

A Design Framework for Reflective Play

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ABSTRACT

Recent research has begun exploring games as a medium for reflection due to their affordances as interactive systems of challenge. However, little effort has been put into (1) synthesizing insights across studies and disciplines and (2) translating the academic work on reflective play into practical takeaways for game developers. This article takes the first steps toward summarizing existing work on reflective play and translating insights for practical implementation by identifying key game elements present in games that evoke reflection. We divide these elements into five approaches: Disruptions, Slowdowns, Questioning, Revisiting, and Enhancers. Finally, we provide an actionable supplement for practicing game developers to apply these concepts to their games.

CCS CONCEPTS

• **Human-centered computing** → **HCI theory, concepts and models.**

KEYWORDS

games, reflection, reflective game design, reflective informatics, meaningful games

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1 INTRODUCTION

Media — through its ability to challenge our foundational beliefs — can lead to personal growth [6], with games considered specifically effective due to their interactivity, experiential nature, and ability to dynamically challenge their players [76]. While this “designed challenge” [76, p. 5] may appear negative, it can become welcomed difficulty, where players turn negative emotions into positive — and even reflective or transformational — experiences [13, 55]. As such, there has been a recent push to understand beneficial emotional challenge, and how the emotional aspects of play enable transformative reflection [31, 69, 116, 120]. While complex, intense, moments of transformative reflection are more discussed in the literature, we are also interested in simpler moments of reflection, (e.g. recollection, or forming relationships between ideas) [43], especially since a simple moment of reflection can lay the seeds for higher level reflection.

The ability for games to facilitate reflection connects them naturally to constructivism, experiential learning, and reflective expertise: fields which have acknowledged reflection for many years as a critical part of deep learning [14, 76, 98, 119, 124]. Not only does reflection lead to better learning [8], but reflection can lead to *eudaimonic appreciation*, or valuing experiences that provide “greater insight, meaning and purpose in life” [103, p. 34].

While Khaled has explored why existing serious and entertainment games largely do not support reflective play [76], prior research has yet to be oriented toward practical heuristics for developers to create reflective play in commercial games — especially since academic publications are often inaccessible to industry professionals [10, 25, 57]. Moreover, though prior research has identified many insights from *evaluating* reflective play, these works have yet to be synthesized into recommendations for the *generation* of reflective play.

Therefore, this article begins the process of synthesizing and translating reflective play insights into a framework of patterns for reflective play — with the goal of distributing an applied version of the framework (which we refer to as “the toolkit”) on accessible platforms. We believe this is useful both to games researchers who are attempting to elicit and study reflective behaviors and

for industry use by contextualizing reflective play in terms of the game elements that enable reflection. We discuss five approaches to designing for reflective play: Disruptions, Slowdowns, Questioning, Revisiting, and Enhancers.

In this way, the purpose of this article is to provide practical support for designing reflective play, both in serious and commercial games. The kind of reflection elicited can be shallow, in-game learning, or deep re-evaluations of ethical and societal world views; although the latter is harder to evoke [96, 133], based on existing literature, we describe the kind of reflection that each pattern elicits and when in the experience (during or after) each pattern applies.

The contribution of our work is two-fold: first, our conceptual categorizations of reflective play advance the theory of (as well as theorizing about) reflection in games by providing a synthesized framework for considering game mechanics that support (or — by going against these patterns — hinder) reflection. The proposed framework will support empirical and design research that can build on and test this work to deepen our understanding of reflection within the context of games. Second, we apply this framework to create a practical toolkit (see the supplementary materials) for actionable use by developers to design for reflective play in their games, whether for commercial or applied purposes. We further work through example generative and evaluative exercises ourselves to show how the toolkit could be used by a practitioner.

2 BACKGROUND

Reflection can be seen as a cycle of “thinking and doing” [115]; a cycle that is “active, persistent, and careful” [38, p. 91] in nature, with the intent of “exploring [one’s] experiences in order to lead to new understandings and appreciations” [14, p. 19] in problems where “there is no obvious solution” [100, p. 98]. Moon argues that the literature’s differing definitions of reflection stem from different *purposes* for reflection [100]. For this article, however, reflection can happen for any purpose, such as learning, eudaimonic appreciation, or re-evaluating a political stance. Therefore, we operationalize reflection as *any cognitive or behavioral reappraisal which supports developing new insights or effecting changes in values or judgment*. Thus, reflection does not have to be intentional or lead to a specific outcome; rather, for this article reflection is the *process* of reappraising.

2.1 The Player Experience of Reflection

Current HCI games scholarship primarily focuses on reflection in terms of the player experience. Mekler et al. [96], for instance, found that, while reflection can be relatively common as part of the player experience, there was an absence of transformational and “critical” [43] reflection (i.e., having an impact on the player’s actions or attitudes toward ethical and societal issues). Whitby et al. [133] deconstructed transformative reflection in games into two categories: endo- and exo-transformative reflection. Endo-transformative reflection is confined within game-related behavior and concepts; in this case, reflection is a critical part of learning that can lead to changes in play style or conceptualizations of the game. Endo-transformative reflections thus can be considered part of the ordinary player experience and one of the lesser explored aspects of reflection (cf. [123]). In a subsequent empirical study, Whitby

et al. [132] established a model of granular triggers and likely resulting reflections. Both the triggers for reflections and the reflections themselves can be the more common game-related (endo-game) or non-game related (exo-game), including frequent self-referential reflection on games as a medium. In general, game-related reflections are much more common and limited in scope [132, 133]. Exo-transformative reflections on the other hand affect beliefs or actions outside or exogenous to gameplay. It is this type of reflection that is sought after when we refer to games that afford ‘transformative’ reflection [7], yet exo-transformative reflection is also much more rare, difficult to predict, and difficult to evoke [96, 133].

In addition, Gandhi et al. [48] identified elements of gameplay that fostered reflection. Their findings discussed (1) how basic game mechanics and characters fostered reflection, (2) the notion of intellectual exploration — the ability for games to enable engaging with different perspectives, (3) that players were more keen to reflect when they related to the themes present in a game, even if that relation was abstract, and (4) that players were consistently frustrated by games that were overly direct in their messaging; that successful games led the player to ideas without bluntly pushing those ideas onto them.

Others have looked into reflection for applied purposes, such as exploring sexism in the workplace [106], developing leadership skills [61], or even teaching healthy dating behaviors [15]. In a recent example, Iacovides et al. [66] examined how players reflected on a game depending on whether they played as themselves or took on the role of a third-person character. They compared two versions of an applied game that aimed to support student reflection on their work-life balance. Their findings suggest the importance of ensuring that the consequences of in-game actions are sensible and visible, whilst also highlighting the influence of external triggers in everyday life. In addition, their analysis illustrated how role-playing as someone else can help to create a space for reflection to occur (through creating distance between the player and the player-character), but that it is also important to ensure the gameplay is considered relevant to players so that they can connect it to their own lives. While these HCI works have shown how players reflect in games, they do not provide guidance for designing further reflective games.

