamiliarization experience that allows the player to feel the loss of a loved one more profoundly.

This design, which brings emotional impact solely through changes in mechanics, also corroborates Magnuson's view that video games can operate as lyric practice, constructing poetic meaning not through linguistic signs but through rule systems and real-time interaction, such as expressing complex emotional states [29].

To more systematically analyze how game mechanics present metaphors, this study adopts the four analytical dimensions proposed by Hargood in the *LocoLudo* (Locative Hypertext Ludonarrative) framework: *Semblance*, where the form of a mechanic

maps onto narrative themes, such as through metaphor or personification; Subversion, where player expectations are deliberately broken to prompt attention and reflection; Pattern, where the structural arrangement of a mechanic's use in context, such as repetition or cycles, contributes to meaning; and Product, where the outcome of executing a mechanic changes the game state and its impact [30]. This provides an operational tool for examining how different aspects of game mechanics convey narrative meaning.

2.4 Affective Interaction and Embodied Cognition

To ensure the mechanical metaphor can evoke the targeted emotional response, the project draws on Affective Interaction and Embodied Cognition.

To evoke a specific emotional experience through mechanical metaphor, one first needs a tool capable of precisely defining the target affective state. The Circumplex Model of Affect, proposed by Russell, categorises emotions along two dimensions of Arousal (high/low) and Valence (positive/negative), forming a continuous two-dimensional coordinate system [31]. Rather than relying on discrete emotional labels, this model offers a quantifiable and comparable means of describing affect, enabling researchers to systematically verify whether the emotions elicited by gameplay align with the intended psychological profile.

To translate this abstract affective model into a more tangible design, Croissant et al. introduced the framework of Affective Interactivity, which is built around a bidirectional emotional feedback loop [32]. In this framework, games not only evoke specific player experiences through emotional output, such as mechanics, but also infer the player's current emotional state in real time through emotional input, that is, various forms of data obtained from the player. Croissant et al. also emphasized that the relationship between game stimuli and emotional responses is not fixed, but depends on the context and individual differences. Therefore, user research is necessary to validate design assumptions and iteratively refine game content accordingly.

The cognitive foundation of this approach can be traced to the central claim of Embodied Cognition, which posits that cognition does not occur merely within the brain but is deeply dependent on the interaction between the body and the environment [33]. Building on this, Duan et al. further introduced Situated Cognition Theory into game narrative research, proposing that mapping concrete sensory experiences onto abstract target conceptual domains can facilitate deeper cognitive reflection in players [34]. This provides theoretical foundation for a core premise of this study. Compared to describing psychological struggles through text, using experiential metaphor, for instance, allowing players to physically experience control resistance similar to the structure of a certain psychological state, may be more conducive to fostering an embodied understanding of that state.

2.5 Related Works

Based on the theoretical frameworks established above, this section reviews existing academic studies and related games that have explored similar themes of psychological states through game mechanics, and identifies the research gaps that the present project aims to address.

2.5.1 Existing Studies

Existing academic research that explores metaphorical representations of psychological states through game mechanics has mostly focused on low-action, exploration-oriented gameplay contexts. Two studies are particularly relevant to this project.

Wu developed *Anxiety Ocean*, a sailing simulation game designed to help players navigate the experience of anxiety through metaphorical gameplay [35]. The game’s core metaphor maps the unpredictability of generalized anxiety onto oceanic environmental forces. Players must balance a cork adrift on waves while searching for lighthouses to illuminate a path toward a hidden island, as shown in Figure 2.1. The

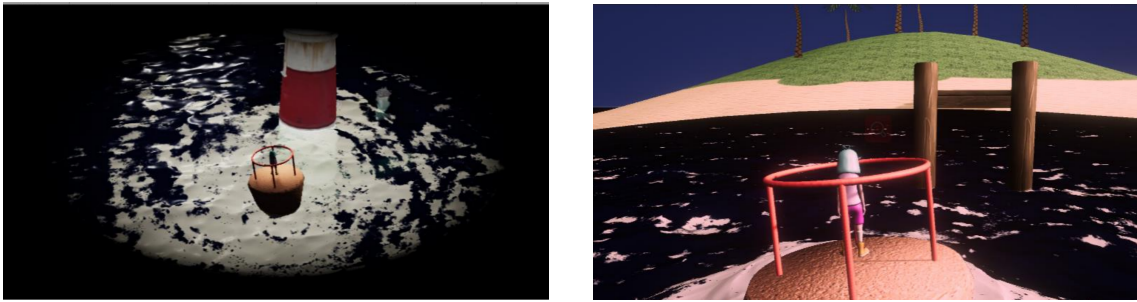


Figure 2.1: Screenshots from *Anxiety Ocean*, reproduced from Wu [35], showing the lighthouse-based navigation metaphor on the left and the player’s search for the hidden island on the right.

whirlpools near each lighthouse generate random forces that destabilize the player’s vessel, creating a sense of uncertainty that mirrors the intolerance of uncertainty (IU) model from cognitive behavioral therapy. In this design, the procedural system itself, rather than any textual narration, functions as what Bogost [18] would describe as a procedural argument, where the rules of the ocean convey the experiential logic of anxiety. Importantly, Wu also adopted a beat chart to structure the emotional arc of the gameplay, mapping target emotions such as hopefulness, confusion, and relief onto specific mechanical events throughout the gameplay process. This approach resonates with the Circumplex Model of Affect [31] discussed in Section 2.4, as it attempts to design toward specific affective coordinates rather than relying on vague emotional goals. However, the metaphorical expression in *Anxiety Ocean* operates mainly at the level of environmental navigation and pacing. The main interaction between the player and the system is to steer and balance in response to external disturbances, which puts the game experience in a relatively low-intensity, contemplative state. From the emotional feedback loop of Croissant et al. [32], the emotional output of the game mainly relies on passive environmental resistance to

trigger affective responses from the player, rather than on the high-intensity action mechanism that requires immediate reflex-based action.

Duan et al. developed *Subway Migration*, a walking simulation game based on situated cognition theory, along a related but different path [34]. Their design framework proposes three types of metaphorical mapping in games, namely audiovisual mapping, interactive mapping, and narrative mapping. In *Subway Migration*, players explore a looping subway corridor where they encounter scattered sheep, guide them into a flock, and gradually realize that the spatial structure is cyclical rather than linearly progressive, as shown in Figure 2.2. The game metaphorically represents

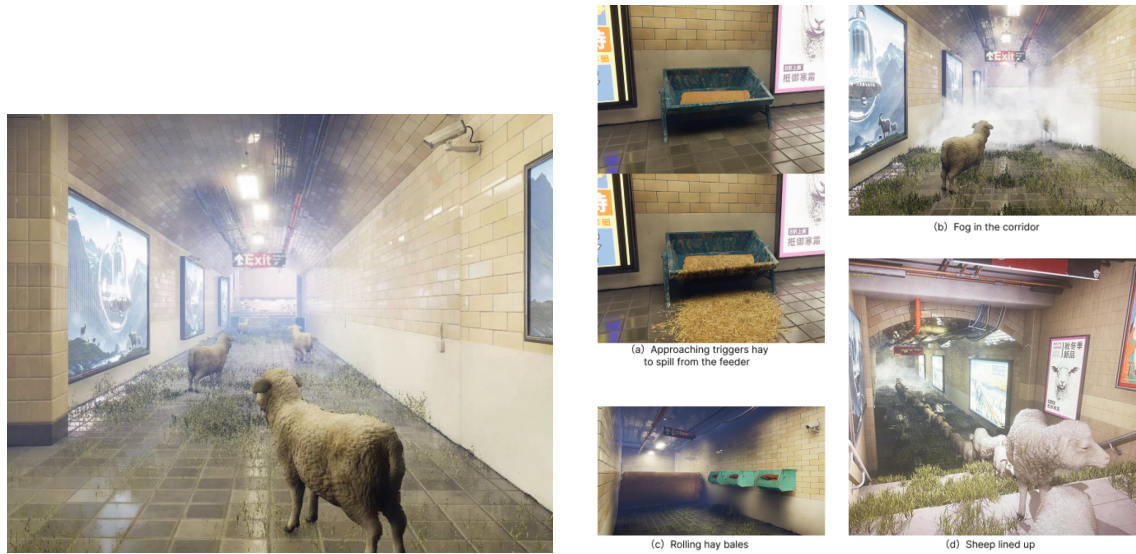


Figure 2.2: Screenshots from *Subway Migration*, reproduced from Duan et al. [34], showing the sheep-filled subway corridor on the left and interactive metaphor in the game environment on the right.

shifts in social structures and individual identity, guiding the player through a psychological transition from the "controller" to the "controlled". From a theoretical perspective, this work directly practices the embodied cognition principle discussed in Section 2.4. By placing the player within a recursive spatial structure, the game allows meaning to emerge through sensorimotor interaction rather than explicit narration. The user study reported significant improvements in players' perception of spatial and social metaphors as well as in identity cognition, indicating that experiential metaphor can indeed promote cognitive reflection. However, similar to Wu's work [35], the gameplay in *Subway Migration* also falls within the category of low-intensity interaction. The meaning construction of the players relies on environmental narratives and symbolic feedback during exploration, without concern about high-intensity physical challenges or mechanics.

In summary, these studies demonstrate the feasibility of using game mechanics as metaphorical vehicles for psychological states. However, existing research reveals a consistent pattern: metaphorical game design for psychological states has almost entirely relied on slow-paced, environment-driven mechanics. Neither study explores how high-intensity action mechanics, such as platforming, combat, or physics-based

movement challenges, might serve as expressions for complex psychological conditions. To the best of the authors' knowledge, this gap extends beyond the two studies reviewed here, as no published work has specifically investigated how the real-time modulation of core movement physics parameters within high-intensity action mechanics can function as metaphorical expressions of psychological states. This observation establishes the research direction this project aims to explore.

2.5.2 Related Games

Beyond academic studies, four action games are particularly relevant as design references, and they fall into two groups. The first pair, *Celeste* and *Inside*, demonstrate distinct approaches to expressing specific psychological states through their core mechanics. The second pair, *QWOP* and *Getting Over It with Bennett Foddy*, establish deliberately awkward control, or "bad game feel", as an expressive medium in its own right.

2.5.2.1 Celeste

Celeste [2] is a primary example of action (platforming) games that utilize mechanics to show internal psychological struggles. The core game mechanic is climbing. But different from a lot of other platformer games, its climbing mechanic only has limited stamina. The main character can only cling to surfaces for a short duration before losing her grip and falling, as shown in Figure 2.3. This stamina mechanic

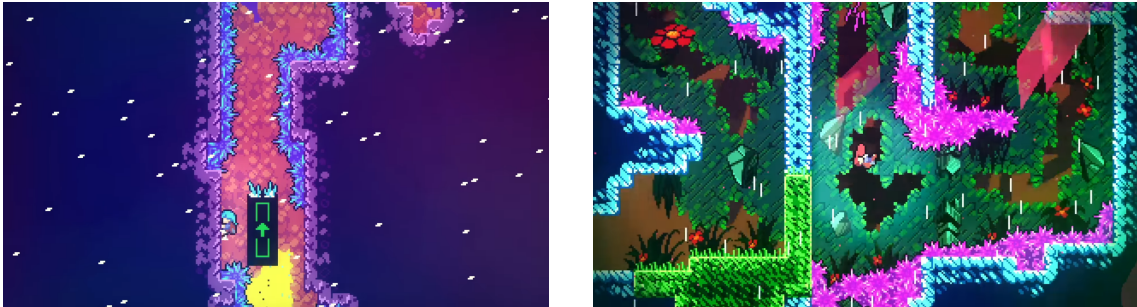


Figure 2.3: Screenshots from *Celeste*, showing stamina-limited climbing on the left and the consequence of losing grip and falling on the right.

transforms the abstract state of anxiety and frustration into a concrete and playable system. As Heron (2025) noted, *Celeste*'s difficulty creates a powerful ludonarrative harmony, especially the high difficulty initially aligning the players frustration with the protagonists self-doubt [36]. However, the games design ultimately demonstrates a narrative of resilience. Through rapid respawn cycles and the accumulation of attempts, obstacles that initially appear insurmountable gradually become manageable. This mechanical progression enforces themes of "overcoming" and "holding on".

2.5.2.2 Inside

Inside [37] mainly uses restricted agency to convey themes of oppression and control. Unlike typical action protagonists, the main character is physically fragile, stumbles easily when encountering obstacles and can even die from a single hit. To be specific, the game does not empower the player but enforces the sense of helplessness as well as hopelessness. As Williams points out, Inside generates distinct affective responses by successfully building a "fluid and unstable link" between the player's controller input and the avatar's movement [38].

As shown in Figure 2.4, environmental surveillance, bodily fragility, and movement resistance contribute to the game's sense of restricted agency. By focusing on weight, momentum, and resistance, the game requires players to adapt their physical inputs to the oppressive rhythms of the game's machinery and environments. This provides a way for how manipulating the precision and responsiveness of action mechanics can serve as a powerful mechanical metaphor for psychological states.



Figure 2.4: Screenshots from *Inside*, showing the protagonist hiding from a large surveillance-like machine on the left and moving through an underwater environment on the right.

2.5.2.3 QWOP

QWOP [39] is a clear example of how deliberately designed clumsy control can become the core of a game experience. As shown in Figure 2.5, the player operates four keys to move a sprinter forward, with Q and W controlling the thighs and O and P the calves, while trying to avoid falling. Although the goal seems simple, namely, to move along a track, this underlying control scheme turns an ordinarily automatic action into a process requiring constant, deliberate coordination, to the point where the player's own inputs become the main obstacle to moving forward.

The significance of QWOP lies in the fact that its clumsiness is not an accidental obstacle during play. Rather, the difficulty of controlling the body itself constitutes the core of the experience. The game demonstrates how the felt awkwardness of control, a deliberately bad game feel, can function as an independent vehicle of expression rather than a flaw to be minimized.

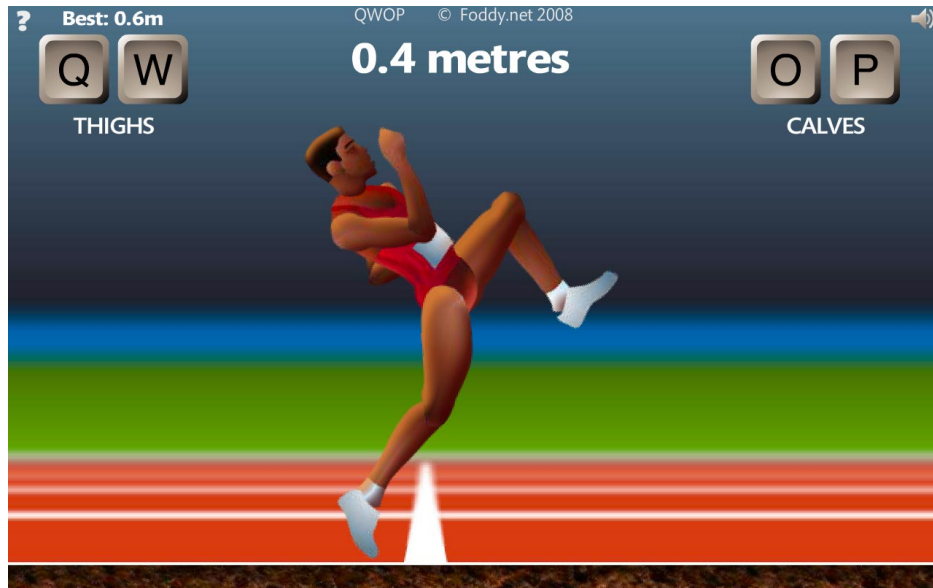


Figure 2.5: Screenshot from *QWOP*, showing the four-key, per-muscle control scheme and the resulting off-balance posture.

2.5.2.4 Getting Over It with Bennett Foddy

Getting Over It with Bennett Foddy [40] takes frustration and loss as its central themes. As shown in Figure 2.6, the player can only control a hammer, manipulated with the mouse, to drag a man sitting in a cauldron up a mountain of obstacles. During play, a single mistake can send the player tumbling to the bottom, instantly erasing all previous progress, with no checkpoints to save it.



Figure 2.6: Screenshots from *Getting Over It with Bennett Foddy*, showing the player using the hammer to navigate irregular obstacles on the left, and the character airborne in mid-air on the right.

This experience is built on a deliberately designed bad game feel. The controls are highly sensitive and have little margin for error. Players must constantly adjust the hammer's angle, pivot point, and range of motion, accepting the potential fall with every mistake. Because the frustration is systematic and predictable, with the same set of rules taking effect without exception on every mistake, players perceive this bad game feel as intentional design, interpreting repeated frustration as an expression of effort, vulnerability, and the need to start over.

2.5.3 Gaps

The previous sections have reviewed both academic studies and the games above. From this review, two interconnected gaps emerge that together define the research space focusing on this project.

2.5.3.1 The Control Alignment

Wus Anxiety Ocean [35], reviewed in Section 2.5.1, escalates difficulty across game-play phases, but this escalation follows a pre-authored emotional arc rather than being driven by the player's own performance. The player does not experience control degradation as a consequence of their growing competence. Beyond the academic studies, existing action games, even those dealing with mental struggles like *Celeste*, typically rely on a linear trajectory of mastery between player skill and character agency. As mentioned in Heron (2025), the gameplay loop of *Celeste* creates a sense of triumph and agency [36]. In these games, as the player acquires the mechanics through precision and timing, the avatar achieves greater stability and overcomes the environment. This design paradigm effectively communicates narratives of growth and resilience. At the opposite end of the game-feel spectrum, the games that foreground awkward control, *QWOP* and *Getting Over It*, hold their friction constant rather than tying it to the player's progress. In neither game does control degrade as a consequence of accumulating success. However, this broader pattern creates a limitation when attempting to represent paradoxical psychological states or internal experience. For example, in the case of Impostor Syndrome, external competence often correlates with internal instability rather than confidence. There is a lack of design approaches in which success and advancement lead to a sense of losing control, thereby using that loss of control to express the accompanying anxiety, rather than conveying psychological distress through the struggle of failure.

2.5.3.2 Static and Dynamic Expressions

While games like *Inside* successfully convey a lack of agency, they often do so through static constraints, such as limited movement, resources, scripted vulnerability, and fixed environmental resistance. This tendency toward static, simplified representations of psychological states is not an isolated case but a systemic pattern prevalent in game design. One of the most common conventions is the "sanity meter", a numerical bar that gradually decreases as the character encounters disturbing stimuli [41]. Games like *Amnesia: The Dark Descent* [42] employ this approach, simplifying complex mental states into a resource that can be consumed and replenished. While this system successfully makes mental states mechanistically relevant, it flattens the complexity of these experiences into quantifiable and predictable variables. The basic assumption is that a psychological condition can be adequately represented as a meter that goes up or down. Regardless of whether the system uses a decreasing bar, a restricted control scheme, or pre-set environmental constraints, the mechanical representation of the psychological state tends to remain structurally fixed rather than dynamically changing throughout the game.

Compared to the game examples above, the existing academic studies present a

more dynamic picture. Duan et al. [34] incorporate environment-level disruptions triggered by the players progress, and Wu [35] escalates whirlpool difficulty and adjusts the balance UI across gameplay phases. In this respect, neither study treats psychological states as completely static. However, the dynamic changes in both operate at the level of environmental feedback, audiovisual cues, and interface assistance, rather than at the level of core movement mechanisms. That is, the basic physical parameters that govern how players move through space, such as friction, inertia, and steering sensitivity, do not change dynamically in either study.

There is limited research on how high-intensity movement mechanics can be dynamically re-engineered to function as an expressive variable. This project seeks to fill this gap by exploring how the fluctuation of physics parameters can metaphorically represent the onset and intensification of a psychological state in real-time.

2.6 Summary

The theoretical frameworks established in this chapter serve interconnected functions. Procedural Rhetoric and its extensions provide the justification for viewing game mechanics as expressive systems, while Mechanical Metaphor and Poetic Gameplay offer the practical strategies for translating abstract psychological concepts into playable forms. Affective Interactivity and Embodied Cognition then provide the tools to target specific emotional states and validate whether the design achieves its intended effect. Together, these frameworks converge on a shared premise: the perceptible physical qualities of interaction, rather than merely narrative or visual representation, can convey the structure of a psychological experience.

The review of existing work revealed that while metaphorical game design for psychological states has demonstrated feasibility and while some studies have incorporated dynamic environmental feedback, few existing works have explored the real-time modulation of core movement physics parameters within high-intensity action mechanics to express certain psychological states. This gap, combined with the paradoxical structure of the Impostor Cycle identified in Section 2.1, defines the design space this project occupies. In this design space, a deliberately uncomfortable, or bad game feel is treated not as a defect to be eliminated but as the expressive medium itself. The following chapter outlines the research methods employed to investigate this space.

3

Methods

This chapter explains the tools, procedures, and methodological logic adopted in this study, with the aim of establishing a clear pathway from abstract psychological states to specific game mechanics. First, it establishes the groundwork by explaining how the act of design itself can function as a means of research. It then outlines how a mixed-methods research strategy is used to construct a logical connection between complex experiences in emotion and precise parameters within the prototype. Finally, this chapter aims to detail how data will be collected and the different ways that the data will be analyzed to make sure that the results are reliable and valid, thereby providing a reliable justification for the construction of the gameplay translation matrix presented in Chapter 5.

3.1 Research Framework

3.1.1 Research-through-Design (RtD)

The primary methodological framework of this study is Research-through-Design (RtD). Based on Zimmerman et al.'s definition of RtD as a practice-led research paradigm [43], this study views design practice not only as a method for producing artifacts but also as a structured approach to research. Within the context of this research, Impostor Syndrome (IS) represents a dynamic experience that is difficult to capture through textual description only. RtD enables the researcher to identify problems and embody psychological states in tangible forms through iterative prototyping.

Accordingly, the research framework is put into action through the development of a practical design artifact, a playable vertical slice made with Unreal Engine 5. Instead of staying at the level of theories and description, this study attempts to turn the phenomenological features of IS into specific physical parameters and control logics. During the prototyping process, design knowledge is created and confirmed. This is done in a systematic way through updated design documentation progressively, which shows how the mechanics have changed over time.

3.1.2 Reflection-in-Action

Guided by the RtD framework, this study adopts Schöns method of Reflection-in-Action [44]. Schön describes how practitioners participate in a continuous "conversa-

tion with the situation" and further enable thinking-in-action when confronting complex and uncertain problems. In the context of developing physical-sensory-based mechanics to present IS, it is difficult for designers to predict exactly how different parameters and their combination will translate into diverse emotional responses.

This method requires continuous self-evaluation and critical reflection. Through iterative prototyping, the designers are able to reflect on the gap between physical feedback and original design intentions. For instance, after changing the friction or steering delay settings, the designer(s) conduct reflective playtesting to see if the resulting feeling of operational discomfort really makes the player feel self-doubt (which is a common trait of IS), or if it simply means that the accessibility of the prototype is poor.

3.2 Project and Development Framework

To support the iterative and reflective demands of the RtD framework established in Section 3.1, this section describes the practical infrastructure underpinning the research: the project management methodology used to organize and pace the development process, and the suite of tools employed to implement, test, and document the prototype.