2.2 Designing for Reflection

Khaled was one of the first to put forward an agenda for reflective game design [76]. She argues that — although gameplay has the strong potential to be a reflective experience — there are several patterns of conventional serious and commercial game design that work against reflection. These patterns are important to understand because they set up some of the problems to which reflective play design patterns propose solutions. Khaled identifies three problematic patterns for each camp. In mainstream entertainment games: (1) a focus on immersion sacrifices opportunity for introspection; (2) designing for the “everyplayer” places designers in a service role, discouraging them from challenging, surprising, or troubling the player with breakdowns needed for reflection; and (3) mechanically quantifying the theme turns reflection into a maximization exercise, limiting the players’ capacity for critically considering the issues. In serious games: (1) an overuse of safe environments prevents

transfer learning, since safe environments pose an unrealistic, irrelevant representation of the issues; (2) presenting well-structured problems with straightforward answers disempowers players to handle realistic, ill-structured problems; (3) stealth learning without debriefing prevents transfer learning because players don't connect their in-game learning to real contexts. If, instead, game sessions were followed with a debriefing session, this learning opportunity could help players draw the connection from the game's experiences to real-world implications [76](cf. [27]).

For positive examples of reflective play, Khaled looks to experimental game design as a space rich for reflection [76]. Because these games are less focused on mass-market appeal, they can innovate and subvert conventions in a way that privileges surprise, ambiguity, the creation of reflective spaces [35], ill-structured problems, and other elements that support critical [43] or transformational [7] reflection. Khaled proposes four qualities of reflective play design: questions over answers, clarity over stealth, disruption over comfort, and reflection over immersion [76].

Similar to Khaled's calls for reflection over immersion, Berge proposes the concept of 'outmersive' game design — a pattern of breaking immersion in favor of reflection. Outmersion, originally coined by Frasca [44], is the process of creating a "critical distance" by directing the player's attention to and outside of the game itself [11]; it can be accomplished by directly invoking the player, complicating the player's place in the avatar's body, deceiving the player, taking (or threatening to take) agency from the player, and referencing game structures directly [11]. Wilson and Sicart [135] instead address designing for the 'everyplayer' without challenging them — through what they call abusive design. Abusive design rejects the notion of "player advocacy" and "player narcissism" in favor of highlighting the dialogic relation between player and designer. They give the example of *Dark Room Sex Game* [G48], an audio-only game for the Wii whose goal is to embarrass players through implied sexual actions using the Wii controller. Wilson and Sicart note that abusive design can take a variety of modalities: physical, unfair design, lying to the player, aesthetic abuse, and social abuse. By "abusing" the player in these ways, abusive design aims to focus on the deeply personal nature of gameplay, 'outmersing' the player and challenging them to reflect on their difficult play experience.

Many designers and researchers are thinking about ways in which games can support reflection. However, prior work says little about *how* their patterns and qualities can be applied to the design process. Translating conceptual knowledge into design resources is in fact a non-trivial challenge. Although these design philosophies individually support reflective play, there is to date no work which connects these ideas and orients them toward practical implementation in commerce or research. Our supplementary design toolkit is written for practical implementation by non-academic audiences for the development of games that support all levels of reflection.

2.3 Frameworks, Toolkits, and Translational Resources for Game Design Practitioners

Successful translations of knowledge present '*digestible*' information better suited for game developers [10]. The digestibility of a translation can stem from (i) how it is disseminated and (ii) the density of information, both of which are factors that contribute to the

often-noted divide between academia and the game development industry [24, 105, 107]. The translation of created knowledge for practical use sometimes happens through white papers, such as in *Designing Games to Challenge the Stigma Around Mental Health* [82], which focused on presenting actionable guidance for how games of all genres can be developed without perpetuating mental health stigmas.

One example of a translational resource is a set of game design patterns. For example, Barney [5] lays out patterns applicable in general game design. Each pattern is made relevant to designers by being associated with a design problem, and is similarly made approachable by associating it with an example game. Related patterns allow designers to chain together ideas, and exercises allow fledgling designers to test their understanding. Pattern languages are also useful for specific game design niches. For instance, El-Nasr et al. [41] looked at how players cooperated in video games, then used that data to build *cooperative game design patterns* such as the "shared puzzle" — a barrier or intellectual challenge that requires cooperation from both players (or possibly even special abilities from each player's character).

Related to patterns are lenses, which are made to help designers focus on one particular aspect of the design at a time [114]. Lenses ask their user to look at their game with a focused, unique perspective, which allows the designer to identify unforeseen issues. Generally speaking, patterns tend to be more prescriptive, while lenses often serve to spark thought. Lenses can be a sub-part of a pattern; in the interactive deck of learning science principles¹, each pattern has an "ask yourself" section containing a set of questions that serve as lenses. One such lens is "*When players make mistakes, how do they know they've done so? How long can a player go before realizing they need to turn back?*", which is part of a larger pattern discussing the timing of feedback.

Frameworks can be process-oriented guides and/or conceptual anchors. One such example is *The Transformational Framework* by Sabrina Culyba is an accessible handbook which supports the process of developing transformational games [28]. In Chapter 3, for instance, Culyba discusses a variety of ways a player could transform after playing a game, asks the reader what kind of transformation they want to focus on, then finally discusses how a game can be designed to support specifically that transformation. While reflection can result in transformation, Culyba's framework has no support specifically for reflection [111] and focuses on transformational *outcomes*, where we focus on reflective *processes*.

Toolkits are an umbrella term for design resources that can take a variety of forms but — in the context of game design — are most often a set of cards with prompts to generate creative ideas. One example is the Afrofuturist speculative design toolkit, which used participatory design and interviews with community leaders to generate a card deck, both for designs that imagine utopian futures, and those that grapple with modern social issues. For a card deck created by an industry practitioner, Schell's *deck of lenses* [114] is a popular resource. Further academic examples include: Beça et al. [9], Compton et al. [26], Lucero and Arrasvuori [92].

¹<https://eharpste.github.io/interactive-principles/>

Toolkits present knowledge in an actionable format, and can be designed to be generative or evaluative. Generative toolkits support ideation, divergent thinking and brainstorming during initial development. Cairns et al. [19], for example, compile many game accessibility guidelines into a “vocabulary for accessible design.” They argue that this vocabulary helps designers have conversations about accessibility during the early brainstorming phases of game design. They chose a vocabulary over accessibility guidelines, since, as they argue, guidelines are rigid, prescriptive, and are better used during the middle and later sections of the design process, such as to see if a certain prototype is accessible. On the other hand, evaluative toolkits support the synthesis of ideas, convergent thinking, and the analysis of an existing design. García [50] outlines a process of organizing design insights from an existing design, pruning irrelevant ideas, and interpreting these grouped insights into larger themes. (See also: Kolko [80]). Below, we describe our approach to the development of a framework and toolkit for reflective play. This toolkit is primarily designed for generative purposes — supporting the inclusion of reflective play in game designs — but can also be used to better understand existing games.

3 DEVELOPMENT OF THE FRAMEWORK AND TOOLKIT

Our team brought together a broad range of expertise in academic game research. Of the seven authors, five have had involvement in designing and developing games. Five authors are currently working in academia, researching games, player experience, the effects games can have on their players, and the creation of games for applied purposes (e.g. education, citizen science, reflection). The remaining two authors have recently completed their post-doctoral studies and are now working in the games industry where they are engaged in design and player experience work. Collectively, we reside in three countries within Europe and North America. We have cultural ties to many countries across the globe, though it should be noted that the majority of games referenced in this paper were designed in English by designers belonging to Western traditions.

We took a meta-narrative approach to synthesizing the literature, with a “critical realist” epistemology — we sought to “illuminate a heterogeneous topic area by highlighting the contrasting and complementary ways in which researchers have studied the same or a similar topic” [137] while acknowledging that our selection and knowledge of reality would be “mediated by our perceptions and beliefs [4].” We looked towards resources on reflective play that had helped us in our own reflective game designs and associated work. Beyond academic papers, we synthesized blog posts, videos, talks, individual games, and specific experiences within individual games to generate this framework. We highlighted resources, previous designs, and exemplar games that we have found particularly important in our own design work and research. The first three authors were involved in the primary development of the framework, while the remaining authors critiqued and discussed the developing framework, whilst also providing examples from their experience.

We began with high-level theoretical frameworks for conceptualizing reflection, including the works of Schön, Fleck and Fitzpatrick, and Baumer [7, 8, 43, 115]. Although our understanding of reflection

does not try to adhere strictly to any of these frameworks, we use them as lenses for positioning different aspects of our framework and provide details on each framework as needed. These theories are relevant because they categorize reflection chronologically (during or after the experience) [115], cognitively (questioning, experiencing dissonance, or transforming) [7], and by ‘levels’ (ranging from non-reflective behavior to critical, transformative reflection) [43]. Our synthesis of these and other works comes from a critical engagement with diverse literature on reflection, games, and adjacent fields such as game-based learning. This method was both inductive (given successful instances of reflective play, what theories explain them?) and deductive (given relevant theories of reflection, what specific game design patterns illustrate them?).

We used the theoretical frameworks and standalone empirical studies to arrive at our initial list of patterns. Similarly, we used our own experiences, forum discussions, articles, and previous work to create a list of game experiences that supported reflection. We then cross-analyzed both lists, iteratively tweaking, combining, and splitting as necessary to ensure that each game moment was represented by a pattern, and that each pattern was represented enough to be worth discussing. As a stable list of patterns emerged, we grouped our patterns into categories, using the process of arriving at transformational reflection as a narrative framing to aid in the understanding of the framework. Finally, we compared each pattern to each other in order to reduce redundant patterns and draw connections between patterns.

4 A FRAMEWORK FOR REFLECTIVE PLAY

We next outline an account of reflective play (see Figure 1 for a summary). Each pattern has a distinct role in reflection, but can be broadly grouped in terms of whether they primarily support reflection in-action, that is, during play (i.e., disruptions, slowdowns, questioning) versus reflection on-action, i.e., after play (i.e., revising, enhancers). In aggregate, we argue that the path to exo-transformative reflection typically involves all of the categories: a Disruption, a Slowdown for Questioning, Revisiting one’s experience, and the Enhancement of reflection (i.e., the realization that insights gained can apply beyond the game). Experiencing these categories does not require the patterns laid out in this framework, but these patterns provide support (e.g. a slowdown in play doesn’t require the usage of the pattern “The Infinite Moment”, described on page 10, but an infinite moment can support a slowdown).

In the following, we articulate each component in more detail and outline their corresponding design patterns. As noted, the components and patterns that constitute the toolkit were synthesized from existing literature on reflection in play and HCI. We further illustrate these components by means of several game examples, based on our personal experiences and those described in games scholarship. Generative questions and guiding strategies for each pattern are included in the supplementary material.

An applied version of the framework (which we refer to as “the toolkit”) can be found in a card-deck form in the supplementary materials (See figure 3, page 9 for an example card). It was designed to be an accessible resource that could be shared with game designers and the academic community to support further empirical and design research.



Figure 1: Summary of the Framework for Reflective Play. Disruptions during gameplay challenge the player’s assumptions or beliefs and create a cognitive conflict that warrants reflection. Slowdowns provide the cognitive space that players need for reflecting on that conflict. That reflection takes the form of Questioning, thinking critically about the disruptive experience, and can lead to endo-transformation. Afterward, the player can Revisit their experiences to more thoroughly process their thoughts and feelings. This has the potential to lead to reflection-on-action [115], and even to exo-transformation, especially when transfer is supported by Enhancers.

Icons from *The Noun Project* licensed under CC BY 3.0: questioning by Adrien Coquet; return by Andrejs Kirma; slow by Bonegolem; Cognitive Dissonance by Jae Aquino; reflection by Tom Ingebretsen; idea reuse by vigorn; growth by Gregor Cresnar; perspective by Massupa Kaewgahya.

4.1 Disruptions

Disruptions are instances during gameplay that create cognitive friction or conflict, which players can seek to understand and resolve. The notion of disruptions stems from Baumer’s concept of breakdowns [7] – violations of user expectations, but also recalls Khaled’s recommendation of breaking the player out of an immersive experience as an opportunity for reflection. Specifically, Disruptions can foster both reflection-*in*-action (during an experience) and reflection-*on*-action (after an experience) [115] as players attempt to reconcile the conflicting experience with their own beliefs or feelings. In this way, a Disruption is also a trigger for Questioning, because this moment of friction creates an opportunity for the player to question their own assumptions and re-evaluate their own systems of thought, much in the same way that they would re-evaluate a game dynamic (see Hypothesis Testing, Section 4.3.2).

Prior work on reflective play suggests that transformations resulting from Disruptions tend to be more often endo-transformative, but they do have the potential for exo-transformative reflection, and Disruption patterns are often given attribution as the triggering

factor when exo-transformations do occur [132, 133]. Specifically, we differentiate two categories of Disruptions: *Dissonance* – creating cognitive dissonance and paradigm shifts, and *Discomfort* – explicitly creating negative or otherwise difficult experiences.

These are: *Dissonance*: Narrative Twist, Genre Subversion, Intentional Ludonarrative Dissonance. *Discomfort*: Emotionally Challenging Mechanics, Confrontation, Loss of Agency, Brave Spaces.

4.1.1 Dissonance. Dissonance is about creating a divide between what the player knows or expects, and the actual game narrative / gameplay experience [76, 135]. We build on the notion of subverting expectations to create cognitive dissonance by highlighting three implementable patterns. The first pattern of Dissonance is the **narrative twist** – a revelation in the story, a “reversal by design” [70], which re-contextualizes past experiences [132, 133]. For example, in *Shadow of the Colossus* [G30] (*warning, spoilers:*), the player is tasked with killing a series of colossi to save a friend. Only near the end of the journey does it become clear that killing these guardians has released an evil entity from its prison. This shift encourages the player to reflect on their role and their complicity (*end spoilers*).



Figure 2: All 32 patterns in the framework, organized by (sub)category.

Icons from *The Noun Project* licensed under CC BY 3.0: questioning by Adrien Coquet; return by Andrejs Kirma; slow by Bonegolem; Cognitive Dissonance by Jae Aquino; perspective by Massupa Kaewgahya.

Surprises in narrative are arguably one of the oldest patterns of design in this paper, and as such there is a rich body of literature to explore for more information on implementing this pattern (e.g., [2, 121, 136]).