3.2.1 Agile Project Management

The development process is based on the agile approach, organized in weekly sprints according to the Scrum framework [45]. For each sprint, the development team conducts a planning session at the beginning to decide what they want to accomplish over the next sprint, giving priority to the current state of the prototype and the lessons learned from the latest iteration. At the end of each sprint, a retrospective meeting is held where the team discusses what went well, what could be improved and makes adjustments for the next sprint. All sprint goals, outcomes, and design rationale are documented and maintained throughout the life cycle of the project.

There are two reasons why this Agile approach is especially relevant for the RtD framework. First, the sprint cycle is structurally similar to the iterative prototyping logic of RtD, as Reflection-in-Action demands constant re-evaluation of design decisions in light of emergent feedback, the Scrum retrospective formalizes this process of reflection at periodic intervals. Second, the lightweight implementation used here is suitable for the small-scale team and favors shared documents over dedicated project management platforms such as Jira or Trello, where the overhead of more complex tooling might outweigh its benefits [46].

3.2.2 Development Tools

The prototype is developed in Unreal Engine 5.5 (UE5) [47], which serves as the main development and testing environment during the project. Apart from the prototype being designed as a 3D game, which makes UE5 the more suitable tool in development in performance, the choice of UE5 is motivated by its high-fidelity physics

simulation system and Blueprint visual scripting framework that provide accurate real-time control over the physical parameters such as the friction coefficients, the delay and velocity thresholds of the steering, which are critical to the mechanical metaphors being explored. The engine also supports the iterative evaluation cycles described in Section 3.1.2, with built-in play-testing and profiling tools.

The primary repository system used for version control is Diversion [48]. Diversion is selected in preference to Git, whose file size limitations are not appropriate for the large binary assets typical of UE5 projects, and over Perforce, which has licensing costs too high for a project of this scale. Diversion thus is a practical and cost-effective solution for game development workflows of this nature.

Microsoft Excel is used to organize and process quantitative behavioral data and psychometric results. This is sufficient considering the scale of data expected in this study, and it ensures accessibility without creating unnecessary analytical complexity.

Remote playtesting and interview sessions are conducted via Zoom, VooV Meeting, and Discord. Both Zoom and VooV Meeting were mainly used for the structured interview and think-aloud sessions, as the platforms have both built-in recording and automatic transcription features, which are likely to facilitate the subsequent qualitative analysis. Discord is considered to be used for remote playtesting sessions, as it has low-latency screen-sharing features that allow for real-time observation of participant behavior in play. For all testing sessions regarding screen recordings (both visual and audio), gameplay footage is recorded through OBS Studio, which provides a reliable and non-intrusive record of in-game events for post hoc review.

The ethical implications of the data collection procedures supported by these tools, such as the use of screen recording and video conferencing software to record participant sessions, are fully discussed in Section 4.2.

3.3 Methodological Strategy

3.3.1 Mixed-Methods Approach

To ensure the depth of qualitative experience while maintaining methodological rigor, this study adopts a mixed-methods analytical approach. Following Creswell and Plano Clarks convergent parallel design [49], qualitative and quantitative data are collected simultaneously and integrated at the interpretation stage to gain a more comprehensive understanding than either approach singly. Quantitative behavioral data, like input frequency or failure rates, cannot explain why players feel anxious, while qualitative data lacks the precision and reliability required to calibrate underlying actual parameters.

Consequently, this mixed approach is intended to provide a more complete picture of the IS experience:

1. **Qualitative dimension:** Semi-structured interviews and participant observation are employed to capture players subjective experiences and emotional

reactions while engaging with the games' physical mechanics.

2. **Quantitative dimension:** Validated psychometric instruments are used to determine baseline measures of participants IS tendencies.

This parallel structure aims to maintain sensitivity to individual differences while also enabling quantifiable analytical reference points.

3.3.2 Triangulation

Triangulation is employed to reduce researcher bias by examining the same phenomenon from multiple perspectives [50]. Because IS is inherently hidden, participants might not report, or may hide their negative feelings during interviews. To enhance the reliability of the findings, this study adopts methodological triangulation. Three data sources are cross-referenced to evaluate the experiential impact of the mechanical metaphors:

Three independent sources of data are cross-referenced to more objectively evaluate the effectiveness of the mechanical metaphors:

1. **Psychometric data:** Stratified results from participants Clance Impostor Phenomenon Scale (CIPS) assessments.
2. **Qualitative feedback:** Subjective oral descriptions and interview documentations collected during playtesting.
3. **Quantitative behavioral data:** Logs of game states and failure events acquired via backend telemetry.

The integration of these multiple data sources is intended to mitigate the limitations of any single method and to strengthen the overall reliability of the research findings.

3.4 Data Collection Methods

This section describes the tools and methods used to collect data on players' cognitive, behavioral, and psychological states and actions during gameplay. The data collection is divided into two phases: Phase 1 (initial prototype testing) focuses on usability and how easy it is to understand the affordances, and Phase 2 (the complete vertical slice testing) looks at how emotionally resonant the fully implemented mechanics are.

3.4.1 Psychometric Stratification

Given that IS is a subjective experience, this study proposes the use of the CIPS as an initial measurement tool. The main reason for introducing this scale is to use it as a basis to divide participants based on their mental states. The study seeks to investigate whether players with intense IS tendencies and those with frequent and low IS tendencies demonstrate different emotional mappings and metaphorical inter-

pretations when confronted with identical loss-of-control mechanics by categorizing participants based on the severity of their IS tendencies.

3.4.2 Qualitative Collection

As the effectiveness of mechanical metaphors highly relies on players subjective emotional resonance [51], this study employs three main qualitative collection methods over the two evaluation phases (defined in Section 3.4 above) to get detailed feedback:

1. **Participant Observation:** During gameplay testing, screen sharing and recordings are used to record players' immediate reactions and responses when certain mechanics are triggered, like rail grinding or losing control of direction. This approach also allows for post hoc review to catch missed details, with the goal of distinguishing between usability friction and psychological friction that was designed on purpose.
2. **Cognitive Walkthroughs:** This method is mostly used in Phase 1. It involves asking players to engage in think-aloud protocols while interacting with the system. This enables the researcher to record participants' instinctive interpretations of visual affordances and physical feedback in real time. Think-aloud sessions are recorded as video with audio by Zoom or VooV Meeting, and the built-in automatic transcription features of these platforms are used to generate initial transcripts. These transcripts are then manually reviewed and corrected to analyze accurately. These transcripts subsequently serve as primary input data for the In Vivo Coding stage described in Section 3.5.1.
3. **Semi-structured Interviews:** This method is utilized after gameplay sessions. Through detailed follow-up questioning, it provides a flexible framework for conversation that lets researchers dig deeper into certain or unusual player behaviors and moments of emotional resonance that happen during their play.

3.4.3 Quantitative Collection

To reduce potential biases in players subjective recall, which is frequently intensified by the large cognitive load of intensive gameplay, the study integrates quantitative data collection. Through constructing a backend telemetry system that objectively collects players behavior data. This data includes key gameplay events (such as grind initiation, grind termination, and failure states) and their associated contextual parameters: grind frequency, interacted rail identifiers, manual versus automatic grind termination, causes and frequencies of failure, as well as the player's exact spatial coordinates, velocity, shell thickness, and degree of control loss during these events.

These specific metrics are selected based on their alignment with established behavioral correlates of IS-related anxiety. For instance, an increased degree of control loss and specific failure patterns may signify hesitation and diminished self-efficacy, in accordance with IS phenomenology [10]. This non-intrusive data collection offers

empirical support for evaluating the alignment between the systems difficulty curves and players actual behavioral stress responses.

3.5 Data Analysis Methods

After gathering a lot of text and interview data, a rigorous coding framework is needed to translate vague psychological descriptions into physical parameters that can be changed in the game engine. The analytical pipeline consists of two stages: In Vivo Coding and Thematic Analysis. The two stages lead to the construction of the gameplay translation matrix defined in Chapter 5.

3.5.1 In Vivo Coding

This study employs In Vivo Coding, as delineated by Saldaña [52], to analyze early-stage questionnaire responses, particularly those detailing bodily sensations, and interview transcripts. This method, also referred to as literal coding, uses the participants' own language as the main unit of analysis. Within the context of this research, it is essential to retain participants' original expressions as codes instead of converting them into academic language.

When turning psychological experiences into embodied game mechanics, it is important to keep these raw somatic metaphors. This method is intended to reduce the researchers' biases from getting in the way of the players' real experiences. Consequently, the way the underlying physical parameters are set up, such as friction and steering delay, reflects what the participants have actually experienced.

3.5.2 Thematic Analysis

While In Vivo Coding preserves raw experiential data, it often results in highly fragmented outputs that cannot be directly translated into design specifications. Thus, after extracting a large number of discrete physical descriptions through In Vivo Coding, this study employs Thematic Analysis, which presents a six-phase framework proposed by Braun and Clarke [53] for data reduction and meaning construction.

By identifying, analyzing, and reporting patterns within the data [53], the researchers aim to cluster embodied descriptions into higher-level themes that carry design relevance, such as loss of agency. These themes are then mapped onto adjustable physical parameters within the game engine, which lays the basis for forming the gameplay translation matrix in Chapter 5. For example, the theme of loss of agency may correspond to the parameters of steering delay and friction variability.

4

Methodology

This chapter details the specific instruments and procedural steps employed to operationalize the Research through Design (RtD) methodology established in Chapter 3. This chapter is organized to follow the chronological progression of the research, beginning with an overview of the multi-phased approach and followed by the pre-study analysis that provided the foundational somatic markers for the project.

4.1 Research Methods Overview

The research was structured into 3 interconnected phases to ensure a traceable transition from abstract psychological states to a concrete, playable artifact. Each phase employed a combination of qualitative and quantitative instruments to achieve methodological triangulation and further promote the validity of the findings.

1. Pre-Study

The initial phase established the phenomenological landscape of IS. Participants were stratified based on the score of CIPS, and a structured questionnaire was administered to elicit somatic markers, with detailed physical descriptions of internal psychological states. These data were analysed using In Vivo Coding and thematic clustering to distil the dominant metaphors that would affect the games physics parameters.

2. Prototype Construction

In this phase, the pre-study findings were translated into a functional vertical slice within Unreal Engine 5. Following a cyclic development approach, formative evaluations - including cognitive walkthroughs -were conducted to identify usability barriers and to verify that the loss-of-control mechanics were clear as the core mechanical metaphors.

3. Evaluation

The final phase employed a mixed-methods design to assess the efficacy of the mechanical metaphors. Quantitative behavioural data were captured via a backend telemetry system that recorded failure events and physics states. Simultaneously, qualitative insights were derived through participant observation and post-play semi-structured interviews.

4.2 Ethical Considerations

Given that this study involves human participants and the collection of personal data, including psychometric assessments, audio-visual recordings, and in-game behavioral telemetry, the research was conducted in accordance with the ethical principles for student research projects at Chalmers University of Technology and University of Gothenburg. All participants were fully informed of the nature and purpose of the study prior to their involvement.

For the collection of the audio-visual recordings, informed consent was obtained from all participants before any data collection took place. This was administered via a written electronic consent form, supplemented by an oral briefing, in which participants were advised of the following: that gameplay sessions would be recorded as screen recordings with audio; that all data collected would be used exclusively for the purposes of this study; that all recordings and personally identifiable data would be permanently deleted upon the conclusion of the research; and that participation was entirely voluntary, with the right to withdraw at any time without consequence. The complete informed consent form is included in the Appendix.

To protect participant privacy, all data, such as CIPS scores, interview transcripts, and telemetry logs, were anonymized upon collection. Each participant was assigned an alphanumeric identifier (e.g., A, B) in place of their name, and this identifier is used consistently throughout all data records and analysis outputs. No personally identifiable information is reported in this thesis.

4.3 Pre-Study

To ensure that the mechanical metaphors developed in this project are grounded in empirical evidence rather than subjective designer assumptions, a pre-study was conducted to investigate the somatic markers associated with Impostor Syndrome (IS). The primary objective was to translate abstract psychological anxieties into tangible, physically describable sensations that could help to build the physics and control parameters within Unreal Engine 5.

4.3.1 Participant Stratification

Data collection was initiated through the distribution of an online questionnaire. The questionnaire targets students at Chalmers University of Technology and the University of Gothenburg. To accommodate the language backgrounds of the participants, the questionnaire was administered in both English and Chinese, with the English version distributed through Discord and the Chinese version through WeChat. This questionnaire sought participants from the general student population who self-identified as experiencing some degree of IS, regardless of severity. To ensure the validity of subsequent qualitative responses, participants were first required to complete the Clance Impostor Phenomenon Scale (CIPS) [5], a validated psychometric instrument used to quantify the intensity of IS traits [17]. The original

CIPS had been adapted to an online version for convenience. (The complete online scale can be found in Appendix A.)

A total of 23 valid responses were gathered and categorized according to CIPS score thresholds, mapping the distribution of IS intensity across participants.

- Moderate IP experiences (Scores 41-60): 4 participants.
- Frequent impostor feelings (Scores 61-80): 9 participants.
- Intense IP experiences (Scores >80): 9 participants.

As illustrated in Figure 4.1, over 81% of participants exhibited frequent or intense IS tendencies. This concentration provides a basis for examining the more extreme somatic manifestations of the phenomenon. Furthermore, the severity-tier division establishes a structural reference for calibrating the games difficulty progression.

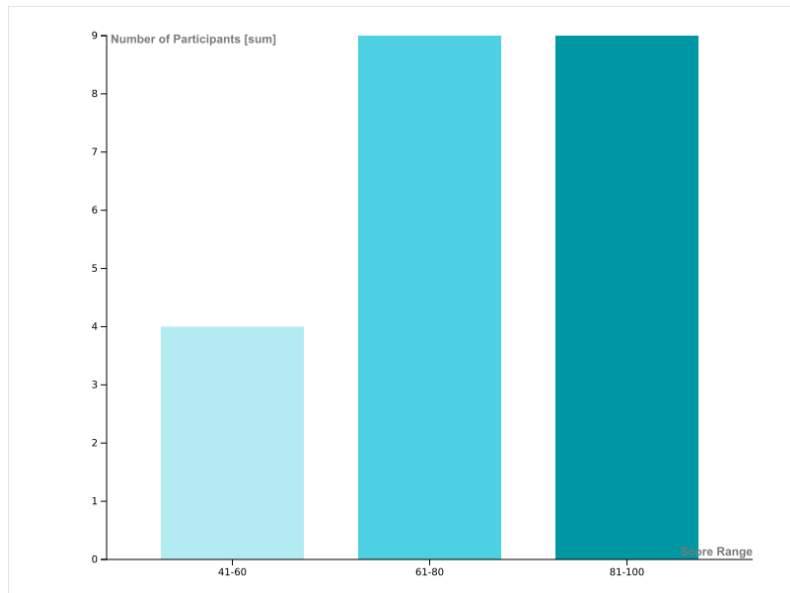


Figure 4.1: The Distribution of Participants based on CIPS Score Ranges in Pre-Study.

4.3.2 Analytical Methodology

The questionnaire comprised 7 open-ended items and 2 multiple-choice questions. (The complete questionnaire instrument can be found in Appendix B.) It targets the embodied phenomenology of IS, specifically prompting participants to conceptualize their self-doubt as physical resistance, environmental conditions, and material properties. The qualitative data were processed using a mixed-methods analytical framework [49]:

- **Weighted Feature Extraction:** For items defining physical environments and constraints (Q1, Q2, Q6, Q9), a structured filtering approach was applied. In Vivo Coding [52] was employed to extract keywords using participants' exact

terminology, thereby preserving the authenticity of their somatic descriptions. Each extracted keyword was subsequently assigned a priority weight (Critical, High, Medium, Low) based on frequency and thematic relevance.

- **Thematic Clustering:** For items exploring dynamic locomotion and sensory perception (Q3, Q4, Q5, Q7, Q8), responses were analysed and grouped into functional clusters following the principles of thematic analysis [53].

4.3.3 Weighted Feature Extraction

To translate the abstract sense of emotions into actionable and playable mechanics, a structured analytical pipeline was applied to the mandatory questions (Q1, Q2, Q6, Q9). These questions were designed to compel participants to map their psychological states onto specific physical properties. The pipeline proceeded through three sequential stages.

1. Criteria were established through a combination of deductive game-design requirements and inductive reading of the raw responses. To render subjective feelings amenable to implementation within a physics engine, the raw text was sorted into structural dimensions. For example, in the analysis of underfoot resistance (Q2), responses were categorized into criteria such as Resistance Type/Texture, Dynamics, Body Feeling, and Tactile Sensation. This step helps to build abstract psychological states turned into distinct physical properties.
2. Keywords were extracted from both the English and Chinese survey datasets via In Vivo Coding [52]. Rather than paraphrasing responses, this method preserves participants' exact terminology (e.g., the literal words feel like being blocked by the speed bump), hoping to reduce the risk that designer biases might overwrite participants' embodied experiences.
3. A frequency-based Weight Allocation was applied. Not all extracted keywords hold equal value for mechanical translation; accordingly, each keyword was assigned a priority level - Critical, High, Medium, or Low based on two criteria: consensus (frequency of occurrence across participants) and mechanical directiveness (the degree to which the keyword provides a clear implementation target). Keywords demonstrating both high consensus and clear mechanical directives (e.g., the co-occurrence of Heavy and Slippery in Q2) received Critical or High weight. Those scattered individual sensations or secondary sensory details (e.g., Cold) were assigned Medium or Low weight, contributing to atmospheric design rather than the primary physics loop.

Utilizing this pipeline yields 4 fundamental elements for the mechanical metaphor in the context of IS.

1. The Environmental Dominance

For Q1, when asked to visualize the IS experience as a physical environment, the criteria of restriction and stability emerged with Critical weight. Visual impairments such as fog or darkness were frequently mentioned but received

only Medium weight. The dominance of spatial restriction and ground instability over visual obscurity dictated that the game's challenge should stem primarily from physics and spatial layout rather than from reduced visibility.

2. The Texture of Resistance

The analysis of Q2, underfoot resistance, revealed an important mechanical parameter. The texture was equally mentioned as either heavy or slippery (one of which should be weighted as Critical, considering heavy and slippery are opposing features). Furthermore, the dynamics of this resistance were uniformly described as accumulating over time (Critical weight) rather than remaining constant. This provides a direct guideline for the core friction system.

3. The Materiality

Q6 mainly explored the materiality. Participants were asked to describe the physical material of their protective mask. The highest-weighted keywords fell under the fragility and transparency. The consensus pointed toward a material that appears rigid and clear yet shatters readily. These empirical descriptors are directly consistent with the designer's original assumption and also inform more visual and physical properties of the metaphor employed in the artifact.

4. The Dynamics of Collapse

Regarding the moment the impostor facade ruptures in Q9, the extracted data highlighted two distinct dynamics with High to Critical weight: one is sudden explosion (shattering) and the other is slow melting (dissolving). These 2 opposing descriptions provided the foundation for designing two distinct failure states within the games core loop.

4.3.4 Thematic Clustering

4.3.4.1 Locomotion

A critical finding is through the thematic clustering of locomotion-related questions (Q2-Q5), which revealed a paradoxical relationship between momentum and perceived agency.

As detailed in Figure 4.2, when individuals with IS push through self-doubt to complete tasks, their physical sensation of movement does not reflect steady progression. Instead, it manifests as a three-stage struggle.

1. Initiation

When initiating a task, the overwhelming consensus characterized the associated physical resistance as "heavy" and "dragged". Participants described their bodies feeling top-heavy and dizzy or heavy and leaning backward. This finding indicates a substantial initial psychological inertia that must be overcome to sustain an ideal external image.

2. In-Motion

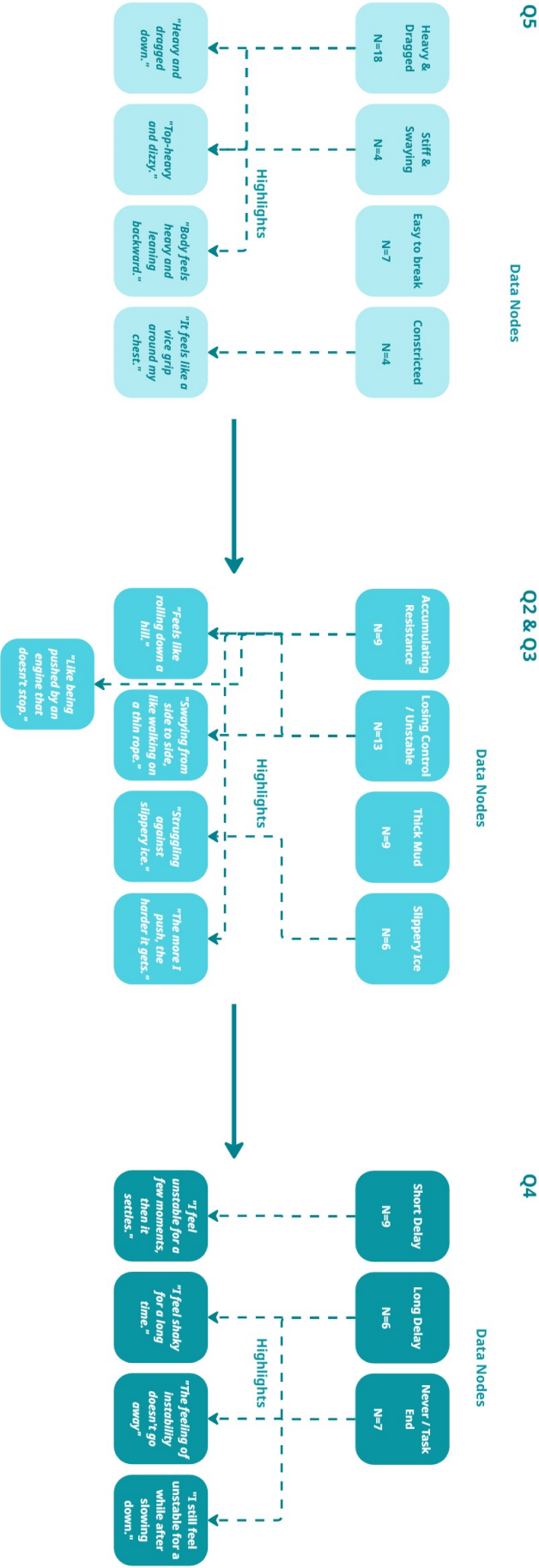


Figure 4.2: The Affinity Chart of Extracted Data.

Paradoxically, once momentum is achieved, the sensation of heaviness transitions into a destabilizing loss of friction. 13 participants indicated an acute sense of losing control or becoming unstable as momentum accumulated. Some descriptions characterized this state as rolling down a hill and swaying from side to side, like walking on a thin rope. This observation yields a core and simple mechanical translation - external success corresponds to internal, uncontrollable acceleration.

3. Delayed Recovery

Upon attempting to stop or complete a task, the return of perceived control is mainly reported as "delayed". Only a minority of participants describe it as achieving immediate stability; the majority described from short delay to long delay, or stated that the instability persists even after task completion.