Genre subversion is when the player expects certain genre conventions but the game intentionally subverts those expectations via its mechanics or narrative [70]. This differs from the narrative twist, which is limited to the narrative alone, while *genre subversion* extends to genre conventions and ludic aspects, such as game mechanics. For instance, *Undertale* [G17] allows the player to kill monsters to grow in power (a typical activity in the RPG genre). At the same time, the player is narratively disincentivized from killing, with severe narrative repercussions if they act genocidal. In this way, players experience a dissonance between their engaging in genre tropes and the narrative of the game.

Finally, **intentional ludonarrative dissonance** can be created by disconnecting the game’s mechanics from its story and world. When game mechanics and narrative are in alignment this creates a sense of immersion [36]. Conversely, disrupting this connection breaks the immersion (cf. ‘outmersion’ [11]). As a result, players are distanced from the game and provided with an opportunity to step back and reflect. In *The Stanley Parable* [G20], for example, the player (as ‘Stanley’) wanders through empty office halls, while an unseen narrator comments throughout. At one point, the player approaches two doors and the narrator says that ‘Stanley’ goes through the door on the left. However, the player can choose to walk through either door. Through this dissonance between narration and player action, *The Stanley Parable* encourages players to reflect on their own agency and the non-linearity of narratives in games.

However, ludonarrative dissonance does not always invite reflection in a positive way. Despain and Ash [36] give an example from *Watch Dogs* [G56]: in one scene, the main character visits an emotionally meaningful grave, to which the player is then prompted through the UI to parkour over the grave like any other waist-high obstacle. This dissonance breaks immersion but does not contribute to reflecting on a larger theme as in *The Stanley Parable*. Instead, effective ludonarrative dissonance needs to have a clear, intentionally-designed meaning that the dissonance is trying to illustrate. In *Dujanah* [G28], the player is given mundane fetch-quests or mini-games, but the presentation of these mundane elements is within a painful and noisy aesthetic. In this case, the dissonance directly ties to one of the game’s themes: the absurdity and pain of doing normal actions when facing extreme grief.

4.1.2 Discomfort. Where Dissonance focused on subverting player expectations, Discomfort foregrounds the role of negative emotions in stimulating reflection. Crucially, “negative or ‘serious experiences’ [94] can potentially ‘linger’ or ‘resonate’ after the game [95], an experience that ‘bleed[s] out’ [99], or continues after the game has finished [117]” [93, p. 49] — thus supporting reflection-on-action. Similarly, Khaled argues for “disruption over comfort” as a core principle of reflective play [76]. Notably, where Dissonance often pertains to disrupting the player’s views on the game (i.e., endo-transformation), Discomfort can be a catalyst for reflecting on wider societal issues [i.e., exo-transformation, 13, 55, 63, 71].

The primary pattern of Discomfort is **emotionally challenging mechanics**. According to Cole et al. [21, p.3], emotional challenge is about “the resolution of tension within the narrative, exploration

of ambiguities within the diegesis, or identification with characters, that is not achieved through skill or dexterity, but with cognitive and affective effort.” Emotionally challenging mechanics are not as direct as “confrontation” (page 7), which means that the effort of interpreting meaning in an emotionally challenging mechanic is up to the player.

An example is *Nurse’s Dilemma* [G3], where players take on the role of a nurse having to make difficult decisions as part of their daily tasks. The game does not have any clear cut positive outcomes, leading to players experiencing emotions such as feeling sad or helpless [63], which in turn appeared to foster a sense of empathy and reflection on what it is like to be a nurse [63]. *Soma* [G18] prepares the player for strong emotions: One of Cole et al.’s participants [22, P3] mentions that *Soma* [G18] provides smaller, potentially easier or clearer moral choices to prepare the player for increasingly nuanced choices that eventually encourage the player to question the actions they took prior. An emotionally challenging experience can also result from a surprising narrative, for example in *Spec Ops: The Line* [G58], the combination of narrative revelations and emotionally challenging moral dilemmas lead to perspective challenges [133]. Whitby et al. note that perspective-challenging moments were most often present when (1) an implicit or explicit expectation was built up (e.g., from prior conventions, mechanics, plot, or world views) and then challenged, and (2) a cognitively or emotionally significant player decision or action invites extended reflection [133].

We note that an emotional experience, alone, is not enough to form a reflective experience. Developers ought to design mixed-emotion experiences rather than making the player strictly uncomfortable, which could potentially shy away players who are hesitant about reflective experiences.

Synthesizing across negative events is more effective than simply recalling specific events [7, 84, 102, 131]. To encourage reflective synthesis, we recommend implementing Enhancers (see Section 4.5) to encourage reflecting on all of the experiences as a whole. When designing an emotional experience, we encourage developers to think about how they will support the player after the experience in processing their feelings. Moreover, the emotional experience should be designed with the intention of challenging specific (kinds of) assumptions with specific emotions, thus narrowing the scope for a more targeted debriefing. For example, although *The Witness* [G53] has emotional moments that instill a sense of awe and beauty, the game is unclear in what it wants players to specifically reflect on. Contrast this with *Papo & Yo* [G34], a game about a father’s alcoholism. *Papo & Yo* is more direct, yet, it leaves the ending ambiguous which encourages reflection by creating a lingering effect [35, 95] (see Section 4.3.1).

Next, Discomfort can be created through a direct **confrontation** with the player in relation to their beliefs and actions. When the player’s actions lead to negative consequences, these consequences should be highlighted [70]. *Undertale* [G17] (*warning, spoilers:*) is an RPG with multiple endings depending on whether the player takes a pacifist or violent stance toward opponents. If the player kills a friendly NPC, Toriel, but then spares her in a subsequent playthrough, the game will taunt the player: “I know what you did. You murdered her. And then you went back, because you regretted it.” This confrontation encourages the player to reflect on

the permanence of their actions (*end spoilers*). However, players have reported that confrontation (or any overt messaging) creates a dislike of the game and a disinterest in engaging with a game’s content [48]. This *psychological reactance* can be seen as a player “putting their guard up” to protect them from an emotionally intense event (and occurs regardless of whether their beliefs align with the content of the message) [18, 74, 106, 138]. Kaufman et al. [74] suggest that this disengagement can be mitigated through three techniques of “embedded design:” intermixing (balancing “on-message” and “off-message” content), obfuscating (diverting expectations away from the persuasive intent), and distancing (increasing the psychological gap between the player and persuasive content).

Another way to create Discomfort is through creating a **loss of agency**, which is intended to snap the player into an outmersive [11] state and force them to pay more attention to the experience. Marsh describes the exemplar from *Limbo* [G42] where the “player’s rhythmic expectations are disrupted by a brain-slug that changes the direction and slows the pace of player movement” [93, p. 48]. This moment invites the player to think about what agency they have when it can be taken away from them so simply. In extreme cases, like a VR proto-holodeck, Murphy [101] argues games should support “patency” (the opposite of agency), and manufacture the player’s experience with little input from them. Murphy brings up the example of *Richie’s Plank Experience* [G54], which creates a “debilitating sense of vertigo” by forcing the player to experience being terrifyingly high up.