4.3.4.2 Materiality and Perception

Beyond locomotion, the pre-study sought to characterize the physical properties of the mask of impostors (through Q6, Q9) and their perceived feelings, as well as the spatial environment (through Q1, Q7, Q8).



Figure 4.3: The Radar Chart of Extracted Data.

As Figure 4.3 shows, when asked how their protective mask would appear in physical form, participants mainly mentioned Fragility and Transparency, which makes the two elements relatively high-weighted criteria. There are also comments like hard that describe how the shell may look fragile, yet actually be firm. Besides, the shattering of this mask is mostly not viewed as a relief but rather as a sudden event

- mainly by metaphorizing it as an explosion. Some participants also referred to melting.

As for environmental perception, according to the radar chart, the spatial crushing constituted the dominant environmental feature (with 18 participants mentioning it). Participants described the fear of failure as being submerged in water or sensing that the "floor disappearing". On the other hand, visually, this anxiety manifests as a restriction of perceptual awareness, predominantly described as tunnel vision.

In summary, the pre-study concluded four significant design elements: environmental dominance, textural resistance, material fragility, and the dynamics of collapse, with several useful features via keywords. These findings do not merely confirm the initial assumptions; they sharpen and even complicate them. These empirically derived constraints form the foundation of the translation matrix presented in Chapter 5, which maps each somatic marker to a corresponding set of physics parameters within the implementation of the prototype. Therefore, the pre-study not only acts as background context but also as an important instrument for reference in the design process.

5

Prototype Construction

5.1 Design Rationale

This section details the concrete translation process from abstract psychological states, as well as data collected previously, to playable game mechanics. Applying the RtD approach, this section mainly concentrates on how initial design intuitions were combined with empirical pre-study data and transformed into a functional loop of game design.

5.1.1 Conceptual Design

The conceptual foundation of this project originated from an intuitive exploration of movement and materiality, guided and validated by the theoretical frameworks established in Chapter 2. Individuals who suffer from Impostor Syndrome (IS) conventionally feature a huge gap between external performance and internal doubts about themselves, often appearing functional or even high-performing while simultaneously suffering from pervasive anxiety. As established in Section 2.1, the Impostor Cycle describes a dynamic in which success cannot be internalized as evidence of competence, and each subsequent achievement exacerbates rather than alleviates the underlying insecurity. Following the principle proposed by Rusch and Weise [25] that rules and interaction can directly model the essential characteristics of an abstract experience, this project sought a combination of locomotion form and material property that allows its inherent physical behaviors to structurally map this paradox.

Before settling on a high-intensity action format, several alternative game genres were also considered during the design stage and ultimately set aside. Narrative-driven games, such as *Depression Quest* [3], offered a precedent for representing psychological experience through player choice and textual framing. However, the aim of this project is specifically to translate IS into somatic and physical game parameters, targeting the bodily and felt dimensions of the experience rather than its cognitive or narrative content. A format that communicates primarily through language and choice architecture is less suited to this particular translational goal. A format that communicates primarily through language and choice architecture seemed unlikely to reproduce this bodily dimension of the experience. Walking simulators and low-intensity exploration games, as reviewed in Section 2.5.1, similarly rely on environmental pacing and ambient feedback rather than moment-to-moment physical negotiation with the game system. Tabletop role-playing games (TTRPGs)

were also briefly considered, given their capacity for nuanced exploration of interpersonal dynamics and feelings. Yet their socially mediated and improvisational nature makes it difficult to isolate and evaluate the effect of specific mechanical metaphors in a systematic way, which is central to the research aims of this project. High-intensity action gameplay was therefore retained as the context of this project.

During the very early conceptualization phase, as for the form of locomotion, traditional parkour and skateboarding were considered but were ultimately discarded. On one hand, traditional parkour relies heavily on active, deliberate jumps, giving the player precise control over every action. However, the core experience of IS is precisely the loss of such control, the feeling of being propelled forward by external momentum without being able to stop. On the other hand, skateboarding can not offer a strong connection to the body and posture, which means the player may step off the board at any moment to abort an action. Rollerblading was selected, as skates act as an extension of the body rather than a detachable, outer tool. In addition, once momentum is gained during skating, stopping, particularly sudden stopping, becomes hard, dangerous, and not easily controlled. This difficulty of halting movement intuitively provided a basic metaphor for IS: the experience of being locked into and propelled by a momentum that grows increasingly difficult to manage.

Apart from the locomotion form, the visual and material properties of hard sugar shell were chosen to represent the impostor's facade. Sugar shell contains several qualities that align with the IS experience. It is "sweet", which stands for external praise and perceived success. It is "transparent", which provides a sense that the individual feels exposed and is sought through, yet their true self remains distorted and even invisible to themselves. The sugar shell appears hard but is acutely fragile. This materiality brought form to the facade of impostors. The outer coating serves as the protective layer that grows more burdensome with each apparent success, yet remains perpetually brittle.

Analyzed through the Semblance dimension of the LocoLudo framework [30], these design choices establish a structural correspondence between the form of the game mechanics and the psychological themes they seek to express. The physical properties of the sugar shell, namely its transparency, fragility, and gradual thickening with accumulation, map directly onto the experiential structure of IS: the fear of being seen through, the brittleness beneath a composed exterior, and the paradox that continued success increases burden rather than confidence. Similarly, the physical characteristics of rollerblading, where once high-speed momentum is gained, it is hard to stop, maps onto the IS dynamic in which individual is locked into an escalating cycle of performance that becomes difficult to exit. In both cases, the metaphorical meaning is not externally imposed through narrative exposition but emerges intrinsically from the physical behaviors and material properties of the mechanics, with the visual presentation integrated into the game system rather than functioning as a separate or main symbolic layer.

5.1.2 Data Extraction

To ground these initial design intuitions established in Section 5.1.1 in empirical reality, the qualitative data from the pre-study (Chapter 4) were systematically analyzed. As reported in Section 4.3.3, the pre-study concluded four significant design elements through weighted feature extraction and thematic clustering: environmental dominance, textural resistance, material fragility, and the dynamics of collapse. This section explains how these empirical findings were selectively filtered and translated into actionable design constraints for the prototype.

Not all pre-study data were carried forward into the design. Several participants described sensations of "darkness", "fog", "itchy", or feeling "cold". These data points were excluded based on two primary reasons. First, they represented lower-frequency responses relative to the dominant somatic themes of friction and spatial restriction. Second, and more fundamentally, incorporating visibility-reducing mechanics such as fog or darkness would directly conflict with the high-brightness, transparent aesthetic central to the sugar metaphor. Maintaining internal coherence between the game's visual language and its psychological argument required that the design exclusively prioritize high-consensus somatic markers related to friction, stability, and spatial restriction.

The data that were retained provided concrete parameters for the physics engine. The thematic clustering of locomotion-related questions from Q2 to Q5 revealed a paradoxical three-stage relationship between momentum and perceived agency, as detailed in Section 4.3.4.1. At the initiation stage, movement was overwhelmingly described as "heavy" and "dragged", indicating substantial psychological inertia, which means that it's hard to start. Yet once momentum was achieved, this heaviness paradoxically transformed into a feeling of instability and frictionlessness, with participants reporting sensations of losing control and uncontrollable acceleration. Upon attempting to stop, the recovery of perceived control was predominantly described as "delayed" rather than immediate. This empirical finding directly validated the initial rollerblading concept from Section 5.1.1 and provided the concrete parameters needed for the physics engine, particularly dynamic friction, which decreases with sugar shell accumulation, steering inertia, which increases with sugar shell thickness, and lateral drift, which amplifies the sideways sliding sensation during turns.

The data from Q6 and Q9 similarly confirmed and refined the sugar shell concept. Most participants consistently described their protective mask as fragile and transparent, aligning with the material properties already selected in the conceptual design. Regarding the moment of collapse, two distinct dynamics emerged with high to critical weight: sudden shattering and slow melting. These opposing descriptions informed the design of two distinct failure states within the core game loop, as elaborated in Section 5.1.4.

The extracted findings, after being filtered and validated, form the basis of the Gameplay Translation Matrix presented in the next section, which maps each somatic marker to a corresponding set of physics parameters and game mechanics.

5.1.3 Gameplay Translation Matrix

The following section maps the filtered pre-study findings from Section 5.1.2 to their corresponding design interpretations and game mechanics. Rather than presenting these mappings in isolation, they are organized according to the four design elements identified in Chapter 4, tracing each somatic marker from its empirical origin through to its implementation within the prototype's physics system.

1. The Texture of Resistance

At the initiation stage, movement was overwhelmingly described as "heavy" and "dragged", indicating substantial initial resistance that must be overcome at the start of each action. This was translated into a turning inertia system in which A/D steering input gradually initiates turning when pressed, producing a delayed onset effect that intensifies as the sugar shell thickens. Once in motion, participants reported that the sensation of heaviness paradoxically transformed into a "slippery" loss of friction, accompanied by feelings of "losing control" and "uncontrollable acceleration". This transition was implemented through three concurrent physics systems: dynamic friction that decreases as sugar shell thickness increases, steering responsiveness that reduces turning sensitivity as the shell thickens, and lateral drift that amplifies sideways sliding during turns. Importantly, participants described this resistance as accumulating over time rather than remaining constant, indicating that the psychological burden of IS compounds with continued performance. Accordingly, the sugar shell thickness grows incrementally through skating, and all related physics parameters shift continuously rather than in discrete steps. Finally, the return of control after stopping was predominantly described as "delayed", suggesting that recovery from the IS state is not immediate. This was reflected in the grinding mechanic, where sugar shell thickness decreases progressively rather than resetting to zero immediately.

2. The Environmental Dominance

Spatial crushing was identified as the dominant environmental feature, with ground instability frequently mentioned by participants. This indicated that the game environment should challenge the player through spatial constraint and unstable surfaces rather than through visual obscurity. The level design therefore emphasizes narrow paths, elevated platforms, and physics-reactive surfaces.

3. The Material Fragility

When asked to describe the physical material of their protective mask, most participants consistently characterized it as fragile and transparent. This directly confirmed the sugar shell concept established in the conceptual design. The impostor facade appears solid but is brittle, and visibility through the shell conveys the fear of being seen through. In the prototype, the sugar shell is rendered as a translucent, glass-like material that visibly turns pink under stress.

4. The Dynamics of Collapse

Regarding the moment of collapse, participants described two distinct dynamics: sudden shattering and slow melting. These opposing descriptions informed the design of two failure states within the core game loop. The first is a collision-triggered shattering that occurs when the sugar shell becomes too thick and the character collides with an obstacle. The second is a gradual dissolution that occurs when the shell is ground away completely, leaving the character fully exposed.

These mappings are summarized in Table 5.1. The mechanics described above are not implemented in isolation but are integrated into a cyclical core game loop, which is detailed in the following section.

Table 5.1: Summary of the Gameplay Translation Matrix

Pre-study Finding	Design Element	Game Mechanic
Heavy, dragged or slippery movement	Texture of Resistance	Steering inertia, dynamic friction, lateral drift
Spatial crushing, ground instability	Environmental Domination	Narrow paths, elevated platforms
Fragile, transparent mask	Material Fragility	Translucent sugar shell material
Sudden shattering and Slow melting	Dynamics of Collapse	Collision shattering and Over-grinding dissolution

5.1.4 Core Game Loop

Driven by the translation matrix, the minimum viable prototype establishes a core loop organized around maintaining a balance where the outer sugar shell is neither too thick nor too thin. A foundational design decision underpinning this loop is that the character moves forward automatically once skating begins. The player does not control whether to move forward or backward, only how to steer. This elimination of the option to pause or reverse simulates the IS experience of being locked into forward momentum by external expectations and professional demands.

Figure 5.1 below summarizes the core gameplay loop, including auto-forward skating, shell accumulation, control degradation, strategic grinding, shell reduction, control recovery, and the two failure boundaries.

Within this continuously advancing structure, the loop can be divided into four stages:

1. Accumulation (Skating)

As the character moves forward, the sugar shell gradually thickens. This stage corresponds to the initial phase of the Impostor Cycle in which the individual engages in tasks and accumulates external markers of success. During this stage, the gameplay feels controllable, and the player’s controls remain relatively responsive, which quick left and right turns. The character’s lateral

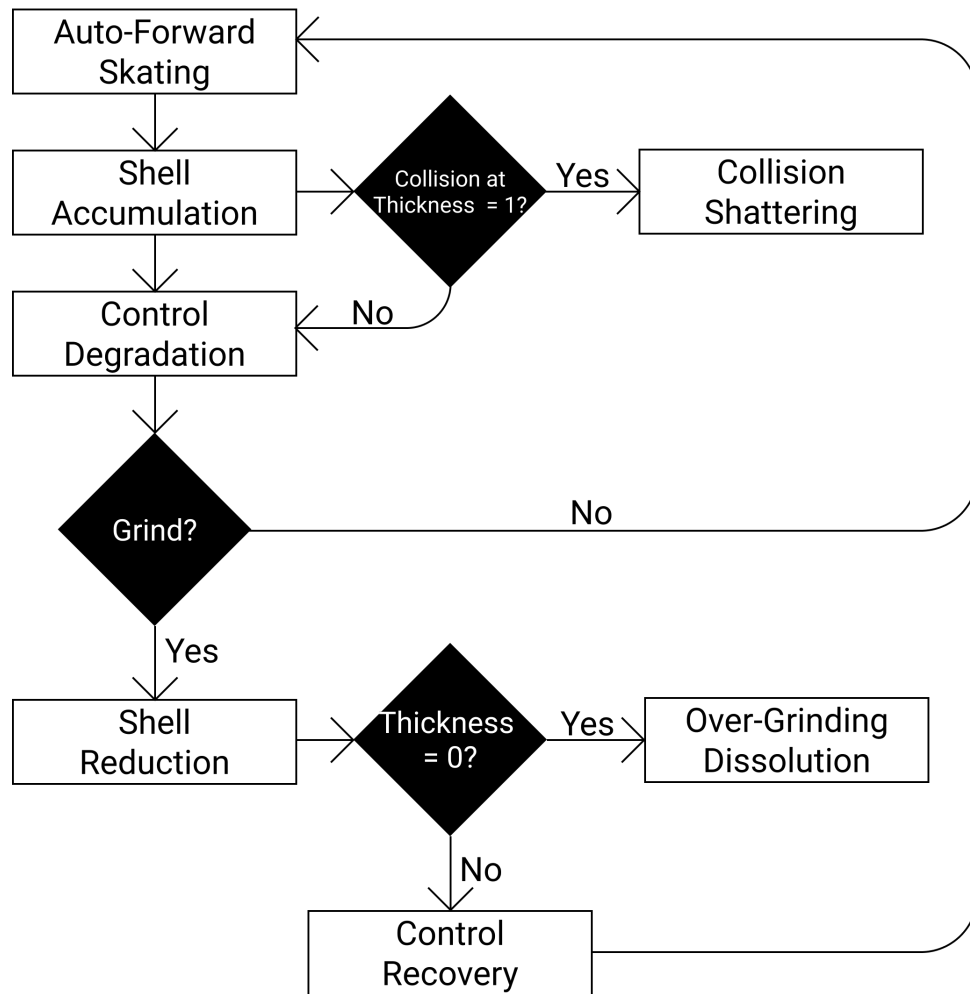


Figure 5.1: Core gameplay loop.

steering can be controlled according to the player's intentions. However, this seemingly smooth progression does not bring true security. The sugar shell grows with every moment of forward motion, creating the conditions for the next stage.

2. Loss of Control

As the sugar shell thickens and the melting degree increases, the physics parameters begin to shift. Dynamic friction decreases, steering sensitivity drops, and lateral drift intensifies, making the loss of control increasingly apparent. The player, who felt fully in control moments ago, now finds it increasingly difficult to maintain their intended trajectory. Steering input becomes slow to respond, and the character continues to rotate after the input is released due to residual inertia. At the same time, the character's facing direction and actual skating direction gradually separate, producing a sideways sliding sensation of losing control. At the same time, the character's facing direction and actual skating direction gradually separate, producing a sideways sliding sensation of losing control. Additionally, the growing shell thickness expands the character's collision radius, making collisions with environmental obstacles more easily. This stage embodies the core paradox of IS: as the player continues skating forward, they appear on the surface to be progressing smoothly. However, this process continuously thickens the sugar shell, gradually transforming the accumulation of outward performance into an internal loss of control.

3. Strategic Abrasion (Grinding)

When the sugar shell becomes too thick and the melting degree too high, making the character increasingly difficult to control, the player cannot resolve the situation by continuing to skate. To survive, the player must actively seek grind rails and jump onto them. Once attached to a rail, the system temporarily takes full control of the player's momentum and direction through spline-based movement, relieving the player's cognitive load and simulating a brief moment of calm. The sugar shell is gradually removed during grinding, restoring the physics parameters to their relatively controllable values. However, this seemingly relieved moment is not without risk. If the player remains on the rail beyond a critical threshold, that is, when the sugar shell has been completely removed, a second failure state is triggered, where the player is destroyed not by external collision, but by the lethal over-exposure of the self beneath the facade.

4. Reset

After exiting the grind rail, the player returns to the skating state with a thinner shell. The accumulation process begins again. Notably, the recovery is not instantaneous. After exiting the grind rail, the player returns to the skating state with a thinner shell. The accumulation process begins again. Notably, the recovery is not instantaneous. The sugar shell thickness gradually decreases rather than resetting immediately, reflecting the pre-study finding that the return of control is perceived as delayed. The loop then cycles back

to Stage 1, which is Accumulation.

Translating a sustained negative psychological experience into a playable action game required a specific and deliberate ludic compromise. In the actual IS experience, sufferers might rarely access an automated relief for shedding accumulated anxiety. However, if the game enforces constant loss of control, it would render the game unplayable and cause players to fully disengage. Therefore, the grinding mechanic was designed with a degree of automation. Once snapped onto a rail, the system temporarily takes full control of players' momentum and steering. The grinding mechanic represents a necessary concession to playability, providing a structured interval of relief within an otherwise escalating cycle of instability.

Having applied the Semblance dimension in Section 5.1.1 to analyze the structural correspondence between the game's material properties and the psychological themes of IS, the core loop can be further analyzed through the remaining three dimensions of the LocoLudo framework [30]. In terms of Subversion, the loop deliberately breaks the conventional action game expectation that increased player progression leads to greater stability and mastery. In this game, continued skating, while seemingly progressing smoothly on the surface, actually directly worsens the player's control over the character. This inversion of the mastery paradigm functions as a form of defamiliarization, prompting the player to question why progress feels instability rather than empowering. In terms of Pattern, the four-stage cycle of accumulation, loss of control, grinding, and reset maps to the repetitive structure of the Impostor Cycle itself, in which each completed task does not bring lasting confidence but renewed anxiety when the next challenge arrives. The cyclical nature of the loop ensures that the player cannot permanently resolve the tension but must continually renegotiate the balance between facade thickness and vulnerability. In terms of Product, the execution of each mechanic produces concrete, observable changes to the game state. Skating increases shell thickness, with the shell visually transitioning from transparent to pink to reflect the growing thickness. This leads to degradation of physical parameters, resulting in steering lag, reduced dynamic friction, and enhanced lateral drift. Grinding reduces shell thickness, restoring control but introducing exposure risk. Moreover, when the shell is too thick, collisions with obstacles trigger shattering, while Over-grinding trigger dissolution. Each mechanical action therefore carries tangible consequences that together construct the experiential argument of the game.

In summary, the core loop gamifies the IS condition. The player has to find a stable place between the accumulation of a thickening facade and the mortal vulnerability of its total removal as they move forward without stopping.

5.2 Technical Framework

5.2.1 System Architecture

The prototype was developed in Unreal Engine 5.5, targeting the Windows platform. The choice of Unreal Engine 5 was driven by two requirements. First, it provides a

physically-based rendering pipeline capable of producing the translucent, glass-like material properties, which is essential to realizing the sugar shell concept described in Section 5.1.1. Second, its Blueprint visual scripting system provides the rapid iteration capability required by this research.

The codebase employs a dual-layer architecture. Game logic is implemented mainly in Blueprint, while a minimal C++ module handles structured log export functionality, which Blueprints are not particularly adept at. This hybrid structure preserves the flexibility needed for prototyping while ensuring that player test data can be saved in a stable format. Keeping the core mechanics within the Blueprint framework allows physics parameters such as shell thickness, steering inertia, and dynamic friction to be rapidly adjusted and their effects observed quickly during iterative testing cycles, without the full compilation cycle required by C++ development. This flexibility is crucial for the reflection-in-action approach outlined in Section 3.1.2, which focuses on adjusting parameters and immediately observing their effects, thus forming the main mode of design exploration. At the same time, since the objective of this research is to validate the expressive potential of mechanical metaphor within high-intensity movement mechanics rather than to develop a complete commercial product, this Blueprint-centered technical approach ensures rapid iteration capability while reducing development complexity.

Asset and version management throughout the development cycle was handled by Diversion. This enabled team members to synchronize their development progress, and Diversion’s file locking mechanism effectively prevented merge conflicts caused by multiple people modifying the same file simultaneously, which is particularly important for the binary asset files in Unreal Engine that cannot be merged directly.

Player input is managed centrally by Unreal Engine’s Enhanced Input system and passed to the core character Blueprint through a single input mapping context, **IMC_SugarGloss**. At the architectural level, the input system serves as the entry point from external player actions to character state updates. The specific logic for steering, jumping, camera control, and automatic forward movement will be described in the subsequent sections.

The runtime structure of the project consists of several main Blueprint classes. **BP_SugarGlossCharacter** handles real-time character movement, sugar shell state, rail detection, death logic, and UI calls. **BP_SugarGlossGameMode** manages respawn locations and character regeneration. **BP_MyGameInstance** handles player event logging and log export. Level Actors such as **BP_Spline** and **BP_MovingPlatform** provide grind rails, moving platforms, and other environmental interactions. Figure 5.2 illustrates the overall system architecture and the relationships between these components.