Lastly, Disruptions can be made effective by reframing the game as a **brave space** [1]. Counter to safe places, brave spaces are opportunities for players to experience fear, discomfort, and vulnerability in a way that promotes transformative learning and new perspectives while maintaining a respectful, voluntary atmosphere for engaging with difficulty. For example, *This War of Mine* [G1] is advertised as a game in which “you do not play as an elite soldier, rather a group of civilians trying to survive in a besieged city; struggling with [a] lack of food, medicine[,] and constant danger from snipers and hostile scavengers.” From the first impression of the game, it is clear that the experience will be an emotionally difficult one, and likely one which will make the player reflect on the atrocities in war and the romanticization of war in media [33, 40]. Framing a game as a brave space links to Khaled’s recommendation for reflective play of “clarity over stealth,” arguing in favor of visible reflective potential instead of embedding or obfuscating the designed intentions [74, 76]. Such framing may help mitigate psychological reactance as players may be more prepared for confrontation in a brave space.

Generally speaking, disruptive experiences are only the first step. Afterward, debriefing and transfer tools (see the Enhancers category) are useful when incorporating the experience into cognitive and behavioral change [32, 97, 109]. For designers looking to implement debriefing, inspiration can be taken from tabletop roleplaying and LARPing, which naturally facilitates social debriefing as a gameplay session ends [16, 60, 122] (cf. physical play [49]; see also analog games as educational or therapeutic interventions [17, 30, 54]).

In summary, disruptions are a powerful tool, though it must be noted that simply making the player uncomfortable for the sake of

breaking immersion does not itself induce reflection. Immersion-breaking needs to be paired with a reason for reflection, and although negative feelings can lead to this [55], eudaimonic and reflective experiences can also be achieved with a mixed-affect experience [22]. Additionally, not all discomfort leads to reflection. In particular, psychological need frustration [126] can have adverse effects, such as dissatisfaction with the game and quitting intentions, especially when unexpected or over a long duration of play [3, 81]. Furthermore, as stated earlier, overt expressions of an agenda can trigger psychological reactance [18, 48, 74, 106, 138].

4.2 Slowdowns

While the pace of gameplay often means that reflection-in-action may be happening quite quickly, the Slowdown approach asks the player to momentarily stop, slow, or take a break, providing a space for exo-transformative reflection and integration [43, 91].

Within the games industry, designers sometimes refer to Kahneman’s *Thinking, Fast and Slow* [72] (for example, [75, 134]). Wilson [134] describes that players will instinctively default to the fast “system 1” as opposed to the more exhausting “system 2,” which is required for critical thinking and reflection. Instead, Wilson and Keren recommend motivating the player to slow down. This is directly opposed to the “big yellow arrows” style of game design which encourages the player to follow instructions using a faster, less reflective thought process [127]. Keren also notes that an excess of cognitive load will push players toward faster, less reflective thought [75], so he recommends minimizing cognitive and perceptual load.

In serious games especially, scholars have proposed slowness as a mindfulness technique. Marsh [93] identified 11 design guidelines for slow serious games, including minimizing extra information, the removal of gamification elements, and the balance of slow- and fast-paced gameplay. As an example, Fullerton developed *Walden, a Game* [G57] as a reflective experience [46, 47]. *Walden* is an exploration-driven open-world narrative game that puts the player in the shoes of American philosopher Henry David Thoreau during his time living among nature at Walden Pond. The game is designed to be played slowly and deliberately as Thoreau and the player reflect on the natural beauty of the environment.

Slowdowns can help accommodate the time needed to reflect, and in doing so provide cognitive space for reflection despite not directly leading to it. (Contrast this with Revisiting and Enhancers, which will provide *systems* and *transformational* support, respectively.) In this way, the purpose of Slowdowns is to support reflection-in-action, which can contribute both to endo-transformative reflection and, eventually, even exo-transformative reflection as the player mentally digests a Disruption and processes their feelings. We divide Slowdowns into four patterns of gentle *Speed Bumps*, two patterns of forcible *Stasis*, and three patterns of voluntary *Stillness*.

These are: *Speed Bumps*: Lingered Defeat, Attention as a Mechanic, Weighting Mechanics, Aesthetics of Slowness, *Stasis*: True Stasis Mechanics, Cutscenes, *Stillness*: The Vista, The Infinite Moment, Safe Places.

4.2.1 Speed Bumps. Like their real-life counterparts, Speed Bumps exist to encourage slowing down and being mindful. Slow play is not strictly mandatory, but the game provides gentle encouragement to

take one’s time. Speed Bumps create slowness without leading to complete inaction (which Stasis and Stillness do, as discussed later on). Speed Bumps were inspired by the design patterns used in slow, serious games and reflective technologies [43, 46, 58, 59, 89, 93].

The first pattern of Speed Bumps is the **lingering defeat**. Johanson et al. [67] give the example of returning to a boss fight after losing in *Dark Souls* [G19]. The time spent returning — through an already beaten, and generally easier, section of play — gives the player space and cognitive capacity to reflect on their defeat and what they could do differently next time (see Hypothesis Testing, Section 4.3.2). From this model, we generalize the lingering defeat as: a section of trivial gameplay between a save point and a challenge that benefits from reflection.

Notably, the lingering defeat runs counter to “good” game design. Typically, especially for the introduction of new material, designers suggest that tests of new skills should be as close as possible to checkpoints in order to reduce perceived risk and frustration — so that players can feel comfortable experimenting and failing [75, 108, 134]. Although this seems like a contradiction, these conflicting heuristics are actually designing for two separate situations. For simple or dexterity-based skills, the “quick return” is ideal, since the design goal is to allow for muscle practice with spaced intervals. For reflection, however, the lingering defeat is meant to invoke “system 2” thinking [72]. In this way, the lingering defeat is the negative space, the liminal space between intense experiences: the analysis between experiments, the time for players to refuel, integrate, and refresh their attention before the next cycle.

The next type of Speed Bump is **attention as a mechanic**. We name this pattern for the style of play which treats attention as a resource the player has which can be spent on game activities and renewed over time through rest — as if the player’s attention is itself a mechanic to design for. Learning science has often discussed the spacing of practice between exercises [73], demonstrating that taking breaks between intervals of practice can improve retention [67]. Integrating reflective experiences requires these resting spaces; constant activity denies reflection and synthesis [45]. In medical practice, pausing has been shown to improve performance and patient safety through interrupting negative momentum and promoting self-monitoring [88].

Similarly, managing the player’s attentional resources is a balance of placing rests between intervals of intensity. In games that use attention in this way, such as *Walden, a Game* [G57] [45–47], players experience cycles of attending and rest. They wander, investigate, reflect, and repeat. Other games with similar cycles include *The Witness* [G53] and *The Talos Principle* [G10]. These games feature self-paced, explorable environments with scattered, bite-sized interactions, such as puzzles and texts. Thus, the gameplay that demands attention is interspersed with spaces of wandering and rest. Players have reported that games that encourage slower play through their world and mechanic design lead to thoughts on treating life with intentionality and care [48]. Similar cycles of play exist for multiplayer games like MMOs that require players to regroup or rest after engaging in a challenge. These moments of downtime between engagements can allow the players to collectively regain attentional resources and reflect on what they can improve on for their next engagement.