The core game logic is concentrated in the character Blueprint **BP_SugarGlossCharacter**. This Blueprint switches between a skating state and a grinding state via a Boolean variable, **IsGrinding**, executing different update logic each frame based on the current state. **ShellThickness** is the central hub of the entire architecture, incrementing during skating and decrementing during grinding. Multiple key subsystems derive their behavior from this variable, forming a unified causal chain. Subsequent

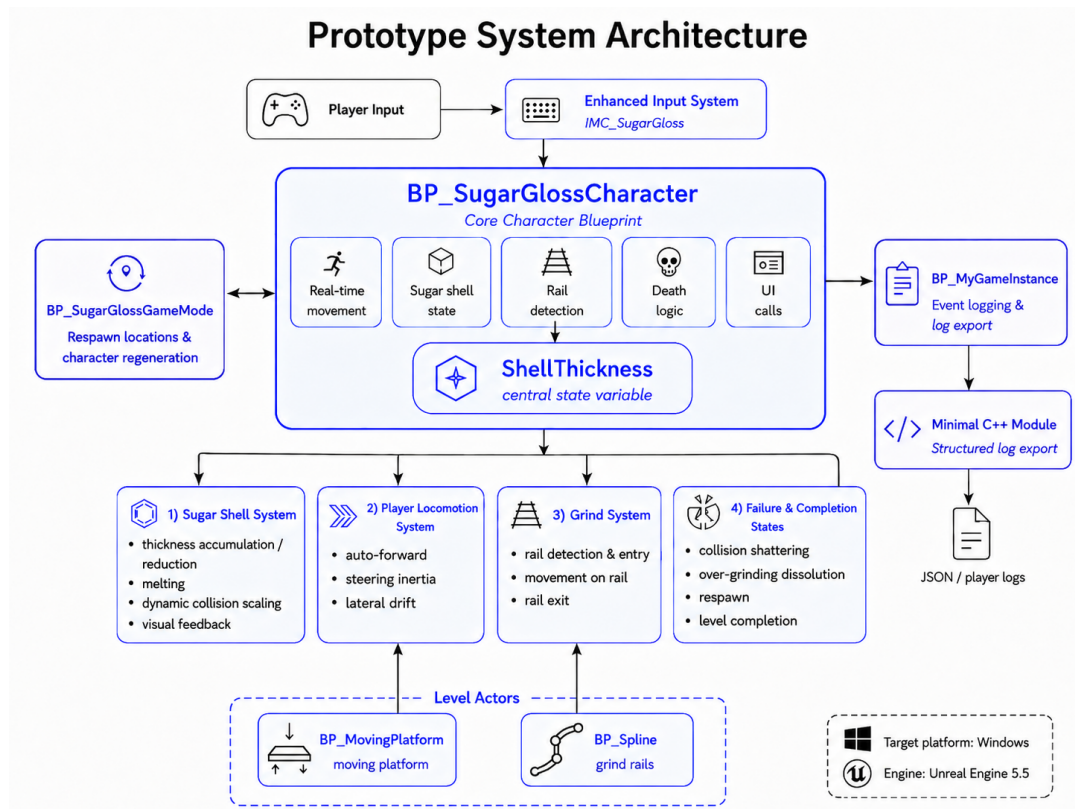


Figure 5.2: Prototype system architecture. AI-assisted figure, revised by the authors.

subsections will detail the specific implementation of each subsystem within the skating and the grinding states.

5.2.2 Sugar Shell System

The sugar shell system is the core mechanic of this prototype, responsible for translating the psychological metaphor of IS into a perceivable gameplay experience. Through a central variable, **ShellThickness**, the system drives the dynamic interaction between the character's physical properties, visual presentation, and control responsiveness in real time, allowing the player to personally experience the core IS paradox: the more external success accumulates, the stronger the internal sense of losing control becomes.

5.2.2.1 Thickness Accumulation and Reduction

During the skating state, when the character's current speed exceeds a minimum threshold, the shell thickness increases each frame by the product of the frame's delta time and a configurable growth rate coefficient, clamped to the range between zero and one. The shell thickness continues to increase as long as the character is in motion.

During the grinding state, the thickness decreases gradually. The rate of reduction is controlled by a separate grinding wear rate, ensuring that the shell is not instantly stripped away but gradually worn away during the grinding process. By designing shell reduction as a continuous process rather than a binary reset, the system preserves the characteristic of delay recovery that described by participants in the pre-study.

5.2.2.2 Melting and Control Degradation

Rather than using the shell thickness value to directly modulate game parameters, the system introduces an intermediate variable, **MeltAmount**, which represents the degree to which the shell gradually degrades and becomes unstable as its thickness increases. This variable has two purposes: firstly, it smooths changes in shell thickness into gradual perceptual transitions, avoiding sudden changes in control responsiveness for the player; secondly, it introduces hysteresis, preventing the melting state from flickering on and off rapidly when the shell thickness oscillates near a threshold boundary.

The melt amount approaches the target value gradually each frame at a fixed speed using an interpolation function (`FInterpTo`). The target value is derived from the shell thickness to the power of 1.5, meaning that at low thickness the target melt value is much lower the actual thickness, while at high thickness it rapidly converges toward it. This non-linearity ensures that the early stages of shell accumulation feel relatively wild, while the later stages produce significantly more dramatic degradation in control.

Melting degradation occurs only during the skating state. When the character is grinding, the target melt value is set to zero, the melt amount gradually recovers

through interpolation, that is, the melt amount approaches zero, and the player's control gradually returns.

The hysteresis mechanism operates through two independent thresholds. The melting state activates when the melt amount exceeds an upper threshold and deactivates only when it falls below a distinct lower threshold. This separation prevents rapid switching of the state near the boundaries, so that once melting begins, it will not immediately be deactivated by minor fluctuations in shell thickness. The player will experience a sustained period of degraded control rather than repeated brief disruptions.

The system derives a control degradation coefficient, `ControlAlpha`, from `MeltAmount`. This coefficient propagates to the locomotion system described in Section 5.2.3, where it modulates steering sensitivity and lateral drift intensity. Through this parameter chain, numerical changes in shell thickness are translated into a perceivable degradation of control, making the sense of losing control an inherent necessity of the system, rather than an external punishment.

5.2.2.3 Dynamic Collision Scaling

As the shell thickens, the collision boundary of the character expands. The system computes the ratio of the current shell thickness to a predefined critical thickness, clamps this ratio to the range between zero and one, and uses it as the interpolation alpha between the base capsule radius and a scaled-up radius at 1.5 times the base value. The resulting radius is applied to the character's capsule collision component each frame, ensuring that the collision boundary is always synchronized with the current shell thickness.

This mechanism establishes a direct causal link between shell accumulation and environmental vulnerability: as the shell becomes thicker, the character occupies more physical space, increasing the likelihood of collisions with obstacles. Collision-triggered shattering constitutes the first of the two failure modes detailed in Section 5.2.5.

5.2.2.4 Visual Feedback

The visual appearance of sugar shell changes continuously with the shell thickness, providing the player with an indication of their current stage within the core loop. Two dynamic material instances are updated each frame with a scalar parameter derived from the current shell thickness, driving a material transition from a transparent, glass-like appearance at low thickness values to an gradually opaque pink at high values. Transparency conveys the fear of being seen through, while the increasing pink opacity represents the visible accumulation of the impostor facade, consistent with the conceptual design established in Section 5.1.1. This visual progression is shown in Figure 5.3.

In addition to the shell material, there are two visual indicators that convey the shell state to the player. As shown in Figure 5.3d, a circular indicator in the upper-left corner of the screen reflects the shell's color change in sync, allowing players

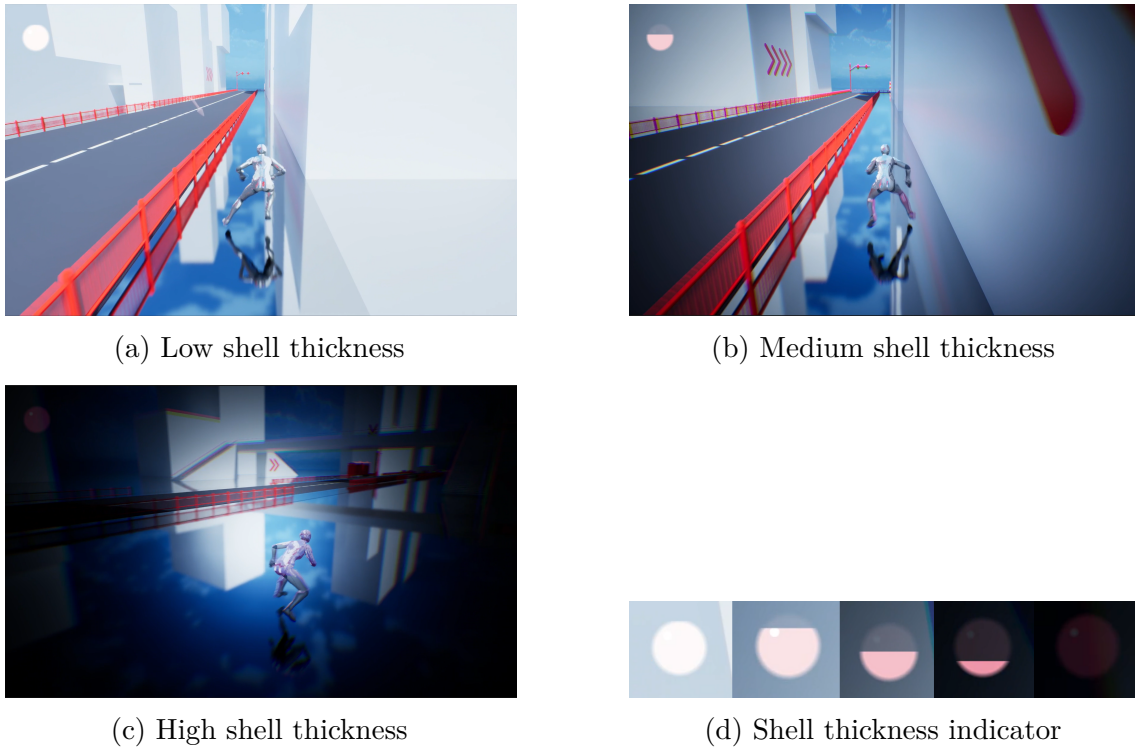


Figure 5.3: Visual progression of sugar shell thickness during gameplay.

to judge the current shell thickness at a glance, even if the character model is partially obscured. As the shell approaches critical thickness, a darkening vignette effect gradually appears around the character, narrowing the player’s visual field and creating an increasing sense of urgency, as visible in Figure 5.3c.

5.2.3 Player Locomotion System

The player locomotion system translates the state variables generated by the sugar shell system into the character’s actual movement behavior within the level. The core design decision is that the character moves forward automatically once skating begins. The player cannot control forward or backward movement, only turning. This constraint eliminates the possibility of pausing or retreating, simulating the feeling of being locked into forward momentum by external expectations in the experience of IS.

5.2.3.1 Auto-Forward and Speed Control

Auto-forward movement is driven by the `UpdateAutoMove` function, which updates the character’s forward state every frame. Once auto-forward is activated, the character skates continuously toward a preset maximum speed. The current speed does not change instantaneously but transitions smoothly toward the target speed each frame via `FInterp To`, avoiding sudden acceleration or speed jumps. The speed is also clamped to a minimum of zero to prevent backward movement.

The character’s movement is composed of two directional components: a forward in-

put applied along the character's forward direction, and a lateral input applied along the character's right direction, with the lateral intensity determined by the current steering input. After the movement inputs are applied, the system continues to update the turn rate and lateral drift by calling `UpdateTurnRates` and `ApplySideSlip`. When the character enters the grinding state, manual steering input is disabled and the character's direction is guided entirely by the rail spline.

5.2.3.2 Steering Inertia

The steering system is the core of the control experience, processing the player's steering input through two layers of smoothing. The first layer smooths the raw input signal so that when the player presses a direction key, the input value does not jump instantly but gradually transitions toward the target value. The second layer converts the smoothed input into a target turn rate, which is then smoothed again to produce the actual turn rate. This is because even after the input has stabilized, the character's actual turning speed still takes time to catch up to the target. This dual smoothing allows the player to feel the dragging sensation of steering gradually starting after the direction key is pressed and the inertia of gradually stopping after it is released, giving the character's movement an obvious sense of mass.

Building on this foundation, the control degradation coefficient, which is `Control Alpha`, produced by the sugar shell system plays a critical role in the loss-of-control design within the second smoothing layer. It modulates how quickly the actual turn rate catches up to the target. When the shell is thin, the response speed is high and steering follows the player's input quickly. As the shell thickens, the response speed drops significantly and steering takes longer to react. The player thus experiences increasingly noticeable steering lag as the shell accumulates, which constitutes one of the main control manifestations of the "loss of control" stage in the core game loop.

5.2.3.3 Lateral Drift

After the steering system, the `ApplySideSlip` function further reinforces the sense of losing control. The system first derives a slip intensity value, `Slip Alpha`, from the control degradation coefficient, `Control Alpha`. As the shell thickens, the slip intensity gradually increases.

The slip intensity affects two aspects. Firstly, the system simulates movement inertia. When the character changes its facing direction, the actual sliding direction does not follow immediately but takes time to gradually catch up. The higher the slip intensity, the slower this catch-up process, and the greater the deviation between the character's actual sliding direction and its facing direction. Secondly, the system directly reduces the character's ground friction, making it easier for the character to slip when turning. The higher the slip intensity, the lower the ground friction. The combination of these two factors makes it increasingly difficult for the player to maintain a straight line, with lateral drift during turns becoming more pronounced as the shell thickens. This constitutes another main control manifestation of the "loss of control" stage in the core game loop.

5.2.4 Grind System

The grinding system implements the third stage of the core game loop, Strategic Abrasion. In this stage, the player actively jumps onto rails to reduce the shell thickness, which is the only action in the game that can alleviate the loss-of-control state. However, grinding is not without cost. Over-grinding introduces its own risk, and the player must find a balance between relieving the loss of control and over-exposing themselves.

5.2.4.1 Rail Detection and Entry

The character triggers grinding by jumping near a rail. After the character jumps, the system initiates periodic detection, casting a sphere trace downward from the character to search for rails. When a rail is detected, the character stops moving freely and is snapped to the corresponding position on the rail.

Upon entering the grind, the system determines the grinding direction by computing the dot product between the character's pre-jump velocity and the rail's tangent direction, determining whether the character should move forward or backward along the spline. The system then switches the character to the grinding state, activates the grinding visual effects and sound.

5.2.4.2 Movement on Rail

Once the character enters the grinding state, the player's manual steering input is disabled and the character's position and orientation are controlled entirely by the rail spline. The system calls the rail movement logic at fixed time intervals. Each update, the system advances the character's distance along the spline based on the grinding speed and recalculates the character's position, creating a continuous and stable grinding effect in which the character appears to move along the rail at a fixed speed. As shown in Figure 5.4 below, the character enters a constrained rail-following state, where its movement is guided by the rail spline rather than by manual steering input. The system also uses a sphere trace to verify that the rail path ahead of the character remains valid.

During grinding, the sugar shell system continuously decreases the shell thickness at the grinding wear rate, while the melt amount target is set to zero and the control degradation coefficient gradually recovers. This means that grinding not only reduces the shell but simultaneously restores the sense of control, providing players with a brief respite. For gameplay viability, different rails are assigned different wear rates, so that on longer and necessary rails the player's shell thickness will not reach zero too easily. Additionally, if the shell thickness reaches zero during grinding, the system will trigger a death event.

5.2.4.3 Rail Exit

The player can leave the rail actively by pressing the jump button, or be launched automatically upon reaching the end of the rail. After exit, the system calculates the launch direction and speed based on the current grinding speed and the tangent

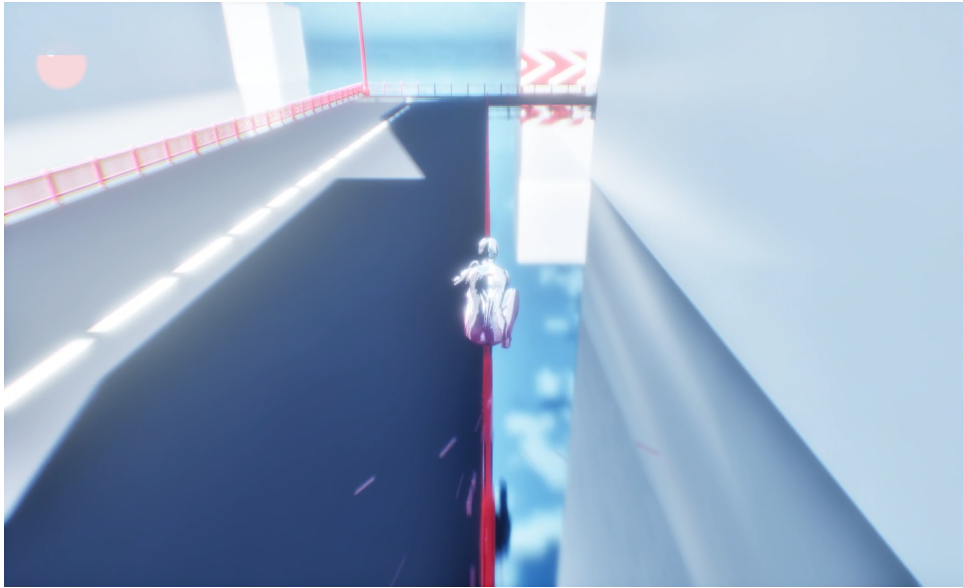


Figure 5.4: Grinding state on a rail.

direction of the rail, propelling the character into the air. At the same time, the system simultaneously restarts the rail detection timer, allowing the character to search for and snap onto another rail while in the air, enabling continuous jumps between rails.

5.2.5 Failure and Completion States

The game has two distinct failure modes, corresponding to the two collapse dynamics identified in Section 5.1.3. These two forms of death differ in their visual presentation, trigger conditions, and metaphorical meaning, together forming the risk structure of the core loop.

5.2.5.1 Collision Shattering

When the character's shell thickness reaches the critical threshold, visually indicated by the shell becoming fully opaque pink, and the character collides with an environmental obstacle, the system triggers collision shattering. The collision event first passes through a series of condition filters to confirm that the character is not already dead, not jumping, not grinding, that the hit-bounce cooldown has reset, and that the collision angle is a direct hit rather than a glancing blow. When all conditions are met, the sugar shell shatters and disappears upon impact, a scattering debris effect is created, and a shattering sound plays. As shown in Figure 5.5 below, this failure state is visually expressed through pink shell fragment.

Collision shattering embodies the IS paradox in which an overly thick facade leads to collapse. As described in Section 5.2.2.3, the thicker the shell, the larger the collision radius and the higher the probability of collisions. The more successfully the player accumulates the shell, the closer they are to this sudden and irreversible collapse.



Figure 5.5: Collision shattering death triggered by environmental impact.

5.2.5.2 Over-Grinding Dissolution

When the shell thickness reaches zero during grinding, the system triggers death. Unlike the instantaneous burst of collision shattering, over-grinding death presents a gradual dissolution process. A blood-like particle effect appears on the character's mesh while the sugar shell material fades frame by frame from pink to transparent until it disappears entirely, after which the character formally dies. As shown in Figure 5.6 below, this failure state is visually communicated through the blood-like fragment and dust effect surrounding the character.

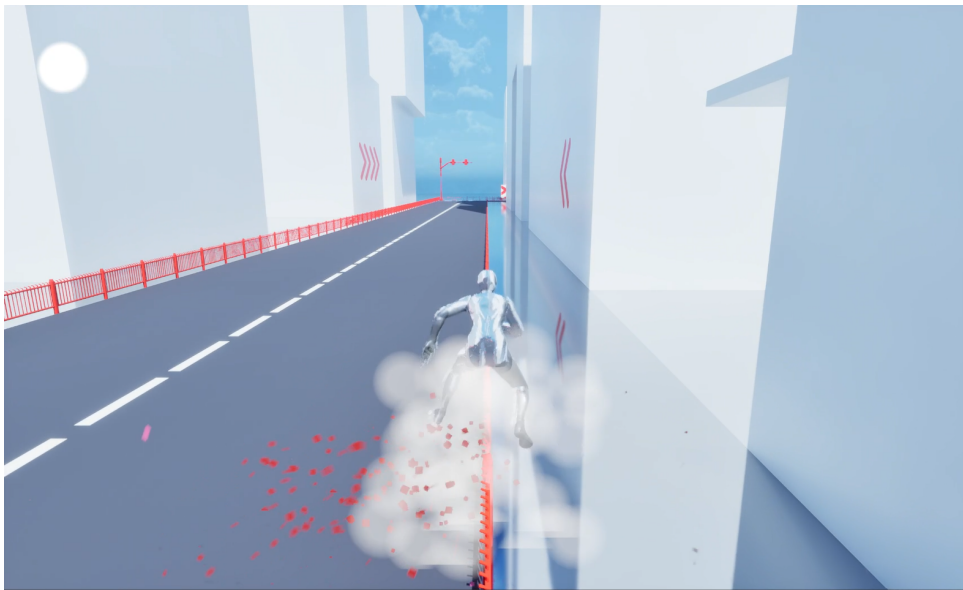


Figure 5.6: Over-grinding dissolution death caused by excessive shell reduction.

This form of death stands in metaphorical contrast to collision shattering. The

character is not destroyed by an external force but by the lethal exposure that results from actively over-reducing the facade. Both failure modes force the player to constantly weigh the risk of a shell that is too thick, leading to shattering, against a shell that is too thin, leading to exposure. This tension constitutes the core decision point of the core game loop.

5.2.5.3 Death Handling and Respawn

Regardless of which failure mode is triggered, the system executes a unified death handling flow. The character is first marked as dead, player input is disabled, and all movement is stopped.

After a short delay, the system triggers the respawn flow. A fresh character instance is spawned at the preset respawn location, which is the starting point of the level, its state is reset, the player controller takes over the new character, and the camera is immediately switched to the new character. After respawning, the shell thickness and all related parameters are restored to their initial values, and the core loop restarts from the beginning.

5.2.5.4 Level Completion

To complete a level, the character must find and reach the level endpoint without dying. The game contains two levels. The first level serves as a tutorial with relatively low difficulty, allowing the player to familiarize with the game's controls and mechanics. The second level is more complex and challenging, with two possible paths to completion, giving the player more room for exploration. The two levels at different difficulty levels are designed to convey different degrees of the IS experience. Players can freely choose which level to play and are not required to complete them in sequence.

5.3 Feedback and Iterations

This section describes the development process of the prototype from proof of concept to final version in chronological order, and the modifications made at each stage based on test feedback.

5.3.1 Proof of Concept

Before entering the pre-study phase, we first conducted a proof of concept to confirm whether our core vision could be realized using Unreal Engine 5. The focus of this stage was to verify whether the game could produce a gradually increasing sense of losing control. This project was based on the third-person game template provided by UE5, and implemented the loss of control by gradually reducing the character's ground friction as it moved forward, creating an increasingly strong drifting sensation. The controls followed the template's default setup, with WASD controlling forward, backward, left, and right movement, and the direction of movement changing based on the mouse-controlled camera orientation.

Once the proof of concept confirmed that character movement component and Blueprint system of UE5 were sufficient to support our design requirements, the broad conceptual direction was determined and the subsequent pre-study phase began.

5.3.2 MVP Construction

After the pre-study, its analytical results were used to concretize the initial vision. The pre-study data helped determine several key design details, such as what kind of loss of control the IS experience should be metaphorized as, whether dragging and heavy or drifting, whether the sense of losing control should be constant or gradually intensifying over time, whether the recovery mechanism should be instantaneous or gradual, and how to metaphorically represent a complete collapse in the game. These decisions directly formed the gameplay translation matrix presented in Section 5.1.3 and guided the implementation of different systems of the game.

In addition to the pre-study results, existing roller skating game *Rollerdrome* [54] was also referenced. It is a third-person action shooter that combines intense combat, fluid movements, and sophisticated mechanics. Its control design philosophy was largely adopted to ensure that the controls accurately and concisely convey the desired sense of loss of control. Specifically, the forward and backward movement via W and S from the proof-of-concept stage was removed, retaining only left and right steering via A and D, and S key changed to slow down. Following *Rollerdrome*'s handling of the W key, forward movement was changed to a mechanism where a single press triggers continuous auto-forward movement that cannot be stopped, making the player feel sustained external pressure. Mouse control over the character's movement direction was also removed, leaving the mouse responsible only for freely observing the environment. At high skating speeds, the camera has strong auto-centering inertia to reduce dizziness caused by rapid changes in perspective.