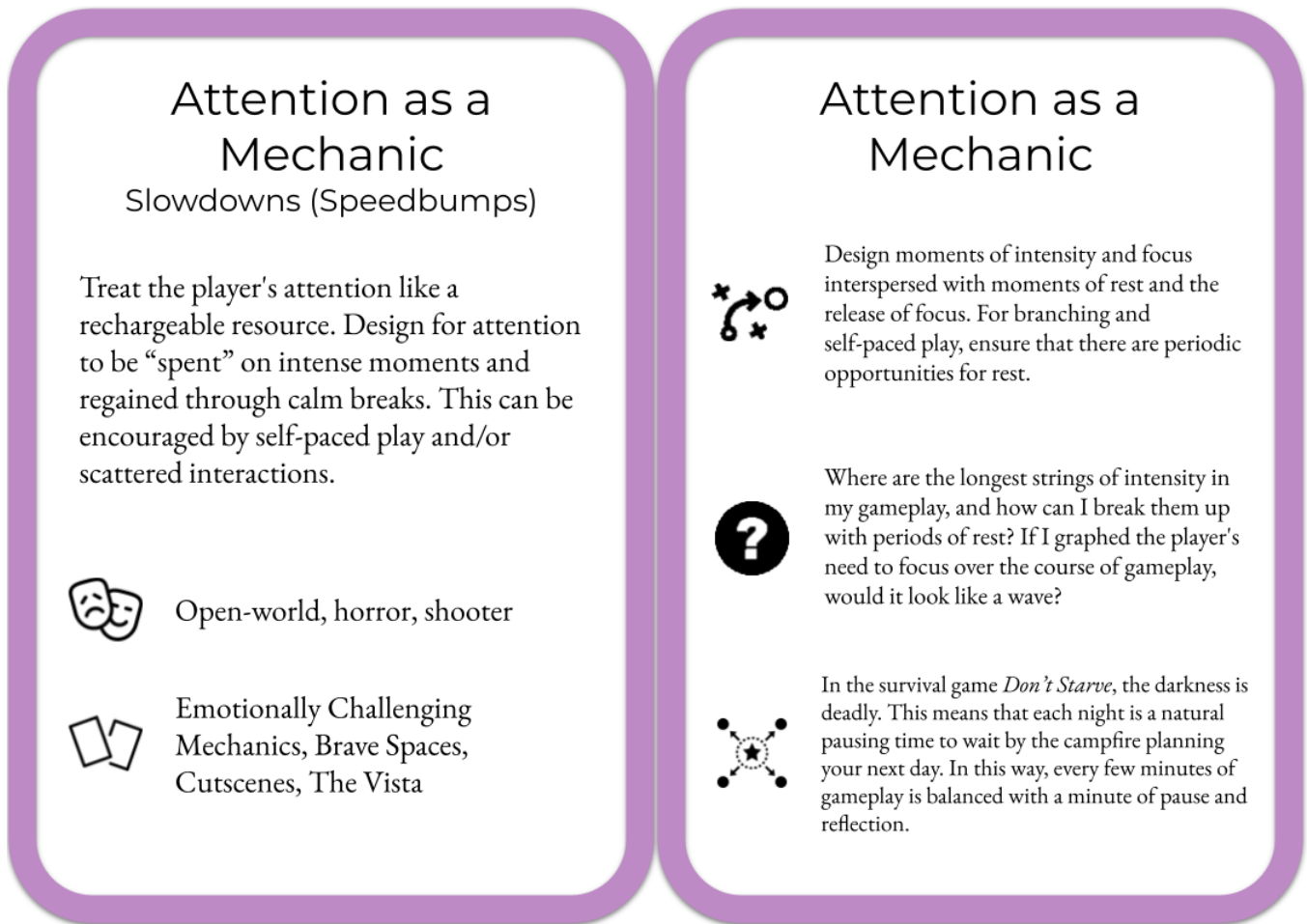


Figure 3: An example card from the card-deck. The card includes: common genres the pattern is associated with (🎭, for easier filtering and sorting of the cards), other patterns that pair well with this pattern (📖, for use in some of the generative exercises, and to make games with multiple, complementary patterns easier to produce), guiding strategies (🔗, to provide implementation advice), questions to consider (❓, for use as lenses to focus a designer’s thoughts), and example games (🎮, so designers have a reference that has implemented the pattern well)

Icons from The Noun Project licensed under CC BY 3.0: theater by Factoricons; pair by Ralf Schmitzer; strategy by Alzam; question by Gregor Cresnar; model by Nithinan Tatah

The most forceful Speed Bump (the kind most likely to pull a player out of the experience, or ‘outmerge’ them [11]) is what we will call **weighting mechanics**. We name this pattern after the sense of physical weight felt in the slowness of actions, such as walking through a sandstorm in *Gris* [G38] or opening a heavy vault door. By slowing the player’s actions, designers encourage players to reflect on the moment and their journey while they push the weight of the game toward their goal. Weighting mechanics use goals that require a certain amount of time to pass before completion, no matter the player’s skill or actions. An exemplar of this comes from *Metal Gear Solid 3* [G32], which has the player climb a ladder for two full minutes to progress. This moment gives the player nothing to do but climb and think. Notably, this scene comes immediately after an intense boss fight, and the climb starts in

silence but is gradually backed by powerful orchestral music. From this example, we believe that weighting mechanics (and, likely, all Speed Bumps), have the most impact when contrasted with intensity, i.e., by immediately following moments of action or stress. That way, when the player is given time to think, they are more likely to spend this time thinking about the intense experience they just had.

Finally, the **aesthetics of slowness** can themselves be Speed Bumps to encourage the player to reflect. We consider the aesthetics of slowness to be any visual or auditory cues that encourage the player to slow down. For example, most of the overworld in *Legend of Zelda: Breath of the Wild* [G37] has patches of calmness and beauty that invite the player to take their time exploring. This pattern is exemplified by calm, serene environments and peaceful

music which set the tone of gameplay for slower, more thoughtful experiences. Unlike Stasis and Stillness (described below) which are marked by complete inaction, the aesthetics of slowness invite slowing down rather than stopping completely. This pattern tends to incorporate elements of beauty and safety in subtle amounts — beauty, since players will be inclined to slow down and appreciate the beauty, and safety, to make players feel safe as they slow down. Extreme moments of beauty or safety become a *vista* or *safe places*, respectively (see Stillness, Section 4.2.3).

4.2.2 Stasis. The concepts of Stasis and Stillness were originally introduced by Scully-Blaker [118]. Briefly, Stasis is mechanical inaction and Stillness is aesthetic inaction. With respect to reflection, the purpose of Stasis patterns is to break the player out of their current attentional mindset and shift focus. Depending on how focus is shifted, this can lead to a moment of reflection or simply a moment of pause. Although Stasis and Stillness can be “injected” by players (i.e., players can cause their own inaction regardless of developers’ intentions), for the purpose of this article we focus only on designed inaction.

The first pattern for designed Stasis could be called **true stasis mechanics**, as originally described by Scully-Blaker [118]. These mechanics ask the player to intentionally idle as the goal itself, such as the non-reflective example of *Until Dawn*’s “Don’t Move!” prompt [G49]. A more reflective example comes from Lindsay Grace’s *Wait* [G33] [56]. *Wait* is an art game designed to explore slow play. The player finds themselves in a 3D grassland and the longer they do nothing, the more the environment fills with rich foliage and beautiful wildlife. Contrast true stasis with weighting mechanics described above. In true stasis, the goal is inaction, but with a weighting mechanic, the player has a goal, it just takes time to complete.