The level is set on a congested city street, with continuous city noise such as car horns in the background, adding a layer of external pressure to the gameplay atmosphere.

The output of this stage was a Minimum Viable Product (MVP) containing a single playable level. The MVP already implemented the principal mechanics of the loop, including shell growth and wear, gradual increasing of loss of control, the detection and snapping of the grinding system, and collision shattering death. However, visual and sound effects were not yet fully implemented, and some visual feedback remained in a placeholder state. To lower the barrier to entry for first-time testers, the death penalty after the sugar shell is completely worn away was temporarily removed from the MVP build.

5.3.3 Iterative Revisions

After the MVP was completed, the first playtest, a formative evaluation, was conducted. The detailed feedback analysis is presented in Section 6.1.4. Based on the results of that test, the following modifications were made to the prototype:

- **Difficulty adjustment and level expansion**

Playtest feedback generally indicated that the game was too difficult. Therefore, a new first level with lower difficulty was added to serve as a tutorial, while the original level was redesignated as the second level. This allows players to familiarize themselves with the basic controls and core mechanics before entering the more challenging level. As shown in Figure 5.7, the new first level continues the vehicle-related setting and is designed as an underground parking garage. It begins with basic movement guidance and ends at the garage exit, while the second level begins from street level as originally planned. This creates a coherent spatial progression from the underground garage to the outside street environment.



(a) Tutorial start area



(b) Garage exit endpoint

Figure 5.7: New first level designed as a lower-difficulty tutorial in an underground parking garage.

The original level was also moderately adjusted. For example, as shown in Figure 5.8a, the original layout required a relatively precise jump onto the target rail. In the revised version, shown in Figure 5.8b, the mandatory jump path was adjusted to give players a clearer and more forgiving approach to the rail.

- **Rail interaction improvements**

In the original design, all rails were unidirectional by default. However, the first testing revealed that players expected to be able to enter rails from both directions rather than being restricted to a fixed direction. Therefore, a bidirectional grinding support was added as an option. All ground rails adopted bidirectional design, enabling players to freely choose the grinding direction based on their approach angle. Aerial rails retained unidirectional design, as the direction of aerial paths is predetermined and bidirectional support could cause confusion. The unidirectional design for aerial rails also ensures players that they are moving in the correct direction.

- **Collision detection improvements**

In the original design, the character's collision range did not change with shell thickness. Some testers reported that collision death sometimes seemed

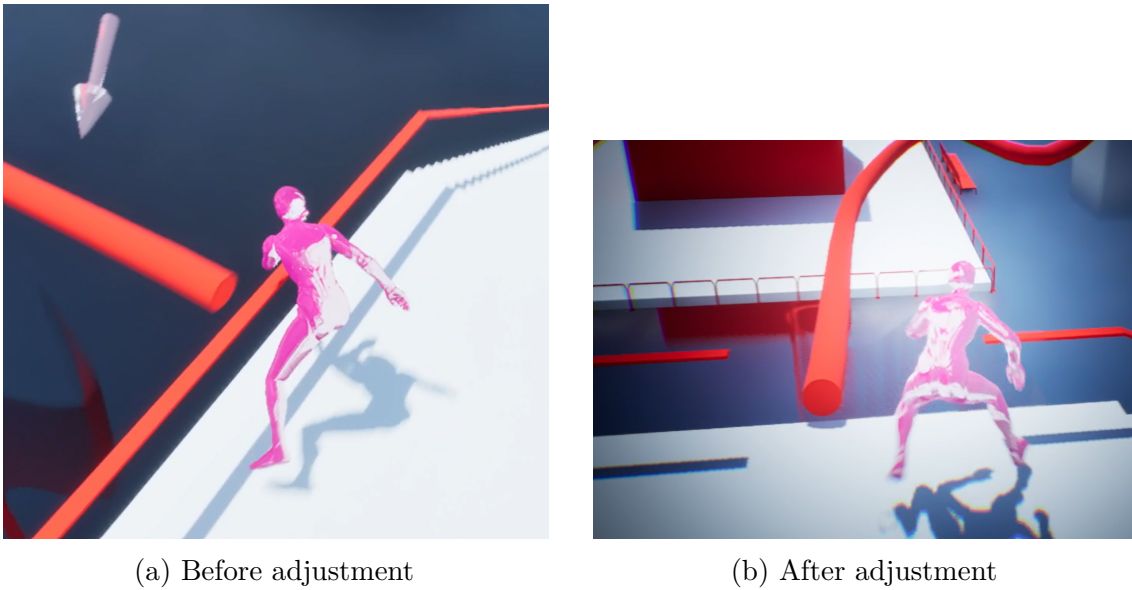


Figure 5.8: Before and after comparison of the mandatory jump path adjustment.

not work. To make collision detection more consistent with the shell state and reduce the possibility of it not working during collision-based death, a dynamic collision scaling mechanism was added, as described in Section 5.2.2.3, causing the collision radius to expand as the shell thickens.

- **Restoration of the death mechanic**

Finding 6 in Section 6.1.4 indicated that death penalty after removing the outer shell in MVP resulted in metaphorical dissolution, meaning players felt no discomfort about being fully exposed on the rail. This was contrary to the intention of the game. Therefore, the revised version restored this death condition, the over-grinding dissolution described in Section 5.2.5.2, making over-grinding a costly behavior again.

- **Removal of slowing down**

In the MVP, the S key was assigned to slow down, but after testing it was found that this function contributed little to the gameplay experience, so the function was removed in the revised version.

- **Visual and audio polish**

Finding 3 in Section 6.1.4 pointed out the lack of visual and audio feedback at the moment of shattering. Shattering particle effects and sound were added, the sugar shell's material gradient from transparent to pink was refined, and added supplementary visual indicators such as the circular shell state indicator in the upper-left corner of the screen and the darkening vignette effect around the character. The overall art quality was improved.

- **Introduction of the telemetry system**

To support quantitative data collection during the second playtest, an event

logging system was introduced. The system records contextual data at each key event during gameplay, including event type, game time, character location, current speed, shell thickness, melt amount, control alpha, grinding state, death reason, death count, grind count, level name and rail name. Data can be exported as a JSON file for analysis when the character dies, a level is successfully completed, or when the tester chooses to end the session intentionally.

- **Bug fixes**

Several bugs were resolved, primarily including the improvement of a lifting platform on one of the completion paths. The lifting platform was originally used for single use. If a player failed to jump onto the adjacent rail immediately after being raised, they would fall and could not use the lifting platform again. To improve playability and fault tolerance, the lifting platform was made reusable. It will automatically return to ground level five seconds after activation. The trigger area on the lifting platform was also reduced, requiring the player to reach the central area to activate it, as shown in Figure 5.9a. After rising, the central area of the platform is positioned a short distance from the rail, giving the player a few extra seconds to assess the path and react with a right jump.



(a) Lift activation area



(b) Raised platform near the rail

Figure 5.9: Revised lifting platform.

After the revisions, the second playtest, a summative evaluation, was conducted. The results are analysed in Section 6.2. Only minor bug fixes were made after the second test, with no further major changes to the core design.

6

Evaluation and Results

This chapter presents the evaluation process and results for the playable vertical slice of the game. To ensure that the embodied experience of Impostor Syndrome (IS) could be accurately translated into game mechanics, the evaluation was structured into two principal phases. The first is the formative evaluation conducted during the Minimum Viable Product (MVP) stage, focusing on the validation of core mechanics as well as functionality and usability. The second is the summative evaluation conducted during the final prototype stage, aiming to measure how metaphors and emotional states are expressed in more details. The following Table 6.1 compares the two phases of evaluation.

Table 6.1: Comparison of the Two Evaluation Phases.

	Formative	Summative
Prototype stage	MVP	Final prototype
Participants	$n = 5$; 3 with CIPS scores	$n = 20$; 18 with CIPS scores
Levels available	1 level (medium difficulty)	2 levels (tutorial + medium difficulty)
Session format	Online via Zoom	Online via Discord
Data collection	Think-aloud Protocol; Screen recording; Semi-structured interview	Structured questionnaire; Backend telemetry
Primary goals	Validate Core Mechanic feel; Distinguish Designed Discomfort from Usability Friction; Initial Metaphor Alignment	Measure Mechanic-Alignment; Evaluate Affective Transmission; Identify Residual Design Gaps

6.1 Formative Evaluation

The overall objective of the formative evaluation was to check if the somatic markers extracted during the previous pre-study had been meaningfully instantiated within the core game loop.

6.1.1 Evaluation Goals

At the first testing stage, complex visual elements were not included. Players just play a simple level with basic materials and the core mechanics. They are taught to try to complete the core game loop: slide → loss of control → grind snap to get control → reset. The testing phase was designed to pursue the following three goals:

1. Validating the core control mechanic

Validating the core control logic. Observing whether the sense of "losing control" successfully induced the intended emotional stress in players.

2. Distinguishing intended discomfort from usability friction

Assessing whether the frustration playtesters experienced during gameplay arose from inner emotional resonance with the system's metaphorical design, or from low usability in the interaction logic.

3. Initial metaphor alignment

Without giving playtesters any context of this prototype, simply collect players' subjective responses, and compare these with the psychological characteristics identified in the pre-study stages.

6.1.2 Evaluation Recruitment

The MVP testing phase recruited five participants in total. Two of the participants had previously completed the pre-study IS questionnaire. Participants were recruited via convenience sampling [55] within the research group. All play tests for each participant were conducted via online video conference (Zoom), with participants' consent for data collection (the informed consent is shown in the Appendix). Gameplay was observed through screen sharing and screen recording. After gameplay finished, each playtest was followed by a semi-structured interview, or the playtester filled in the questionnaire with the same questions. The full interview questions are included in the Appendix.

6.1.3 Evaluation Setup

As mentioned previously, the goal of this test is to calibrate metaphors roughly. The research group did not provide very detailed instructions before players quit the game. Only how to control the movement in the game is fully taught. Besides, players were informed to "reach the destination somewhere" without knowing the accurate location of the destination. This is designed to check if the guidance in the prototype is well set up.

Players played the level designed to simulate a *frequently experienced* degree of Impostor Syndrome corresponding to the mid-to-high range of the Clance Impostor Phenomenon Scale (CIPS), in which the individual frequently recognizes IS-characteristic thoughts and feelings in themselves. This level represents the second

of three tiers of IS intensity around which the game's levels are structured, with each tier corresponding to a different frequency band on the CIPS scoring continuum.

The level was estimated to take approximately five to ten minutes to complete based on internal testing, while the observed completion times ranged from 15 to 30 minutes, which is significantly longer than anticipated. This discrepancy is discussed in the qualitative findings below (see Section 6.1.4), where affordance deficiencies and the absence of clear directional guidance are identified as primary contributing factors.

Additionally, as the initial test is via Zoom, this setup is likely to introduce latency due to stream compression. No participant reported input lag; however, it caused severe observation latency for the research group. The research group cannot capture players' screens in real-time during tests. Therefore, the observation is disturbed to some extent.

6.1.4 Qualitative Findings

This section mainly analyzes representative gameplay observations and cites some direct interview quotations from MVP participants. The feedback revealed there is a strong correspondence between the game's mechanics and the theoretical constructs drawn from the pre-study as well as the previous mechanic-metaphor framework, while also exposing several cognitive conflicts in the current prototype.

1. Locomotion

The pre-study analysis identified the characteristics of the experience of IS as "losing control" and "struggling against slippery ice". By using forced auto-forward movement and a delayed rotational response, the prototype's locomotion system successfully realized this experience at the physical interaction level.

During the tests, participants explicitly described the experience of controlling the character as "slippery" and "agonizingly out of control". Another participant mentioned, "The sliding feels out of control - I kept panicking... When the direction wouldn't respond, I just kept trying to force it back". These responses suggest that constraining players' physical mobility triggers the internal anxiety or pressure of IS, to some extent. This further shows the locomotion mechanic simulates the state of being swept along by external achievement pressures - the discomfort players experience is the mechanic's argument about internal loss of control.

2. The Grinding System

Within the metaphor framework, the sugar shell represents the mask to hide authentic selves. The grind rail mechanic not only takes charge of players' directions, but also accompanies the erosion of the sugar shell. This maps onto the moment in the IS experience when the true selves are exposed. Such moments contain a dual charge. One is the relief of removing the burden of pretense. Another one is the discomfort of being seen completely.

On one hand, when asked about the experience of snapping onto the grind rail, most participants exhibited an obvious sense of safety on the rails. A participant described it as "the moment of calm" and "being able to breathe again". Another mentioned that "not having to control the direction on the grind rail felt really good." A third participant offered very detailed feedback: "When I was fully pink I was really scared, but when the shell was gone I felt quite relaxed... The moment of pressure was highest when I was trying to jump onto the rail but kept missing it, going around in that loop." When players are exhausted from controlling directions and the shell, surrendering agency does indeed produce some inner relief.

However, on the other hand, the anxiety of self-exposure was absent from the test data. Participants mainly viewed the rail and the behavior of grinding as completely safe, yet did not feel the disturbance that should accompany the stripping away of one's facade. This affective gap leads to an important finding, that is, the erosion of metaphor (see section 6 below).

3. Visual and Audio Feedback

The audio and visual feedback in the MVP phase demonstrated a distinct difference in the capacity to communicate metaphor.

In terms of audio, one participant noted: "The music has a sense of urgency - the car horns made me feel tense, like I was being pushed and rushed." Other participants expressed similar thoughts. It can be reasonably concluded that the audio pressure, combined with the auto-forward movement mechanic, successfully catalyzes an emotional register of stress and anxiety through non-visual means.

However, visually, certain deviations from expectations exist. At the beginning of gameplay, one participant did not recognize the material as sugar; instead, the participant interpreted it as ice that was melting. While the ice partially accounts for the sliding physics and is similar to the sugar shell's translucency, it still has some deviations from the shell. Two participants expressed marked confusion about the death mechanic. The color shift of the character's shell was intended to show the gradual thickening of the IS mask, yet the death logic and the visual cues remained insufficiently clear. One participant also noted that "when it shattered, pieces just fell, there was no visual or sound cue". This demonstrated that the absence of audio and visual response at the moment of death intensifies this ambiguity.

4. Affordances

The tests exposed several significant deficiencies in the level design's communication of affordances. Through the observation of testers' gameplay, there are conflicts between players' intuitive expectations and the system's actual interaction logic. For example, when faced with the staircase, most participants' first instinct was to climb the steps directly down the center, rather than approaching the red handrails, which are more conspicuous in color. They did not recognize the railing as an interactive grind edge. Similarly, a participant

could not determine how to engage with the crane. In the absence of clear kinetic feedback cues, players became mired in a frustration that resembled arbitrary puzzle-solving, rather than experiencing the anxiety generated by the core metaphor.

5. Designed "Bad Feel" vs. Cognitive Dissonance

There is a need in design to distinguish between effective "bad feel" IS experience induced and cognitive dissonance produced by system deficiencies (whether in design or implementation) [51].

The deliberately difficult controls not only act as a mechanical challenge, but also as a psychological catalyst. Among all participants, two of them did not recognize that the delayed steering was an intentional design decision at first. Instead, they attributed it to their own poor operational skills. Further, when receiving praise for their play, one participant responded with immediate self-denial, a response pattern coincidentally resonant with IS affect. This form of "bad feel" was reasonably effective in provoking internal conflict and self-doubt during testing.

However, apart from validating design intent, the tests also revealed usability deficiencies that disrupted the flow largely. There are gaps between the visual state and the underlying logic. One participant stated the dissonance directly: "Sometimes I clearly feel like it should be dead already - but it doesn't..." When the character's total pink appearance (critical condition) conflicted with the physics engine's decision not to trigger death (logic state), it was hard for players to distinguish the should-be "bad feel" and the real "bad feel". Besides, bugs such as spline nodes directing the character in the wrong direction drove players further into confusion and disrupted the metaphorical flow state.

6. Metaphor Dissolution

The central motivation of this prototype is to explore how players strike a balance between exposing their authentic selves and maintaining facades. To reduce the barrier to entry for first-time players, the death penalty triggered by complete sugar shell erosion was temporarily removed from the MVP build provided to the 5 participants. However, this decision largely affected the test results. Players barely felt unease when their facade fell away; one participant stated that "the white or transparent color, when the shell has worn off, actually feels like a more comfortable color". Once over-exposure of the authentic self ceased to carry any systemic threat of death, players naturally lost any apprehension about becoming fully transparent.

6.1.5 Design Revisions

Based on the formative evaluation findings, a series of targeted revisions were made to the prototype before the summative evaluation phase, as Table 6.2 shows.

The most critical revision concerned the death mechanic. As identified in Section 6.1.4, removing the death penalty from the MVP build had substantially weakened

Table 6.2: Design Revisions for Core Issue Found in the MVP Test.

Finding	Core Issue	Design Revision
1. Locomotion	Core control successfully induced the intended sense of slipperiness and loss of direction; no usability barrier identified.	No structural change; Mechanic confirmed and carried forward.
2. Grinding System	Players felt safe and relieved on rails but showed no discomfort about self-exposure during grinding.	Over-grinding dissolution death reinstated.
3. Visual & Audio Feedback	No audio or visual response at moment of shell collapse; Shell material misread as ice; death logic ambiguous to players.	Shattering particle effects and sound added; HUD shell indicator and darkening vignette introduced.
4. Affordances	Grind rails not recognized as interactive surfaces; Spatial navigation and endpoint location unclear.	Grind rail edges given more distinct visual treatment; Mandatory jump paths adjusted; Level layout clarified.
5. Designed Discomfort vs. Cognitive Dissonance	Function errors made the designed loss of control indistinguishable from implementation friction.	Dynamic collision scaling introduced; Spline errors and lifting platform bug resolved.

the IS metaphor by eliminating the systemic threat of self-exposure. This penalty was fully reinstated in the final prototype: complete erosion of the sugar shell now triggers character death, restoring the affective stakes attached to the grind rail mechanic.

Visual and audio feedback was also substantially revised. Death-state cues, including visual particle effects and a distinct audio response at the moment of shell collapse, were added to resolve the ambiguity participants had reported. The color ramp of the shell's pink accumulation was recalibrated to more legibly signal the character's critical state. In addition, a status indicator was introduced in the upper-left corner of the HUD to provide a persistent read of the shell condition.

At the level design level, affordance clarity was improved around key interactive elements. Grind rail edges were given more distinct visual treatment to differentiate them from non-interactive surfaces. A second level (Level 2) was introduced alongside the original level (Level 1), designed to escalate movement difficulty, enabling a within-session comparison of IS intensity across two degrees of experience.

6.2 Summative Evaluation

The summative evaluation aimed to assess the full prototype's capacity to communicate the affective and metaphorical dimensions of Impostor Syndrome through its completed mechanicmetaphor system. Where the formative evaluation focused on calibrating core interaction feel, this phase examined whether the revised prototype successfully translated the psychological experience of IS - including pressure accumulation, loss of control, and the ambiguity of self-exposure - into legible player experience.

6.2.1 Evaluation Goals

The summative evaluation was structured around three primary goals:

1. **Measuring mechanicmetaphor alignment**

Assessing the degree to which the core mechanics, locomotion, shell accumulation, and the grind rail system, were perceived as intentional expressions of the IS experience rather than technical deficiencies or arbitrary difficulty.

2. **Evaluating affective transmission**

Measuring whether the prototype successfully induced the target emotional states identified in the pre-study's somatic marker analysis: sustained pressure, compulsive forward movement, a sense of vulnerability, and transient relief upon shell restoration.

3. **Identifying residual design gaps**

Determining which dimensions of the IS construct, particularly the "fear of being exposed" and the tension between outward performance and inner doubt, remained under-expressed in the current build, and collecting structured feedback to inform further iteration.

6.2.2 Recruitment and Setup

6.2.2.1 Participants

The summative evaluation recruited 20 participants through convenience sampling within the researcher's network. Nineteen participants completed the questionnaire in Chinese; one participant responded in English. Eighteen of the twenty participants provided a valid CIPS score. Of these, ten scored below the commonly referenced moderate IS threshold of 62, and eight scored at or above it, yielding a participant pool with a considerably wider range of IS experience than the MVP cohort. All participants reported prior experience with at least one comparable game genre - platform games, racing, skateboarding, or parkour - with the sole exception of one participant, suggesting a broadly comparable baseline of relevant game literacy across the group.

6.2.2.2 Procedure

Unlike the formative phase conducted via Zoom with real-time researcher observation, the summative evaluation was administered as an independent play session. Participants completed the game on their own devices without researcher's presence and subsequently filled in a structured questionnaire independently. Eighteen of twenty participants played both levels during the session; one played Level 1 only, one played Level 2 only, and one played both (the English-language respondent). Average reported play time was 20.9 minutes.

6.2.2.3 Questionnaire Structure

The questionnaire comprised five sections. The first four sections used 5-point Likert scales (1 = strongly disagree, 5 = strongly agree), covering: (1) control mechanic perception (5 items); (2) shell mechanic perception (6 items); (3) emotional response, including a single overall emotional intensity item rated on a 110 continuous scale (5 Likert items + 1 continuous scale item); and (4) a between-level comparison available to participants who played both levels (4 items, $n = 18$). The fifth section comprised open-ended questions inviting participants to describe the moment of greatest perceived loss of control; reflect on the effectiveness of the IS metaphor following disclosure of the design intent; characterise the overall experience through somatic or physical analogy; interpret the symbolic meaning of the shell and its transformations; and identify priority areas for improvement.

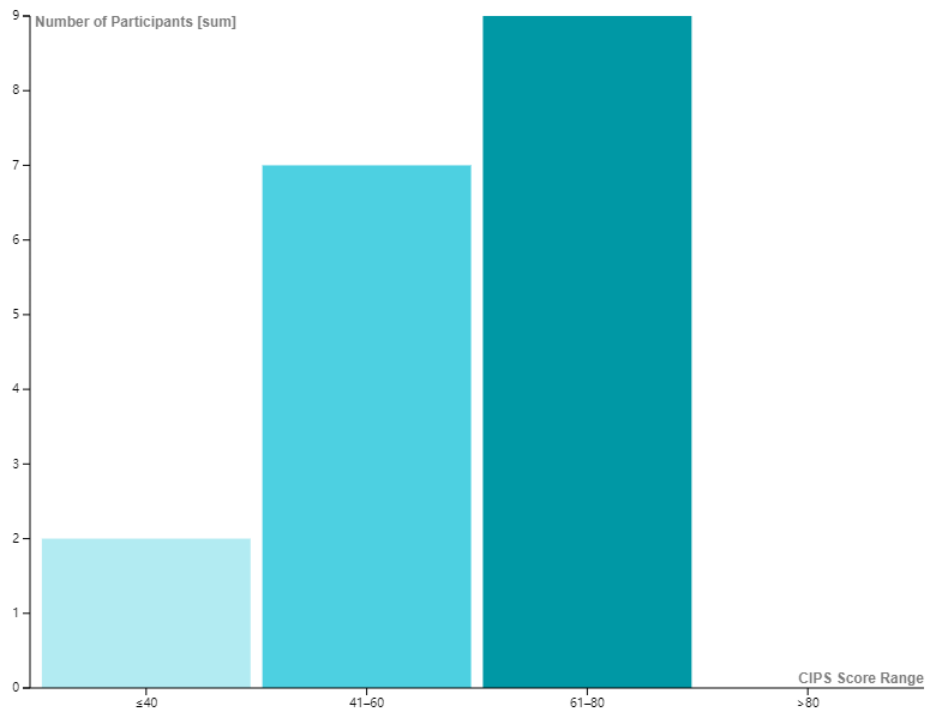


Figure 6.1: The Distribution of Participants based on CIPS Score Ranges in Summative Evaluation.

Table 6.3: Quantitative Questionnaire Results of the Summative Evaluation

Item	Mean	Standard Deviation
<i>Control Mechanic Perception</i>		
C1 I was able to understand how to control the character.	4.10	0.72
C2 The character's movement felt unstable or difficult to fully control.	4.05	0.76
C3 The loss of control felt intentional rather than caused by technical issues or bugs.	4.00	1.26
C4 As the game progressed, the character became harder to control.	3.70	1.34
C5 I felt a delay between my input and the character's actions.	3.60	1.27
<i>Shell Mechanic Perception</i>		
S1 I noticed the shell on the character changing during gameplay.	4.55	0.76
S2 I understood that the grind rail / friction area can help regulate the shell.	4.20	0.95
S3 I understood that over-grinding the shell also carries a lethal risk.	4.20	1.01
S4 The visual changes of the shell helped me understand the character's current state.	4.10	1.02
S5 The pinking of the shell felt like an accumulating burden.	3.85	1.09
S6 The transparent shell mechanism helped me understand the character's psychological pressure.	3.70	0.80

6.2.3 Quantitative Results

The general quantitative results for the questionnaire of the summative evaluation are shown in Tables 6.3 and 6.4. Also, Figure 6.1 presents the CIPS range distribution in this evaluation.

6.2.3.1 Control Mechanic Perception

Participants largely understood the control scheme while simultaneously experiencing the character as unstable and difficult to fully master. Critically, the loss-of-control sensation was predominantly attributed to intentional design rather than technical malfunction, indicating that the locomotion system's deliberate slipperiness was legible to most players as a purposeful design condition. Perceived escalation in difficulty over the course of play scored somewhat lower, as did perceived input latency, suggesting that while the broad arc of increasing difficulty was felt, its moment-to-moment granularity was less consistent across participants.

Table 6.4: Quantitative Questionnaire Results of the Summative Evaluation

Item	Mean	Standard Deviation
<i>Emotional Response</i>		
E0 Overall emotional intensity (1 = Very Relaxing, 10 = Extremely Tense).	6.95	1.79
E1 This level made me feel pushed to keep moving forward, even when I wanted to slow down.	4.15	0.99
E2 The more the character lost control, the more pressure I felt.	3.85	1.23
E3 When the pink shell was worn away, I felt the character became more vulnerable.	3.60	0.99
E4 When the character entered the grind rail, I felt briefly relaxed.	3.50	1.32
E5 This level made me feel tense, anxious, or stressed.	3.25	1.12
<i>Between-Level Comparison (n = 18)</i>		
B1 Level 2 was more difficult than Level 1.	4.67	0.69
B2 Level 2 felt more tense, anxious, or stressful than Level 1.	4.33	0.91
B3 Level 2 expressed a stronger sense of loss of control than Level 1.	4.33	0.77
B4 The two levels felt like different intensities of the same experience.	3.83	1.10

6.2.3.2 Shell Mechanic Perception

The shell’s visual transformation was the single most clearly perceived mechanic across the entire questionnaire. Participants almost universally reported noticing the shell changing during play. Understanding of the grind rail’s dual-risk structure - that it can restore the shell but that over-grinding carries its own lethal risk - was strong and evenly distributed. The visual feedback was also broadly felt to aid comprehension of the character’s current state. The lowest-scoring item in this section concerned whether the transparent shell mechanism helped players understand the character’s psychological pressure, indicating a residual gap between the shell as a perceptible visual event and the shell as a legible psychological metaphor.

6.2.3.3 Emotional Response

The strongest emotional response across this section was the sense of being compelled to continue moving despite a desire to slow down, which maps directly onto the IS-adjacent experience of being propelled by external performance demands without the capacity to pause or step back. The relationship between loss of control and heightened stress was also clearly felt. Explicit self-reported anxiety or tension

scored lower than other stress-adjacent items, suggesting that the stress induced by the prototype operated as a persistent background pressure rather than acute episodic anxiety - a pattern arguably consistent with the chronic, low-grade nature of IS affect as described in the literature. Transient relief upon entering the grind rail and the feeling of increased vulnerability during shell erosion were both present, though less pronounced. Overall emotional intensity was rated at 6.95 out of 10 on the continuous scale.

6.2.3.4 Between-Level Comparison

Among participants who played both levels, the escalation between Level 1 and Level 2 was clearly perceived. Level 2 was rated as meaningfully more difficult, more anxiety-inducing, and more explicitly expressive of loss of control. Participants also broadly agreed that the two levels represented the same underlying experience at different degrees of intensity, suggesting that the intended progressive IS severity structure across levels was partially legible as a coherent arc. Taken together, these results validate the dual-level design as an effective structure for staging the accumulation of IS affect.

6.2.4 Qualitative Findings

1. Partial Metaphor Transmission

The open-ended responses revealed a structurally consistent pattern across the 20 participants: the prototype successfully communicated the "accumulative" dimension of IS while largely failing to communicate its "performative" dimension. Participants across multiple independent responses noted that sustained pressure, persistent self-doubt, and the sensation of being carried toward an outcome beyond one's control were strongly present. Several described the experience in terms that closely echo IS phenomenology without being prompted - representative responses included "I felt like I was always about to fail," "the pink kept building up and I couldn't stop it", and "the pressure built up continuously from the moment I started".

However, the specific IS characteristic of "appearing successful to others while experiencing internal doubt", the social performativity at the heart of the IS construct, was almost entirely absent from unsolicited responses. When participants were informed of the game's IS intent and directly asked whether this aspect had been communicated, the majority stated it had not. Representative responses included "I felt the pressure accumulation, but not the fear of being exposed" and "I couldn't connect the mechanic to being seen by others". This pattern was consistent across the range of CIPS scores, suggesting it reflects a structural gap in the metaphor system rather than a deficit of personal resonance with the IS theme.

2. Interpretive Divergence

Participants' interpretations of the transparent shell's symbolic significance fell into two broad categories. The first group read the shell as a psychological

metaphor, describing it variously as "a facade of competence that is about to stop holding up," "a self-constructed protective barrier that changes with inner turbulence," "the accumulated weight of success and the pressure it brings," and "accumulated self-doubt that, when it reaches a critical level, collapses." These readings were broadly aligned with the design intent, and several responses demonstrated a sophisticated understanding of the shell's dual-risk logic.

The second, and larger, group interpreted the shell primarily as a gameplay resource, functionally equivalent to a health bar, stamina gauge, or armor durability indicator. Responses in this category included "it represents the character's life," "it's like a stamina meter", and "full pink or fully transparent both mean I'm about to die". This interpretive divergence suggests that the shell's symbolic affordance remains insufficiently self-evident: absent prior contextual framing, the game's visual language defaults to established genre conventions rather than conveying psychological meaning. One participant articulated this gap explicitly: "I would not have understood the shell's meaning without being told. Once explained, it made sense - but I needed the explanation".

3. Somatic Resonance

Despite the interpretive gaps in metaphor comprehension, the somatic quality of the experience was consistently articulated with striking specificity. Participants described the gameplay through physical and sensory language: "like a rollercoaster where I couldn't control the drift," "my hands were sweating," "I felt like I was being pushed and couldn't slow down", "like walking a tightrope", "like my vision was getting worse - a kind of dizziness while still being able to move forward", and "getting increasingly feverish". These descriptions map closely onto the somatic markers identified during the pre-study phase, particularly the embodied registers of sustained pressure, loss of directional agency, and the physical sensation of being swept toward an outcome without the ability to pause. This finding suggests that the prototype successfully induced the bodily dimension of IS affect even in participants for whom its symbolic intent remained opaque.

4. CIPS Score as a Moderating Factor

One participant explicitly reflected on the relationship between their own low CIPS score and their capacity to engage with the game's IS theme: "Because my own CIPS score is relatively low, I rarely have this kind of feeling, which made it harder to connect with this aspect while playing. After the explanation, however, I found the design reasonable and coherent." This response raises the possibility that the game's metaphorical resonance is partially modulated by the player's pre-existing personal familiarity with IS experience - a relationship that would benefit from systematic examination in future evaluations using CIPS as a between-groups variable. It also has implications for the game's intended audience: a prototype designed to externalize IS may be most effective for players who already carry some degree of IS experience,

while remaining interpretively accessible to others only through supplementary framing.

5. Guidance and Onboarding

The single most consistently raised concern across the open-ended responses was the absence of in-game guidance. At least seven participants independently identified insufficient information about controls, objectives, or spatial navigation as a significant obstacle to engagement, with several stating they would have required external assistance to navigate Level 2. This issue was considerably less prominent in the MVP cohort, where the researcher was present to provide minimal guidance during Zoom sessions. The shift to an independent play format in the summative evaluation exposed a structural onboarding gap that had previously been masked by researcher presence.

Representative responses included, "I didn't know where I was supposed to go", "I looked up a walkthrough video before I understood the second level's layout," and "There should be an introductory screen that explains the controls and what the game is trying to do." One response is particularly significant in its phrasing: "The guidance was not clear. I'm not sure if that is intentional, but without it I got frustrated in a way that didn't feel meaningful". This directly echoes the "designed bad feel vs. cognitive dissonance" distinction established in the formative evaluation (Section 6.1.4), and indicates that disorientation produced by absent onboarding was not consistently interpretable as an intentional expression of IS, in several cases, it was read simply as poor usability.

6. Partial Metaphor Transmission

Several participants noted control and camera behaviors that introduced discomfort distinguishable from the intended designed discomfort. The most consistently cited issues were the inability to move in a straight line after using left or right rotation inputs; camera follow latency causing disorientation during rapid direction changes; and the difficulty of aligning with narrow grind rails in the absence of a proximity snap-assist. One participant described the camera lag as "making me dizzy in a way that felt separate from the game's intended feeling", and another characterized the directional-lock issue as "a bug rather than a feature, because it prevented me from doing what I was trying to do rather than making me feel out of control in an interesting way".

These accounts indicate that a portion of the stress experienced during the summative evaluation remained attributable to implementation friction rather than the core metaphorical system, an ongoing challenge that mirrors the findings of the formative phase. Resolving these issues in future iterations would help ensure that all discomfort experienced during play is interpretable as expressive rather than incidental, strengthening the coherence of the mechanic-metaphor relationship.

7

Discussion and Conclusion

In this chapter, the results of the project are summarized and related to the overall research question. The discussion concentrates on several interrelated themes, such as the effectiveness of the mechanical metaphors developed in this project, the paradox of using intentional loss of control as an expressive device, and the ethical implications of designing for deliberate psychological discomfort. The chapter then summarizes the projects contributions at the methodological, design and field levels, based on this discussion. It also identifies several design research directions from the whole research process and points out the limitations of the current work as well as future directions for investigation.

7.1 Discussion

7.1.1 The Efficacy of Metaphor

The central aim of this project was to translate the experience of Impostor Syndrome (IS) into a playable system through the dynamic modulation of core movement physics parameters. The evaluation results present a differentiated picture: the prototype successfully transmitted certain dimensions of the IS experience but also left some dimensions largely unreached. Understanding which dimensions were communicated, meanwhile which were not, and the reasons for that, constitutes the primary analytical contribution of this discussion.

7.1.1.1 Dimensions Transmitted Successfully

The most consistently discussed dimension was what this project refers to as the accumulative quality of IS. That is, the experience of being pushed forward by external momentum, of pressure mounting without resolution, and of growing instability as a result of continued performance. The quantitative results confirmed that the feeling of not being able to slow down when participants wanted to was strongly experienced. Also, the overall feeling of loss-of-control was mostly due to intentional design and not to technical failure. The somatic language participants spontaneously used like a rollercoaster I couldnt control, walking a tightrope, getting increasingly feverish qualitatively correspond closely to the embodied markers extracted during the pre-study phase. This suggests that the physics parameter translation pipeline yielded a meaningful correspondence between the designed system and the lived phenomenol-

ogy of IS. In addition, the dual-level structure worked as intended. Participants who played both levels explicitly recognized the increased difficulty and IS-adjacent affect. These results suggest that the majority of participants are able to read the core mechanical argument of the prototype, that success leads to instability, not stability, as a deliberate condition.

7.1.1.2 Dimensions Transmitted Inadequately

Despite these successful aspects above, the evaluations revealed a consistent and significant gap. The social and performative dimension of IS, that the experience of appearing competent and successful to others while internally fearing exposure, was almost entirely absent from unsolicited participant responses. When directly asked if this dimension had been communicated, the majority of participants stated it had not. Representative responses mostly included descriptions of feeling internal pressure and accumulation, but an absence of any sense of being observed, evaluated, or at risk of being seen through by others.

This gap can be explained through the framework of reobjectification introduced in Chapter 2. Grimwood argues that effective psychological expression in games emerges not from procedural constraints alone, but from the combination of those constraints with culturally resonant imagery and associations that players can draw upon to make meaning [21]. The sugar shell successfully encodes the internal dimensions of IS - fragility beneath a composed exterior, the burden of accumulation, the brittleness of the facade, to a large degree. However, it lacks the relational and social associations necessary to convey the interpersonal dimension of the phenomenon. There is no culturally established connection between a thickening transparent shell and the specific fear of being evaluated and found fraudulent by others. In the absence of such an association, the mechanic defaults to the most available interpretive frame within the action game genre, such as a health bar, a stamina gauge, or an armor durability indicator. For a significant portion of participants, this is precisely how the shell was read. The genre convention, being more immediately accessible, overwrote the intended symbolic meaning. This finding potentially suggests a broader design principle. When the psychological state to be expressed contains a social or relational dimension, physics-based metaphors acting on the player's body alone may be insufficient. Conveying the experience of being watched, evaluated, and potentially exposed may require additional design strategies.

A related observation concerns the conditions under which metaphorical meaning did emerge. Several participants who did not spontaneously identify the IS dimension during play were nonetheless able to articulate a coherent interpretation when directly prompted in the post-play interview. This pattern echoes what might be called a 'rubber duck' effect in meaning-making: much as a programmer often identifies the source of a bug only upon explaining the code aloud to another person, players may require the act of externalizing their experience, whether through conversation, reflection, or direct questioning, before latent interpretive connections become conscious. This suggests that the metaphorical argument of the prototype may be present but dormant for some players, activated by interrogation rather than spontaneous during play. Whether this constitutes a limitation of the design or an

inherent feature of how procedural rhetoric operates in practice remains an open question."

7.1.1.3 Dimensions Transmitted Divergently

The evaluation data also indicate that the effectiveness of the mechanical metaphor appears not to be a uniform mode across different participants. In contrast, it was modulated by multiple player-side variables. According to test observations, these variables at least include IS tendency as measured by the Clance Impostor Phenomenon Scale (CIPS) and prior gaming experience.

When analyzing the CIPS score among all the participants, a regular tendency was found, that is, those participants with higher IS scores reported a deeper resonance with the affective metaphor content of the prototype (although the sample size of 20 participants does not support any definitive statistical conclusions). One participant with a low CIPS score explicitly described this feeling in detail. The participant mentioned the relative lack of personal IS experience made it difficult to relate the somatic sensations of the game to the psychological construct they were supposed to represent. This pattern is theoretically consistent with the framework of embodied cognition presented in Chapter 2.4. The prototype succeeded in producing physical sensations, such as pressure, instability, and compulsion. However, the translation of these sensations into IS-specific meaning depends on whether the player has a pre-existing experiential schema onto which those sensations can be mapped. This schema is familiar to players with deeper IS experiences, and thus the games somatic cues are able to bring immediate recognition and resonance. While those who have had little IS experience still feel the somatic layer to some extent, it is not conceptually mapped. They have a diffuse sense of stress without the psychological identification. This provides implications for the functional placement of the game. The current prototype appears to act less as an introduction and simulation to IS experience for general audiences and more as a kind of experiential validation for those who already have IS experience a way of making something that is usually invisible and internalized external and tangible. This finding is meaningful and more specific than originally anticipated and has design consequences. Players without personal IS experience may require additional contextual framing within the game itself to establish the conceptual connection that higher-CIPS players bring to the experience independently.

In addition, proficiency also causes differences. Although the evaluation did not systematically vary participant skill level in gaming, this perspective raises a structural tension built into the projects design approach. The main expressive mechanism of the prototype is intentional loss of control. This means that the effectiveness of the prototype depends on players actually experiencing that loss, particularly whether they feel it as a constraint on their agency. Players who have little experience in games are likely to blame their own lack of skill, rather than intentional design. They mostly mistake the discomfort of the design for a more general sense of inadequacy. Conversely, players with high game proficiency intend to develop effective strategies, such as more precise rail timing or more efficient shell management. These strategies partially prevent them from the designed instability, and thereby weaken the IS

metaphor. The prototype implicitly assumes a range of target player skill for which neither of these failure modes applies, and making that explicit is both a recognition of the limitations of the design and a pointer towards future work.

Beyond these player-side variables, the evaluation also revealed a more fundamental form of interpretive divergence: participants did not merely engage with the metaphor to varying degrees, but in some cases constructed entirely different symbolic readings of the same mechanic. As documented in Section 6.2.4, a significant portion of participants read the sugar shell not as a psychological metaphor but as a conventional gameplay resource, functionally equivalent to a health bar or stamina gauge. From a design intent perspective, this constitutes a failure of metaphorical transmission. However, Barthes' concept of the 'death of the author' invites a more nuanced position [56]: once a text is released to its readers, the author's intended meaning loses its privileged status, and meaning becomes something produced in the encounter between the text and the reader. Applied to game design, this suggests that the divergent readings produced by the prototype are not simply errors to be corrected, but evidence of players actively constructing meaning within their own interpretive frameworks. A player who reads the shell as a health bar and nonetheless experiences sustained pressure, loss of control, and compulsive forward movement has engaged with the affective argument of the prototype, even without accessing its intended symbolic layer. Whether this constitutes a partial success or a fundamental limitation depends on what one takes the primary goal of procedural rhetoric to be: the transmission of a specific authorial argument, or the provocation of a particular quality of experience.

7.1.2 The Legibility of Procedural Rhetoric

In section 7.1.1, the discussion of metaphor efficacy repeatedly runs into a tension that warrants more direct theoretical attention, that is the gap between design intent and player legibility. Several of the project's core findings, such as the social dimension failing to be perceived, genre conventions overwriting symbolic readings, and players retroactively identifying meaning only when prompted or being told explicitly, can be persuasive instances of a common underlying problem. Procedural rhetoric, as implemented in this prototype, was not always sufficiently legible to stand on its own to support the intended argument.

This raises two related but distinct questions. First, should legibility be pursued as a design goal? And secondly, if so, how can it be improved in projects of this kind?

This logic extends further to the dimension of temporal immediacy. Like reception theory in literary studies [57], this does not mean that the reader has to understand the novel's argument on the first reading, nor is there an a priori obligation for players to reach the intended meaning of a procedural argument in the course of playing. For some participants in this study, IS-adjacent articulations were only achieved under interview questioning, which means a retrospective form of meaning-making that may be no less valid than in-the-moment recognition.

Barthes's formulation of the "death of the author" argues that meaning is not deliv-

ered by the creator but produced by the reader, and further by the player [56]. In this case, the player who read the shell as a health bar was not misreading the game. Instead, they were producing a valid meaning through the lens of their own genre literacy. For this reason, the prototype succeeded as a text even where it failed as a message. This interpretation has practical implications for how evaluative success is defined in projects using games as expressive media. For instance, if the criterion is fidelity of transmission, did the player receive the intended meaning? Then the social and divergent findings represent shortfalls. Or, if the criterion is productive engagement, did the game produce meaningful and embodied experiences that participants connected to psychological states? Then the results appear considerably stronger. The choice of criterion is itself a design and research stance.

Nonetheless, this research also suggests that the gap between intent and legibility is not a completely inescapable feature of the medium. At least it is partly addressable through design. The evaluation data suggest three directions. The first relates to the clarification of thresholds. The summative results indicate that clearer audiovisual feedback at key mechanical thresholds, especially the onset of instability and the progressive erosion of the shell, would have reduced the interpretive noise from ambiguous visual transitions. The second is the framing of the context. As noted in Section 7.1.1.3, participants with lower CIPS scores found it more difficult to map somatic sensations onto IS-specific meaning without prior experiential schema. Minimal in-game framing, namely guidance and orientation, might lower the interpretive threshold without prescribing meaning. The last is relational scaffolding. The most significantly unresolved dimension, the social and performative aspect of IS, may require design elements that cannot be reduced to physical parameters acting on the player's body alone. Mechanics that place the player in a visible and evaluative context, like systems that imply that performance is being observed or recorded, may provide the relational vocabulary that the current design lacks.

Overall, these directions reframe the intent's legibility rather than resolve it. The question for future work in this area is likely not whether procedural rhetoric can be made perfectly transparent. It should focus on how much legibility is needed for a given communicative purpose and what design strategies can be calibrated to that threshold.

7.1.3 The "Bad Game Feel" Paradox

One recurring tension in this project has been the difficulty of using intentional control degradation as an expressive device in a medium where control degradation is usually understood to be a flaw or a difficulty parameter. The formative evaluation in Chapter 6 identified this tension as the difference between designed discomfort and cognitive dissonance, and it did not fully resolve across the evaluation phases and warrants direct theoretical attention.

The results of the summative evaluation suggest that, overall, the architecture of this tension was handled successfully to a large extent. Most participants identified the sensation of loss-of-control as a result of the intentional design, and several expressed the link between the feel of the mechanic and a deliberate psychological

argument.

But some of the discomfort during the summative phase was still the result of implementation friction, for instance, the latency in following the camera, the difficulty aligning to grind rails, and the directional lock after steering input, but not the core metaphorical system. During play, the distinction was not always clear, but participants were able to retroactively distinguish these two sources of discomfort. Some participants interpreted incidental implementation issues as features, while others interpreted designed instability as bugs.

This observation is a structural problem for any game that uses "bad game feel" as an expressive medium. The expressive intent of the designed discomfort depends on players reading it as intentional, but implementation imperfections produce a kind of discomfort that is superficially indistinguishable from the designed kind [51]. The solution is not to remove all implementation friction, which is an unrealistic standard for any prototype, but to make sure that the designed discomfort is clear and consistent enough that players can recognize it as a coherent system even in the presence of incidental friction. In this project, the visual feedback of the shells color transition and the HUD status indicator partially served this function, but the summative results suggest that their communicative power was incomplete. Greater legibility of the intentional system is likely to reduce interpretive ambiguity, such as in the form of more pronounced audiovisual responses at key mechanical thresholds or through minimal onboarding that explicitly frames the control experience.