Another common pattern of Stasis is **cutscenes**. Cutscenes are a natural pause of gameplay, allowing the player time to recover their attentional resources and perhaps reflect on the story so far. This is especially true for slow cutscenes that have little action themselves or cutscenes which the player has already viewed. *The Last of Us II* [G46] is known for its narrative focus — between intense gameplay moments of survival, the game gives the player a break and builds up the relationships between characters by showing them talk with each other and live their lives in cut scenes (cf. *In Defense of Cutscenes* [79]).

4.2.3 Stillness. Like Stasis, the goal of Stillness is to create a moment of inaction. However, rather than being forceful and mechanical, Stillness patterns are encouragements for the player to voluntarily pause given the aesthetics of the game. Unlike the *aesthetics of slowness*, though, here we refer to aesthetic patterns which cause a complete pause of action. The core of Stillness patterns is offering the player a place to rest, integrate, and prepare. (For literature on the benefits of rest, see Section 4.2.1, specifically the discussion on *attention as a mechanic*.) Scully-Blaker gives an example of Stillness in *Animal Crossing: New Leaf* [G14] which has a bench overlooking an ocean. The only purpose to the bench is to pause and appreciate the beauty of the environment, encouraging players toward inaction.

The first pattern we call **the vista**: a beautiful scene that invites the player to voluntarily pause. The vista is an extreme moment of

the aesthetics of slowness focused on a single, beautiful view that invites complete pause. Adventure games like the *Dark Souls* [G19] series exemplify this pattern by contrasting dark dungeons with magnificent cliff-side sunsets. These peaceful scenes provide solace for the player to stop and mentally recharge.

The second pattern we call **the infinite moment**. These are experiential moments that only advance when the player chooses to move on, such as with a button press. By allowing the player to stay in the moment as long as they would like, games like *Walden* [G57] [46] and *Night in the Woods* [G45] create opportunities for players to process their thoughts and feelings on prior gameplay without a sense of time pressure from the game. Similarly, ‘moments of calm’ are used with the *Life is Strange* [G13] series of games to allow players to contemplate their journey so far, e.g., while sitting on a bench or listening to music.

The last pattern of Stillness is the **safe place**. In the *Resident Evil* [G8] series, levels are separated by safe rooms which serve as checkpoints and moments of respite. Here, the player can debrief themselves from the last mission, rest, and prepare for the next one. Safe places can also be player-made. In *Minecraft* [G35], a common play-style is to build a house then venture out into the wild and bring resources home. In this way, one’s home becomes a safe place and creates troughs of rest between waves of intensity.

As counter-examples, *Fortnite* [G15] and other match-based multiplayer games leave no room for idleness — the only time you are safe is between matches. Similarly, in *DOOM (2016)* [G24] and *DOOM Eternal* [G25], the player is encouraged to constantly move forward and aggressively attack enemies, especially when low on health, as doing so provides additional healing through the “glory kills” mechanic. These counter-examples put the player in a constant state of action.

4.3 Questioning

Questioning is a form of reflection-in-action that draws from previous literature on dialogical reflection [42, 43], interpretation [76], and active learning [52], and is especially connected to Baumer’s concept of inquiries [7] and Khaled’s suggestion of “questions over answers” [76]. The Questioning approach is a framing for the entire experience, designed to inspire a sense of curiosity and put the players in the mindset of questioning their experience. In this way, Questioning increases the effectiveness of Disruption techniques by priming the player to think critically about experiences which challenge their beliefs or assumptions. We divide Questioning into two types: Demanding Self-Explanation and Hypothesis Testing. We introduce three patterns of *Demanding Self-Explanation*, a gradual form of inquiry that can encourage exo-transformative reflection-on-action, and four patterns of *Hypothesis Testing*, the primary technique for supporting endo-transformative reflection through an inquisitive mindset.

These are: *Demanding Self-Explanation*: Absurdism, Ambiguous Instructions, Ambiguous Story, *Hypothesis Testing*: Varied Tools and Solutions, Explorable Space, System Dynamics & Emergent Behavior, Projective Stances.

4.3.1 Demanding Self-Explanation. Self-explanation is an instructional technique of generating interpretations for one’s own understanding [110]. Self-explanation has been studied as a reflection tool

to some success, especially when learners are assisted (e.g., with prompts) [12, 68]. In the context of games, this means evaluating a situation to infer explanations for observed behavior. The game can facilitate self-explanation, for example with an NPC who asks the player what they think happened using open-ended questions designed to lead the player to reflecting on the event at hand.

The reflective experience should be about meaningful questions rather than “correct” solutions [76]. Games that are open to interpretation (and demand interpretation) are more evocative of reflection [22]. Therefore, games with ambiguous, open-ended scenarios where there is no one answer or explanation – yet demand the player come up with an answer or opinion on the situation – invite the player to question what they know and the assumptions they’re making to fill in the ambiguous gaps. By demanding that players self-explain, the game avoids the “Butterfly Defect” of touching on a topic without meaningfully interacting with it [113, 125].

One notable genre that does this well is **absurdism**. In a 2018 talk, Mark Chen described absurdist games as having built-in moments of forced reflection [20]. For example, in *Sisyphus* by George Prosser [G21], players re-enact the tale of Sisyphus rolling a boulder up a mountain only for the boulder to roll back down (in this case, when the player fails to continue pressing buttons). When the player falls down the mountain, they must make a conscious choice to roll the boulder back up again (or choose to quit the game). Absurdist situations that have no explanation, Chen argues, demand reflection on the system. Khaled’s [76] example of *Art Game* by Pippin Barr [G40] also falls into this category: judgments are arbitrary, and thus absurd. Elements of absurdism, such as in these examples, demand self-explanation because the game does not provide justification for the observed behaviors.

Similar to absurdism, interpretation can be demanded when the game has **ambiguous instructions** in its goals, rules, or feedback. In *Art Game* [G40], for example, players must infer the goal in order to engage with the game at all. Cole and Gillies [22] describe ambiguous design not as a lack of information but as the possibility of multiple interpretations: giving the players little enough information that they can create their own understanding, but not so little that they have nothing to build on. *Art Game* presents the situation of being an artist but refuses to give meaningful direction for what one’s art should be, creating space for interpretation of what it means to be an artist in this game.

Likewise, a game can have an **ambiguous story**. *Dark Souls* [G19] and *Nier: Automata* [G41] demonstrate how this pattern can be effective, achieving an openness to their lore and its interpretation by providing only partial information. When information about the world, story, and events of the game are incomplete – or when the game’s ending is ambiguous or non-existent – this requires that the player fill in these gaps to understand the narrative. This pattern is occasionally irritating to players, some of whom express concern that others may not have had the same experience as them (or that they themselves may not have understood the story and message of a game), however the opposite pattern is, empirically, far more annoying to players – in a study by Gandhi et al. [48], when a player felt like the message of a game was too clear cut, they felt that they were being preached at rather than discovering things for themselves.

Games like *Gone Home* [G51], *Tacoma* [G52], and *Her Story* [G44] are based entirely around ambiguous story: the core gameplay loop is seeking information to piece together a story and reflect on the missing information. One common element is scattered, bite-sized clues, such as texts, audio logs, and environmental storytelling. The pattern is also present in “immersive sims” and adventures with rich world lore like *BioShock* [G2], *Prey* (2017) [G4], and *Horizon: Zero Dawn* [G22]. Scattered clues in the environment encourage curiosity and prompt the player to connect the dots between clues, reflecting on what information they have and suggesting that they try to fill in the gaps (i.e., self-explain) in the untold story.