In certain aspects, this paradox also reflects the dimension of player skill referred to in the previous section. For the less skilled players, the danger lies not only in that intended discomfort is attributed to lack of skill, but also in that the two become truly indistinguishable. Both of them produce the same phenomenological experience of not achieving the goal, or specifically not finishing a level. The IS argument of the game may be ambiguous for these players. The reason is mostly that the medium itself is an action game that requires a minimum threshold of motor skill, thus introducing a confounding layer of actual skill-based frustration. This suggests the importance of games that use loss of control as an expression to thoughtfully consider the minimum competence threshold [7], [8] needed to engage with the designed system at all, and to avoid setting the bar so high that it filters out the audiences most likely to benefit from the experience.

7.1.4 Ethical Reflection

The design of a game that intentionally produces anxiety, loss of control, and persistent psychological discomfort in the player brings with it ethical questions that are separate from the ones associated with traditional game research. The following are three notable dimensions.

First, this project exists within an established lineage of interactive and performative works that use discomfort as a medium of meaning-making, including immersive theater, participatory installation art, and an expanding canon of games that aim to communicate rather than simply entertain [58], [59]. The ethical justification for

intentionally causing discomfort within this tradition is based on several conditions: that the discomfort is intentional and limited, that participants are meaningfully informed prior to participation, and that the experience is designed to lead to understanding or reflection, not distress for its own sake. This project dealt with these conditions through the informed consent process and through the explicit framing of the research context. However, the distinction between discomfort that leads to insight and discomfort that merely causes harm is not always obvious to participants in the act of play, and the design itself cannot ensure that each players experience falls on the correct side of that line.

The evaluation results show that players with higher CIPS scores are more likely to have a more intense experience of the affective content of the game. One corollary of this finding that was not directly explored is that higher resonance may also carry a greater risk of the experience being distressing rather than illuminating. For strong IS tendency participants, who comprise a large portion of both the pre-study and the evaluation pool, the game may not only mirror their experience but also re-activate it beyond the playtest context. This is a sort of risk which is difficult to screen for in advance and which the current procedures for obtaining consent may not fully capture. In future iterations of this or similar projects, it is helpful to explicitly include content warnings, options to opt out without providing a reason, and resources for reflection following play for those who may find the project more distressing than they expected.

This project does not claim therapeutic intent or efficacy, and it is important that this line be clearly maintained in the framing of the prototype and any future distribution. This game serves mainly as an externalization and representation of a psychological experience, but not a tool for working through or recovering from that experience, which requires clinical expertise and a fundamentally different design framework. The distinction must be kept clear. This project has attempted to counter the danger of IS being further banalized by its incorporation into game mechanics, a danger mentioned in Chapter 2.1 as a consequence of its increasing public visibility, through rigorous grounding in IS phenomenology. It is an ongoing responsibility to continue to hold that rigor in future iterations and in how the work is communicated to wider audiences.

7.2 Conclusion

This section summarizes the main contributions of this research, identifies several research directions for mechanical metaphor targeting psychological states, discusses the limitations of the study, and outlines directions for future work.

7.2.1 Research Contributions

This research makes contributions in the following aspects:

First, through the design, implementation, and evaluation of a playable prototype, it verifies the feasibility of expressing the IS experience through game movement

mechanics. The evaluation results show that certain metaphorical dimensions, such as the escalating sense of losing control, can be successfully conveyed, while others, such as the fear of being seen through, still require further design refinement. These empirical results provide a concrete answer to the question of how to design mechanical metaphors to convey psychological states.

Second, it provides first-hand qualitative data on the embodied experience of IS. The descriptions collected during the pre-study, such as "heavy", "dragged", "slippery", and "fragile", serve not only the design of this project but can also provide reference material for future research related to the bodily perception of IS.

7.2.2 Research Directions

Based on the design, implementation, and evaluation of this project, several broader directions emerge for research on the translation of psychological experiences into game mechanics:

First, the translation of first-hand embodied descriptions into mechanical parameters deserves closer examination. In this project, somatic descriptions collected from the pre-study questionnaire, such as "being pushed forward", "slippery", and "heavy", were translated into physics parameters including steering inertia, lateral drift coefficient, and speed curves. The evaluation results suggested that these mechanics, constructed from participants' responses, achieved relatively strong metaphorical transmission at the somatic level, indicating that using first-hand qualitative data to drive parameter design helps to narrow the gap between design intent and player experience.

Second, the role of culturally recognized imagery in supporting metaphorical interpretation requires further investigation. As discussed in Chapter 2 through Grimwood's reobjectification framework [21], when the imagery used in a game already has clear psychological associations within a culture, such as fragility, transparency, or the abyss, it is easier for players to establish connections between mechanics and psychological states. Choosing abstract imagery that requires additional explanation increases the difficulty of metaphorical transmission.

Third, the relationship between metaphorical mechanics and perceivable gameplay consequences warrants closer examination. In this project, when the over-grinding death was temporarily removed, players felt no unease about exposure, and the metaphor failed. After the death penalty was restored, the metaphor became effective again. If a mechanic carries metaphorical meaning, it must produce tangible consequences at the gameplay level; otherwise, players will ignore its symbolic meaning.

Fourth, the legibility of designed discomfort remains an important issue in the design of mechanical metaphors. Discomfort experienced during play may originate from design intent or from bugs and unpolished interactions. In this project, the sugar shell's color gradient and the HUD status indicator partially mitigated this issue, but the evaluation showed that their effectiveness was still incomplete. This suggests that designers need to provide more pronounced and

consistent audiovisual feedback at moments when the system state undergoes critical changes, enabling players to recognize designed discomfort as a coherent system rather than an implementation flaw.

Fifth, the expressive boundary between physics-based mechanics and the social dimensions of psychological experience requires further exploration.

The evaluation findings in Chapter 6 revealed that the accumulative and somatic dimensions were successfully transmitted, but that the social and performative dimension of IS (the feeling of appearing competent to others whilst internally fearing that you will be exposed) was almost entirely absent from the unsolicited responses of participants. This gap suggests that movement physics alone cannot bear the full weight of psychological states with large interpersonal components. This raises the question of how additional layers, such as non-player characters, spectators, evaluators, or culturally recognizable imagery, might complement movement physics when representing psychological states with strong interpersonal dimensions. Such layers may help extend a metaphorical argument that physics parameters can initiate but may not fully express on their own.

Sixth, the influence of player skill on the reception of loss-of-control mechanics deserves closer examination.

The evaluation of this project showed that the effectiveness of the metaphor was modulated not only by IS tendency but also by player proficiency. Less experienced players tended to attribute designed loss of control to their own lack of skill, while more experienced players could develop strategies that partially circumvented the designed instability. Both weakened the metaphorical transmission. Some participants suggested providing adjustable game parameters, such as toggles for death conditions and sliders for speed and wear rate. This suggests a need to examine how difficulty layering and parameter adjustment influence the reception of loss-of-control mechanics across players with different levels of proficiency.

Seventh, the role of psychometric stratification and prior familiarity in metaphor reception warrants further investigation.

As discussed, the current project revealed a consistent pattern of participants with higher CIPS scores reporting a greater resonance with the affective content of the game, whereas those with lower scores had greater difficulty finding the conceptual connection without an external explanation. This means that the CIPS, or equivalent scales for other target states, can be used not only in the pre-study phase to stratify participants and ensure the extraction of somatic markers at varying levels of experiential intensity, but also in evaluation to uncover differences in the metaphorical transmission of the game across audiences with different degrees of personal familiarity with the condition. If players have not directly experienced the target psychological state, this raises a further question about whether in-game framing or contextual guidance is necessary to support metaphor reception.

7.2.3 Limitations

This research has the following limitations:

First, the sample size was limited. The pre-study involved 23 participants, the first playtest involved 5 participants, and the second playtest involved 20 participants, which may be insufficient to support statistically significant conclusions. While the qualitative and quantitative data obtained provided rich insights, the generalizability of the findings requires validation through larger-scale testing. In particular, the majority of participants in the second playtest had moderate CIPS scores, with a lack of participants in the higher score ranges, meaning the findings may not reflect the experiences of individuals with more severe IS tendencies. Furthermore, participants in both the pre-study and evaluations were primarily university students, whose IS experiences may differ from those of individuals in other professions and age groups, potentially limiting the applicability of the results to this specific demographic.

Second, the prototype was relatively rough and had several design shortcomings. In-game path guidance was not intuitive enough, making it difficult for players to determine the correct direction and the location of the endpoint without assistance, requiring researchers to provide support during testing, which may hinder the recruitment of a wider pool of testers. Furthermore, the difficulty gap between the two levels was too large. The first level was too short to allow players to fully adapt to the controls, while the sudden difficulty increase in the second level may have prevented some players from experiencing the entire gameplay. A more balanced difficulty gradient and more levels might produce different experiential feedback.

Third, the game had certain hardware requirements. On computers with lower specifications, the game may experience frame rate drops or some visual effects may not be fully rendered, which differs from its performance in the development environment and may interfere with the players' perception of the intended design of the game.

Fourth, the evaluation was primarily based on self-report data collected through interviews and questionnaires. Different players may have varying understandings of the same issue and express their feelings during gameplay differently. During testing, it was observed that some players exhibited visible signs of pressure and frustration during gameplay but did not identify or categorize their reactions as corresponding experience options in subsequent questionnaires. This suggests that self-report data may not fully reflect players' true emotional responses during gameplay. Future work could consider introducing supplementary data sources such as physiological measures to improve evaluation accuracy.

Fifth, the evaluation captured players' responses only immediately after play. The timing of the evaluation may have limited this study's ability to capture how players interpret the metaphor. The study mainly collected feedback during play or immediately after it. This approach is beneficial for recording immediate reactions such as pressure, frustration, and the loss of control. However, a player's understanding of the mechanical metaphor does not necessarily form at the moment of play. Some players may need to reflect after the experience, connecting the mechanics to their own understanding or rethinking certain moments in the game. In addition, if the researcher explained the intended metaphor immediately after play, it may have influenced participants' subsequent responses, making it difficult to observe how players

form their interpretations independently. Future research could combine immediate feedback with delayed interviews, for example by re-interviewing participants one week later, in order to analyze whether players' understanding changes or deepens over time.

7.2.4 Future Work

Based on the findings and limitations of this study, future work of the project can focus on the following directions:

First, improve the social and comparative dimensions of the metaphor that were not adequately expressed in the current prototype. The evaluation indicated that "the fear of being seen through" and "the accumulation of external success" were not sufficiently perceived by players. Future iterations could refer to Grimwood's reobjectification framework [21] to find imagery with stronger cultural or social associations to express these dimensions. For example, an audience system could be added so that spectators observe the player's skating and react differently as the sugar shell becomes thicker or thinner. This would make the experience of being watched and evaluated more directly perceptible. Future iterations could also introduce ghost skaters that apparently display competent performances by other players or simulated characters, creating a stronger sense of social comparison. In addition, at certain stages of the game, players could be informed that their performance is being recorded or may later be shown to others. This may increase pressure at specific points in the game, reflecting how IS may intensify when performance becomes visible or subject to evaluation.

Second, expand level content. The current prototype only includes two levels, which cannot fully represent the variation of the IS experience across different stages. Additional levels could express the different degrees of IS from mild anxiety to severe self-doubt, while also providing players with more opportunities to adapt and explore.

Third, conduct larger-scale player testing. Increasing the sample size and including more diverse groups of participants of different ages, occupations, and cultural backgrounds would help validate the generalizability of the research findings and support qualitative and quantitative analysis.

Fourth, consider introducing physiological measurements as a supplementary evaluation method. In addition to self-reported data, incorporate physiological indicators such as skin conductance response and heart rate variability to more objectively capture players' emotional responses during gameplay and reduce reliance on verbal expression.

Fifth, incorporate delayed follow-up interviews. Future studies could avoid disclosing the theme and intended metaphor immediately after gameplay, and conduct an additional interview after a fixed period of time, such as one week later. This may help examine whether players independently develop interpretations of the mechanics after reflection, and whether their understanding of the relationship between the gameplay experience and IS becomes clearer or more nuanced over time.

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A

Online Clance IP Scale

This appendix presents screenshots of the online self-assessment tool used to administer the Clance Impostor Phenomenon Scale (CIPS) to pre-study participants. The scale was deployed as an interactive web form available in English and Mandarin to accommodate the language backgrounds of participants at Chalmers University of Technology and the University of Gothenburg. The full scale comprises 20 items, each rated on a 5-point Likert scale from 1 (Not at all true) to 5 (Very true). The English version is hosted at <https://sidiaole.github.io/cips-test/> and the Mandarin version at https://sidiaole.github.io/CIPS_CN/.

A.1 The Online Clance IP Scale (English version)

CIPS Self-Assessment

Clance Impostor Phenomenon Scale

Instructions: For each question, please select the number that best indicates how true the statement is of you. It is best to give the first response that enters your mind rather than dwelling on each statement and thinking about it over and over.

Privacy Note: This test runs entirely in your browser. No data is collected or stored.

1. I have often succeeded on a test or task even though I was afraid that I would not do well before I undertook the task.

☐ 1 Not at all true	☐ 2 Rarely	☐ 3 Sometimes	☐ 4 Often	☐ 5 Very true
---	--------------------------------------	---	-------------------------------------	---

2. I can give the impression that I'm more competent than I really am.

☐ 1 Not at all true	☐ 2 Rarely	☐ 3 Sometimes	☐ 4 Often	☐ 5 Very true
---	--------------------------------------	---	-------------------------------------	---

3. I avoid evaluations if possible and have a dread of others evaluating me.

☐ 1 Not at all true	☐ 2 Rarely	☐ 3 Sometimes	☐ 4 Often	☐ 5 Very true
---	--------------------------------------	---	-------------------------------------	---

Figure A.1.1: Page 1 of the Online CIPS self-assessment form (English)

4. When people praise me for something I've accomplished, I'm afraid I won't be able to live up to their expectations of me in the future.

☐

1

Not at all true

☐

2

Rarely

☐

3

Sometimes

☐

4

Often

☐

5

Very true

5. I sometimes think I obtained my present position or gained my present success because I happened to be in the right place at the right time or knew the right people.

☐

1

Not at all true

☐

2

Rarely

☐

3

Sometimes

☐

4

Often

☐

5

Very true

6. I'm afraid people important to me may find out that I'm not as capable as they think I am.

☐

1

Not at all true

☐

2

Rarely

☐

3

Sometimes

☐

4

Often

☐

5

Very true

7. I tend to remember the incidents in which I have not done my best more than those times I have done my best.

☐

1

Not at all true

☐

2

Rarely

☐

3

Sometimes

☐

4

Often

☐

5

Very true

8. I rarely do a project or task as well as I'd like to do it.

☐

1

Not at all true

☐

2

Rarely

☐

3

Sometimes

☐

4

Often

☐

5

Very true

Figure A.1.2: Page 2 of the Online CIPS self-assessment form (English)

9. Sometimes I feel or believe that my success in my life or in my job has been the result of some kind of error.

☐	☐	☐	☐	☐
1	2	3	4	5
Not at all true	Rarely	Sometimes	Often	Very true

10. It's hard for me to accept compliments or praise about my intelligence or accomplishments.

☐	☐	☐	☐	☐
1	2	3	4	5
Not at all true	Rarely	Sometimes	Often	Very true

11. At times, I feel my success has been due to some kind of luck.

☐	☐	☐	☐	☐
1	2	3	4	5
Not at all true	Rarely	Sometimes	Often	Very true

12. I'm disappointed at times in my present accomplishments and think I should have accomplished much more.

☐	☐	☐	☐	☐
1	2	3	4	5
Not at all true	Rarely	Sometimes	Often	Very true

13. Sometimes I'm afraid others will discover how much knowledge or ability I really lack.

☐	☐	☐	☐	☐
1	2	3	4	5
Not at all true	Rarely	Sometimes	Often	Very true

Figure A.1.3: Page 3 of the Online CIPS self-assessment form (English)

14. I'm often afraid that I may fail at a new assignment or undertaking even though I generally do well at what I attempt.

☐

1

Not at all true

☐

2

Rarely

☐

3

Sometimes

☐

4

Often

☐

5

Very true

15. When I've succeeded at something and received recognition for my accomplishments, I have doubts that I can keep repeating that success.

☐

1

Not at all true

☐

2

Rarely

☐

3

Sometimes

☐

4

Often

☐

5

Very true

16. If I receive a great deal of praise and recognition for something I've accomplished, I tend to discount the importance of what I've done.

☐

1

Not at all true

☐

2

Rarely

☐

3

Sometimes

☐

4

Often

☐

5

Very true

17. I often compare my ability to those around me and think they may be more intelligent than I am.

☐

1

Not at all true

☐

2

Rarely

☐

3

Sometimes

☐

4

Often

☐

5

Very true

Figure A.1.4: Page 4 of the Online CIPS self-assessment form (English)

18. I often worry about not succeeding with a project or examination, even though others around me have considerable confidence that I will do well.

☐ 1 Not at all true	☐ 2 Rarely	☐ 3 Sometimes	☐ 4 Often	☐ 5 Very true
---	--------------------------------------	---	-------------------------------------	---

19. If I'm going to receive a promotion or gain recognition of some kind, I hesitate to tell others until it is an accomplished fact.

☐ 1 Not at all true	☐ 2 Rarely	☐ 3 Sometimes	☐ 4 Often	☐ 5 Very true
---	--------------------------------------	---	-------------------------------------	---

20. I feel bad and discouraged if I'm not "the best" or at least "very special" in situations that involve achievement.

☐ 1 Not at all true	☐ 2 Rarely	☐ 3 Sometimes	☐ 4 Often	☐ 5 Very true
---	--------------------------------------	---	-------------------------------------	---

Figure A.1.5: Page 5 of the Online CIPS self-assessment form (English)

A.2 The Online Clance IP Scale (Mandarin version)

CIPS 自我评估测试

Clance Impostor Phenomenon Scale (CIPS)

填写说明： 对于每一道题目，请选择最能反映您真实情况的数字。最好凭**第一直觉**回答，不要在每一句话上反复斟酌。

隐私说明： 本测试完全在您的浏览器本地运行，不会收集或存储您的任何数据。

1. 我经常在考试或任务中取得成功，尽管在开始之前我非常担心自己做不好。

○

1

完全不符合

○

2

很少符合

○

3

有时符合

○

4

经常符合

○

5

非常符合

2. 我能给别人留下一印象，让他们觉得我比实际能力更强。

○

1

完全不符合

○

2

很少符合

○

3

有时符合

○

4

经常符合

○

5

非常符合

3. 如果可能的话，我会尽量避免被评估，并且害怕别人对我进行评价。

○

1

完全不符合

○

2

很少符合

○

3

有时符合

○

4

经常符合

○

5

非常符合

Figure A.2.1: Page 1 of the Online CIPS self-assessment form (Mandarin)

VII

4. 当人们因为我完成的事情表扬我时，我害怕将来无法达到他们对我的期望。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

5. 有时我认为，我获得现在的职位或成功，是因为我在正确的时间出现在了正确的地方，或者认识了对的人。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

6. 我害怕那些对我重要的人会发现我并不像他们认为的那样有能力。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

7. 相比于我尽全力的时候，我更容易记住那些我没有尽全力的经历。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

8. 我很少能把项目或任务做得像我希望的那样好。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

Figure A.2.2: Page 2 of the Online CIPS self-assessment form (Mandarin)

9. 有时我觉得或相信，我在生活或工作中的成功是某种误打误撞的结果。

☐
1
完全不符合

☐
2
很少符合

☐
3
有时符合

☐
4
经常符合

☐
5
非常符合

10. 我很难接受别人对我智力或成就的赞美或表扬。

☐
1
完全不符合

☐
2
很少符合

☐
3
有时符合

☐
4
经常符合

☐
5
非常符合

11. 有时，我觉得我的成功归功于某种运气。

☐
1
完全不符合

☐
2
很少符合

☐
3
有时符合

☐
4
经常符合

☐
5
非常符合

12. 有时我对目前的成就感到失望，认为自己本应该取得更多成就。

☐
1
完全不符合

☐
2
很少符合

☐
3
有时符合

☐
4
经常符合

☐
5
非常符合

13. 有时我害怕别人会发现我在知识或能力上有多么欠缺。

☐
1
完全不符合

☐
2
很少符合

☐
3
有时符合

☐
4
经常符合

☐
5
非常符合

Figure A.2.3: Page 3 of the Online CIPS self-assessment form (Mandarin)

14. 尽管我通常能把尝试的事情做好，但我经常害怕在新的任务或事业中失败。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

15. 当我在某件事上取得成功并获得认可时，我会怀疑自己能否在未来重复这种成功。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

16. 如果我因为某项成就获得了大量的赞扬和认可，我倾向于低估我所做事情的重要性。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

17. 我经常将自己的能力与周围的人比较，认为他们可能比我更聪明。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

18. 即使周围的人对我充满信心，认为我会做得很好，我还是经常担心项目或考试不会成功。

☐	☐	☐	☐	☐
1	2	3	4	5
完全不符合	很少符合	有时符合	经常符合	非常符合

Figure A.2.4: Page 4 of the Online CIPS self-assessment form (Mandarin)

19. 如果我要获得晋升或某种认可，在事情板上钉钉之前，我会犹豫要不要告诉别人。

☐
1
完全不符合

☐
2
很少符合

☐
3
有时符合

☐
4
经常符合

☐
5
非常符合

20. 在涉及成就的情境中，如果我不是“最好的”或者至少是“非常特别的”，我会感觉糟糕和沮丧。

☐
1
完全不符合

☐
2
很少符合

☐
3
有时符合

☐
4
经常符合

☐
5
非常符合

Figure A.2.5: Page 5 of the Online CIPS self-assessment form (Mandarin)

B

Pre-Study Questionnaire

This appendix reproduces the full pre-study questionnaire administered after participants completed the CIPS. The questionnaire comprised seven open-ended items and two multiple-choice items (Q1 - Q9), designed to prompt participants to describe their experience of Impostor Syndrome through physical and somatic language, including bodily sensation, spatial environment, material properties, and movement. It was available in English and Mandarin; the English version is presented in Section B.1 and the Mandarin version in Section B.2.

B.1 Pre-Study Questionnaire (English version)

Embodied Experiences of Imposter Feelings Description

Hello,

We are Zi Ye and Biting Lin, two Master's students in Game Design & Technology at the University of Gothenburg and Interaction Design and Technologies at Chalmers University of Technology.

Before starting this questionnaire, we strongly recommend you take a CIPS scale test (<https://sidiaole.github.io/cips-test/>).

And in this questionnaire, we want to understand how "feeling like an imposter" feels physically in your body. **There are no right or wrong answers—please use your imagination to describe physical sensations, textures, or movements.** We recommend you answer these questions by your first instinct, but if you don't know how to describe, you check the prompts under the questions or just type in "I don't know".

The survey is anonymous, and all answers will be used exclusively for academic research.

Thank you so much for helping us!

Figure B.1.1: Page 1 of the pre-study questionnaire (English)

1. Think back to a specific moment when you felt a strong sense of * being an "imposter" (e.g., fearing you would be exposed as a fraud, or feeling you didn't deserve your success). **If this feeling were a physical environment or weather condition, what would it be? And which feature of this environment is the MOST dominant?**

- e.g., Walking in a thick fog, standing on the edge of a cliff, trapped underwater, etc.

☐ Visibility (e.g., fog, darkness, blurry...)

☐ Stability (e.g., slippery ground, crumbling floor, floating...)

☐ Verticality (e.g., heights, falling...)

☐ Restriction (e.g., small room, heavy pressure, underwater...)

☐ Other: _____

2. When you are in the state of self-doubt but trying to push through to * get work done, **how does the physical resistance feel under your feet?** And does this resistance feel constant, or does it accumulate over time?

- e.g., Does it feel like slipping on ice where you have no grip? Or does it feel like walking through thick mud where every step requires immense effort?

Your answer _____

Figure B.1.2: Page 2 of the pre-study questionnaire (English)

B.2 Pre-Study Questionnaire (Mandarin version)

3. Many people with Imposter feelings describe a pressure to "keep achieving" to maintain their image. **How does this forward momentum feel physically for you?** As this momentum builds up, how does your ability to steer or change direction change?

- e.g., Do you feel like you are being pushed by an engine? Or does it feel like you are rolling down a steep hill and cannot stop yourself?
- And, the faster you go, the harder it is to control? Or does speed not affect your stability?

Your answer

4. If you try to slow down or take a brief pause from your task, does your sense of control return immediately?

- ☐ Immediately (I feel stable the moment I stop).
- ☐ Short Delay (I feel unstable for a few moments/minutes, then it settles).
- ☐ Long Delay (I feel shaky for a long time).
- ☐ Never / Only after completion (The feeling of instability doesn't go away until the task is completely finished).
- ☐ Other:

5. When you are being pushed forward by this pressure to perform (well), **how does your body posture feel?**

- e.g., Do you feel top-heavy and dizzy, like you might tip over? Or do you feel heavy and dragged down, as if your legs are filled with lead?

Your answer

Figure B.1.3: Page 3 of the pre-study questionnaire (English)

6. You might feel like you are wearing a mask or hiding behind a facade. **If this protection were a physical material, what would it be made of?** *

- e.g., Is it fragile like thin glass? Is it heavy like iron armor? Is it sticky?

Your answer

7. When you are overwhelmed by the fear of being exposed (or being revealed that you are an imposter), **how does your vision change?**

- e.g., Does the world become blurry? Do you get tunnel vision where you can only see the task in front of you? Does everything look darker?

Your answer

8. **How does the space around you feel when you are afraid of failing (or getting revealed)?**

- e.g., Does the space feel like it is shrinking and crushing you? Or do you feel like the floor is disappearing beneath you?

Your answer

9. Imagine that your mask or facade finally breaks, such as when you make a mistake. **What would that moment of breaking feel like physically?** *

- e.g., A sudden, sharp explosion like popping a balloon? Or a slow, silent melting?

Your answer

Figure B.1.4: Page 4 of the pre-study questionnaire (English)

关于“冒名顶替感”的具身体验问卷

您好！我们是哥德堡大学游戏设计与技术专业 and 查尔姆斯理工大学交互设计与技术专业的学生。

在开始填写本问卷之前，我们强烈建议您先进行一下 CIPS 量表自测 (https://sidiaole.github.io/CIPS_CN/)，以便您对自己目前的心理状态有一个量化的了解。

1→ 您的 CIPS 量表得分是？

问题描述

待填写者输入

- *2→ 回想一个您感到强烈的“冒名顶替感”的具体时刻（担心自己会被拆穿是骗子，或者觉得配不上现在的成功）。如果这种感觉变成了一种物理环境或天气状况，它会是什么样的？请选择这种环境中主导的特征是什么。

问题描述

☐ 可见度（例如：黑暗、模糊...）

☐ 稳定性（例如：地面湿滑、地板崩塌、悬空漂浮...）

☐ 垂直高度（例如：高处不胜寒、坠落感...）

☐ 束缚感（例如：狭窄的空间、重压、水下憋气...）

3→ 您可以大致描述一下这个环境(Q2)吗？

问题描述

待填写者输入

- *4→ 当您处于自我怀疑的状态，但仍试图硬着头皮完成工作时，您感觉脚下的物理阻力是怎样的？这种阻力感是恒定的，还是会随着时间累积？

- 提示：是像在冰面上打滑（感觉抓地力不足）？还是像在泥潭里行走（感觉阻力过大）？

待填写者输入

- 5→ 许多有冒名顶替感的人都说，为了维持形象，他们时常感到一种“必须不断取得成就”的压力。这种向前的动量在身体上感觉如何？随着这种动量的累积/速度变快，您感觉控制方向的能力会发生什么变化？

- 提示1：感觉像被什么推着走？还是像下坡一样难以刹车？ - 提示2：速度越快越难控制？还是速度不影响稳定性？

待填写者输入

Figure B.2.1: Page 1 of the pre-study questionnaire (Mandarin)

B. Pre-Study Questionnaire

6→

如果您试图慢下来或暂停手头的任务，您的控制感会立即恢复吗？

问题描述

☐ 立即恢复（一旦停止就感觉恢复控制感了）。

☐ 延迟一小会（会不稳定一小段时间，然后恢复）。

☐ 延迟很久（会感觉失控较长时间）。

☐ 始终无法恢复/直到任务完成（这种失控感直到任务彻底结束才会消失，甚至不会消失）。

7→

当您被这种（想要表现好的）压力推着向前走时，您的身体姿态感觉如何？

- 提示：感觉头晕目眩？还是感觉身体沉重？

待填写者输入

*8→

您可能会觉得自己戴着面具或伪装。如果这层保护壳是一种物理材质，它可能会是什么？

- 提示：像薄玻璃一样易碎？像钢铁一样坚实？还是黏糊糊的？

待填写者输入

9→

当您被那种“担心被拆穿”的恐惧淹没时，您的视觉会发生什么感官上的变化？

- 提示：世界变得模糊？周围一切都变暗了？

待填写者输入

10→

当您害怕失败（或那种“被拆穿”的感觉）时，周围的空间给您什么感觉？

- 提示：感觉空间在收缩/挤压？还是感觉脚下没有支撑？

待填写者输入

*11→

假如您的面具或伪装终于破碎了（比方说那种犯错的时刻）。那一瞬间的物理感觉会是怎样的？

- 提示：像爆炸一样突然/尖锐？还是那种缓慢的融化感？

待填写者输入

Figure B.2.2: Page 2 of the pre-study questionnaire (Mandarin)

C

Interview and Testing Protocols

This appendix presents the complete feedback instruments used in the two rounds of prototype evaluation. Section C.1 contains the survey administered during the formative evaluation (the MVP Playtest), conducted with five participants via Zoom after gameplay of the MVP build. Section C.2 contains the structured feedback form used in the summative evaluation (The Second Playtest), completed independently by 20 participants after playing the final prototype. The Test 2 form was organized into five thematic sections: basic information, level experience, control mechanic perception, shell mechanic perception, emotional response, between-level comparison, and open-ended reflection.

C.1 The Questionnaire of the MVP Test

Prototype Gameplay Feedback Survey

Please share any of your thoughts on this prototype!

How would you describe the overall vibe or feeling of this prototype to a friend?

Your answer _____

While controlling the character encased in the sugar shell, how would you describe your mental or emotional state during the gameplay?

Did you feel relaxed, rushed, anxious, or something else? Can you explain why?

Your answer _____

Was there a specific moment or situation in the prototype that made you feel the most stressed or tense? Please describe what was happening.

Your answer _____

How intuitive did the character's movement and steering feel to you?

	1	2	3	4	5	
Very Unintuitive	☐	☐	☐	☐	☐	Very Intuitive

Did you feel the character becoming gradually harder to control over time?

If so, did this difficulty feel like an intentional design choice, or did it feel like the system was just not working properly?

☐ Yes

☐ No

☐ Other: _____

Figure C.1.1: Page 1 for the questionnaire of the MVP Test

C.2 The Questionnaire of the Second Test

When you are attached to the grinding rails/tracks, does it feel like helping you recover from that loss of control? How did the sudden change in speed and steering make you feel?

How did the sudden change in speed and steering make you feel?

Your answer _____

The game features a mechanic where the sugar shell wears down and shatters. Did you feel the prototype gave you clear enough feedback (visually or through controls) about the current state of your shell?

	1	2	3	4	5	
No	☐	☐	☐	☐	☐	Yes

Does the game give you sufficient feedback when you are close to failing?

Your answer _____

You may fell off or struggled a few times at [somewhere in the level]. Can you walk me through your thought process when judging the distance/timing there?

Which section of the entire level did you find most unreasonable or frustrating?

Your answer _____

If you had an opportunity to instantly change or improve 1-2 things in this prototype, what would it or them be?

Your answer _____

Figure C.1.2: Page 2 for the questionnaire of the MVP Test



Figure C.2.1: Cover Page for the questionnaire of the Second Test

A. Basic Information

This section simply gathers some basic context about your play session and prior experience.

How long did you play the game in total? (Approximately) *

Hr Min Sec

__ : __ : __

Have you played similar types of games before (e.g., platformer, racing, skating, parkour)? *

☐ Platformer (2D/3D)

☐ Racing/Speedrun

☐ Skating/Movement-focused

☐ Parkour/Running

☐ None of the above

What is your CIPS score?

If you don't know, you can click here to test your CIPS score: <https://sidiaole.github.io/cips-test/>

Your answer _____

Figure C.2.2: Page 1 for the questionnaire of the Second Test

B. Level Experience

This section focuses on your direct experience within the level you just played.

Which level did you just play? *

- ☐ Level 1 (The First Level)
- ☐ Level 2 (The Second Level)
- ☐ Both.

Did you complete either of the levels? *

- ☐ Yes, I completed both levels.
- ☐ Yes, I completed Level 1.
- ☐ Yes, I completed Level 2.
- ☐ No, I stopped before completing either level.

Figure C.2.3: Page 2 for the questionnaire of the Second Test

Please rate your agreement with the following statements. *

1=Strongly Disagree, 5=Strongly Agree.

	1	2	3	4	5
I was able to understand how to control the character.	☐	☐	☐	☐	☐
The character's movement felt unstable or difficult to fully control.	☐	☐	☐	☐	☐
I felt a delay between my input and the character's actions.	☐	☐	☐	☐	☐
As the game progressed, the character became harder to control.	☐	☐	☐	☐	☐
The loss of control felt intentional rather than caused by technical issues or bugs.	☐	☐	☐	☐	☐

Figure C.2.4: Page 3 for the questionnaire of the Second Test

How would you rate the overall emotional intensity of the level?

1 2 3 4 5 6 7 8 9 10

Very Relaxing ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely Tense/Stressful

Please rate your agreement with the following statements. *

1=Strongly Disagree, 5=Strongly Agree.

	1	2	3	4	5
This level made me feel tense, anxious, or stressed.	☐	☐	☐	☐	☐
I felt pushed to keep moving forward, even when I wanted to slow down.	☐	☐	☐	☐	☐
The more the character lost control, the more pressure I felt.	☐	☐	☐	☐	☐
I felt a brief sense of relief when the character entered grinding/friction areas.	☐	☐	☐	☐	☐
When the pink shell was worn away, I felt the character became more vulnerable.	☐	☐	☐	☐	☐

Figure C.2.5: Page 4 for the questionnaire of the Second Test

The following question compares the two levels. If you have only played one level, please click next immediately.

This section mainly compares your experiences across the two levels; if you have only played one level, please click next immediately.

Please rate your agreement with the following statements.
1=Strongly Disagree, 5=Strongly Agree.

	1	2	3	4	5
The second level was more difficult than the first.	☐	☐	☐	☐	☐
The second level felt more tense, anxious, or stressful than the first.	☐	☐	☐	☐	☐
The second level expressed a stronger sense of loss of control.	☐	☐	☐	☐	☐
The two levels felt like different intensities of the same experience.	☐	☐	☐	☐	☐

Figure C.2.6: Page 5 for the questionnaire of the Second Test

D. Open-ended Questions

This section invites you to reflect more freely on your experience. Hopefully you can dig into personal interpretations, metaphorical associations, and specific moments.

Was there any moment in the game where you felt a strong sense of losing control or unease? What happened at that moment, and how did you feel? *

Your answer

The game aims to express Impostor Syndrome. Do you think the game mechanics effectively convey this feeling? Which aspects succeeded, and which did not? *

Your answer

If you were to describe your gameplay experience using a bodily sensation or a physical phenomenon, how would you characterize it?

Your answer

What do you think the transparent shell on the character represents? What do its changes (thickening, wearing down, cracking) signify to you?

Your answer

What do you think needs the most improvement at this stage, and why?

Your answer

Figure C.2.7: Page 6 for the questionnaire of the Second Test

D

Technical Specifications and Telemetry

This appendix presents a complete telemetry log from a single play session recorded during the summative evaluation. The log is exported in JSON format by the `ExportLogsToJson` function. Each entry in the array represents one `PlayerEvent` struct, capturing a discrete game event along with the player’s state at the moment of its occurrence.

Table D.1 summarizes the fields recorded in each event.

Table D.1: `PlayerEvent` telemetry fields.

Field	Description
<code>EventType</code>	Event category
<code>LevelName</code>	Identifier of the active level
<code>GameTime</code>	Elapsed time in seconds since session start
<code>Location</code>	Player world coordinates (X, Y, Z)
<code>CurrentSpeed</code>	Player speed at the moment of the event
<code>ShellThickness</code>	Normalised sugar shell thickness (0.0 to 1.0)
<code>MeltAmount</code>	Smoothed intermediate melt value
<code>IsGrinding</code>	Whether the player is currently on a grind rail
<code>RailID</code>	Identifier of the active rail, or <code>None</code>
<code>GrindDirection</code>	Direction of travel along the rail
<code>DeathReason</code>	Cause of death, if applicable
<code>ExtraNote</code>	Additional contextual annotation
<code>DeathCount</code>	Cumulative death count in the session
<code>GrindCount</code>	Cumulative grind count in the session
<code>ControlAlpha</code>	Current control degradation coefficient

The following listing shows the complete log of one session. In this session the player died once from a shell collision on Level 0, which is the first level of this game, respawned, completed three grinds, and finished the level.

Listing D.1: Example telemetry log exported from one Level 0 session.

```
[
  {
    "EventType": "RunStart",
```

```
"LevelName": "Lv0",
"GameTime": 0,
"Location":
{
  "X": 0,
  "Y": 70,
  "Z": 161.27499961853027
},
"CurrentSpeed": 0,
"ShellThickness": 0,
"MeltAmount": 0,
"IsGrinding": false,
"RailID": "None",
"GrindDirection": 0,
"DeathReason": "",
"ExtraNote": "BeginPlayTest",
"DeathCount": 0,
"GrindCount": 0,
"ControlAlpha": 0
},
{
  "EventType": "Death",
  "LevelName": "Lv0",
  "GameTime": 23.666055679321289,
  "Location":
  {
    "X": 4347.2291029609141,
    "Y": 3264.8328019119508,
    "Z": 136.65000425836726
  },
  "CurrentSpeed": 570.049560546875,
  "ShellThickness": 1,
  "MeltAmount": 0.9832388162612915,
  "IsGrinding": false,
  "RailID": "None",
  "GrindDirection": 0,
  "DeathReason": "ShellFullCollisionDeath",
  "ExtraNote": "Death",
  "DeathCount": 1,
  "GrindCount": 0,
  "ControlAlpha": 0.97992044687271118
},
{
  "EventType": "RunStart",
  "LevelName": "Lv0",
  "GameTime": 25.661838531494141,
  "Location":
  {
    "X": 0,
    "Y": 70,
    "Z": 134.5
  },
  "CurrentSpeed": 0,
  "ShellThickness": 0,
  "MeltAmount": 0,
  "IsGrinding": false,
```



```
"RailID": "None",
"GrindDirection": 0,
"DeathReason": "",
"ExtraNote": "BeginPlayTest",
"DeathCount": 1,
"GrindCount": 0,
"ControlAlpha": 0
},
{
  "EventType": "GrindStart",
  "LevelName": "Lv0",
  "GameTime": 39.157512664794922,
  "Location":
  {
    "X": 3653.2977285376642,
    "Y": 1478.2149992949473,
    "Z": 155.57282575356425
  },
  "CurrentSpeed": 576.0040283203125,
  "ShellThickness": 0.53890764713287354,
  "MeltAmount": 0.35228115320205688,
  "IsGrinding": true,
  "RailID": "Lv0_Rail_01",
  "GrindDirection": 1,
  "DeathReason": "",
  "ExtraNote": "GrindStart",
  "DeathCount": 1,
  "GrindCount": 1,
  "ControlAlpha": 0.28593498468399048
},
{
  "EventType": "GrindEnd",
  "LevelName": "Lv0",
  "GameTime": 39.560115814208984,
  "Location":
  {
    "X": 3768.0000011927323,
    "Y": 1947.1292521953608,
    "Z": 85
  },
  "CurrentSpeed": 589.38922119140625,
  "ShellThickness": 0.43825772404670715,
  "MeltAmount": 0.35228115320205688,
  "IsGrinding": false,
  "RailID": "Lv0_Rail_01",
  "GrindDirection": 1,
  "DeathReason": "",
  "ExtraNote": "RailEndAutoExit",
  "DeathCount": 1,
  "GrindCount": 1,
  "ControlAlpha": 0.28593498468399048
},
{
  "EventType": "GrindStart",
  "LevelName": "Lv0",
  "GameTime": 43.229606628417969,
```

```
"Location":
{
  "X": 3950.4291463767095,
  "Y": 3923.3468108342054,
  "Z": 157.66706661061647
},
"CurrentSpeed": 599.9937744140625,
"ShellThickness": 0.62173229455947876,
"MeltAmount": 0.44464057683944702,
"IsGrinding": true,
"RailID": "Lv0_Rail_03",
"GrindDirection": 1,
"DeathReason": "",
"ExtraNote": "GrindStart",
"DeathCount": 1,
"GrindCount": 2,
"ControlAlpha": 0.37810370326042175
},
{
  "EventType": "GrindEnd",
  "LevelName": "Lv0",
  "GameTime": 44.974075317382812,
  "Location":
  {
    "X": 4104.1641784815129,
    "Y": 5495.1955725551279,
    "Z": 60
  },
  "CurrentSpeed": 599.99981689453125,
  "ShellThickness": 0.098391376435756683,
  "MeltAmount": 0.44464057683944702,
  "IsGrinding": false,
  "RailID": "Lv0_Rail_03",
  "GrindDirection": 1,
  "DeathReason": "",
  "ExtraNote": "RailEndAutoExit",
  "DeathCount": 1,
  "GrindCount": 2,
  "ControlAlpha": 0.37810370326042175
},
{
  "EventType": "GrindStart",
  "LevelName": "Lv0",
  "GameTime": 52.779464721679688,
  "Location":
  {
    "X": 4313.3101658649002,
    "Y": 7426.9715847505395,
    "Z": 158.06760703029329
  },
  "CurrentSpeed": 435.56121826171875,
  "ShellThickness": 0.48866090178489685,
  "MeltAmount": 0.30043518543243408,
  "IsGrinding": true,
  "RailID": "Lv0_Rail_05",
  "GrindDirection": 1,
```

```
    "DeathReason": "",
    "ExtraNote": "GrindStart",
    "DeathCount": 1,
    "GrindCount": 3,
    "ControlAlpha": 0.23621144890785217
  },
  {
    "EventType": "LevelComplete",
    "LevelName": "Lv0",
    "GameTime": 54.408061981201172,
    "Location":
    {
      "X": 4318.3456387884671,
      "Y": 8944.7502810371134,
      "Z": 815
    },
    "CurrentSpeed": 593.88861083984375,
    "ShellThickness": 0.3258013129234314,
    "MeltAmount": 0.30043518543243408,
    "IsGrinding": true,
    "RailID": "None",
    "GrindDirection": 1,
    "DeathReason": "",
    "ExtraNote": "Lv0Finish",
    "DeathCount": 1,
    "GrindCount": 3,
    "ControlAlpha": 0.23621144890785217
  }
]
```


E

Ethical Compliance and Consent

This appendix reproduces the informed consent form used for the MVP playtest. The form was distributed electronically prior to each session and supplemented by an oral briefing at the start of the Zoom call. All participants provided signed consent before gameplay began. For the second playtest, equivalent consent was obtained through a digital consent mechanism integrated into the online questionnaire platform.

E.1 Informed Consent Form

Informed Consent Form for SugarGloss MVP Playtest

- **Research Project:** *SugarGloss* (Master's Thesis Project)
- **Researchers:** Biting Lin (biting@chalmers.se), Zi Ye (gusyezip@student.gu.se)
- **Institution:** Chalmers University of Technology & University of Gothenburg

1. Purpose of the Study

You are invited to participate in a playtest for *SugarGloss*, an early-stage 3D game prototype developed for our Master's thesis. The purpose of this test is to evaluate the game's core mechanics, usability, and the overall player experience.

2. Test Procedure

If you agree to participate, the session will take approximately 20–30 minutes and will be conducted online via Zoom. The process includes:

- **Gameplay (7-15 mins):** You will play the game on your local computer while sharing your screen with the researchers (via Zoom). We encourage you to "think aloud" (express your thoughts, confusion, or intentions verbally) while playing.
- **Post-Play Feedback (10-15 mins):** After playing, you will be asked to share your experience through either a short interview or a written questionnaire, based on your preference.

3. Data Collection and Recording

With your permission, the Zoom session will be recorded.

- **What is recorded:** Only your shared screen and your voice (audio) will be recorded. You may keep your camera turned off.
- **Purpose:** The recording is strictly used by the researchers for note-taking and observing gameplay behavior.

4. Data Privacy and GDPR Compliance

Your participation and all data collected will be handled in strict accordance with the General Data Protection Regulation (GDPR).

- All data will be **anonymized**. Your name or any identifiable information will not be used in the final thesis, publications, or presentations.
- The recordings and raw data will be stored securely on the researchers' local devices and will be permanently deleted after the thesis defense and grading process are completed (expected around June 2026).

5. Voluntary Participation & Right to Withdraw

Figure E.1.1: First page of the informed consent form for the MVP playtest

Your participation is entirely voluntary. You have the right to pause, skip any questions, or completely withdraw from the test at any time without providing a reason and without any negative consequences. If you choose to withdraw, any data collected from you up to that point will be immediately deleted.

Contact Information

If you have any questions or concerns regarding this test or your data, please feel free to contact the researchers via the emails provided above.

Consent Declaration

- ☐ I have read and understood the information provided above.
- ☐ I understand that my participation is voluntary and that I am free to withdraw at any time.
- ☐ I consent to the screen-sharing and audio recording of the gameplay session for research purposes.
- ☐ I agree to participate in this playtest.

Participant's Name: _____

Signature: _____

Date: _____

Figure E.1.2: Second page of the informed consent form for the MVP playtest