4.3.2 Hypothesis Testing. Inquiry-based reflection resembles the hypothetico-deductive model of science: form a hypothesis, test it, and repeat the “cycle of probing” [52]. Similarly, work by Iacovides et al. [65] illustrates how players engage in strategies such as “experiment” and “trial and error” in order to overcome breakdowns they experience when playing games. These behaviours set a foundation for incremental (endo-) transformation and establishes a habit of questioning. The technique relies on the *Einstellung effect* – players who learn a solution (here, the solution of probing and questioning) will be primed to apply it to new problems (other moments in the game worth reflecting on) [85]. This pattern is most common in open-ended puzzle games like *SpaceChem* [G59] and *Kerbal Space Program* [G47], or open-world games like *Minecraft* [G35] and *Breath of the Wild* [G37].

Open-ended games often have **multiple, varied solutions** to every problem and **multiple, varied tools** to solve problems with. For example, a chasm in *Minecraft* can be crossed by going around, building a bridge over, or going through. In *Kerbal Space Program*, players have a variety of engines available to build with, each with its own properties that affect the overall rocket. This open-endedness allows players to engage in a cycle of hypothesis testing. Depending on the nature of the game, feedback about a player’s actions may not be immediately obvious, and developers should strive to make the ramifications of player actions clear. For example, players felt frustrated when the impact of the choice at the ending of *Mass Effect 2* [G6] wasn’t explored by the game [48]. On the other hand, players feel frustration if a game preaches at a player over a “choice” they felt they had no control over, such as in *Spec Ops: The Line* [G58] (*warning, spoilers:*) when the player is forced to bomb civilians in order to progress [48] (*end spoilers*).

Games with large **explorable spaces** also encourage inquiry. In *Breath of the Wild* [G37], there are secret areas, multiple paths for traversal, and multiple means of traversing each path. By allowing multiple options for basic gameplay, the game subtly encourages players to be constantly thinking about the various affordances of the environment in relation to the abilities at their disposal. Explorable spaces can be not only environmental spaces, but design spaces as well, such as the possibilities of rocket-building in *Kerbal Space Program* [G47]. Notably, designers can build hints and tips into explorable spaces so that players can employ the “take the hint” strategy during hypothesis testing [64].

Many puzzle games provide limited overt instruction beyond the goals and controls (cf. ambiguous instructions), requiring the player to explore the **system dynamics and emergent behaviors**. In *SpaceChem* [G59], for example, the required output is made

clear, but the game gives no specific guidance on how to achieve that output. This too promotes hypothesis testing and a “cycle of probing” to understand the game’s dynamics and emergent systems [52]. The lack of instruction invites curiosity to explore how the systems work. In *Breath of the Wild* [G37], there are emergent interactions between wind and fire which inquiring players can take advantage of. Similarly, the electrical engineering of redstone in *Minecraft* [G35] has many curious properties and non-intuitive behavior to play with. These systems — and, importantly, the immediate system-driven feedback they provide — encourage inquiry throughout the entire play experience.

Lastly, these games typically feature a *tabula rasa* avatar, what Gee refers to as a *projective identity* [51]. In combination with characters, events, or world elements that the player can relate to [48], the player takes on a **projective stance**, whereby they insert themselves into the game’s characters and situations to understand themselves from a different perspective or reflect on how they might respond to novel situations [52]. The player can then, for example, hypothesize and experiment on how the situation would play out if they were a different person with a different worldview. Iacovides et al. [66] add that having the right cognitive distance (“close but not too close”) between the player and player-character is critical for experimenting within the game without feeling personally vulnerable [66]. The concept of distance is also important when using disruptive patterns like confrontation as psychological reactance can be triggered if the player feels personally attacked by the game’s messaging.

There are three pitfalls to be cognizant of when designing for hypothesis testing. The first is allowing a breakthrough (overcoming a breakdown) in action without having a breakthrough in understanding [65]. When players are focused on their input actions (“I wonder what happens if...”), they rely on trial-and-error — this can lead to solving problems without understanding the solution. Experimentation on the other hand (“If... then...”) is more focused on the output behaviors and the causal link between actions and consequences (cf. [64]). One solution to this pitfall is to challenge mental models from every angle [75]. By creating problems which test common misunderstandings, you safeguard against the player never reaching critical understanding breakthroughs.

The second, related, pitfall is providing experiences without the theory or knowledge that supports reflection. William Edwards Deming claimed that experience by itself teaches nothing: “Without theory, experience has no meaning. Without theory, one has no questions to ask. Hence, without theory, there is no learning” [34, p. 103]. Experiential inquiry can be an excellent introduction to more formal learning or informed reflection. For example, in-game observations can lead to looking for more information online. Games with built-in wikis afford this kind of learning as a supporting mechanism for player inquiry.

The third pitfall is creating (accidentally) a dominant strategy with implications the designers may not have intended. For example, in *Minecraft*, players can trade with villagers for a variety of useful resources. However, if there are no villages near your base, “the best, most straightforward way to create a new village in *Minecraft* is to kidnap villagers from an existing village” [104]. Game critic Dan Olsen comments that the emergent dynamics encourage and mimic “the brutal relocation policies of colonialism” [104]. Therefore, it

is important for all game developers, but especially those working with emergent behaviors, to think about the metaphors used by the game and whether the practical gameplay strategies echo the intended behavior and thought processes.

4.4 Revisiting

The process of revisiting experiences (what Fleck and Fitzpatrick call the ‘R0’ level of reflection [43]) is, in our model, the first step for reflection-on-action (though we agree with Fleck and Fitzpatrick that revisiting is, in itself, not necessarily reflective). We further incorporate Lin et al.’s concepts of process displays, process prompts, and process models as Revisiting techniques [90]. Revisiting can make visible the thought processes of past experiences, documenting past goals and strategies, all of which help players access content on which to reflect [112], especially since players may choose not to reflect on disruptive elements when they first encounter them. As such, this category focuses on *system* support for reflection (as opposed to the cognitive support of Slowdowns and the transformational support of Enhancers). By enabling the player to access, sort, annotate, or otherwise engage with their experiences, systems can promote reflection-on-action. We list six patterns of Revisiting (with no sub-categories to divide them).

These are: Reflective Revisiting, Multiple Perspectives, Killcams, Process Displays, Process Prompts, Process Models.

First, the pattern of **reflective revisiting** refers to any tool which allows the player to review their past experiences in ways that support reflection. We identify six archetypes, though there may be others: (1) quest journals that keep records of completed quests with descriptions of the player’s activity, such as in *Underhero* [G39] and *Runescape* [G29], (2) cutscene theaters — modes where players can revisit any cutscene previously viewed, such as in *Xenoblade Chronicles* [G36] and *Skylanders* [G55], and (3) choice trackers, which remind the player of important decisions they have made, especially when the player revisits the game after some time. This mechanic is common in choice-based games like Telltale’s *The Wolf Among Us* [G50] — at the end of the story, players can see what percentage of all players picked each choice and compare their outcomes to that of other players. One notable game built around revisiting tools is *Her Story* [G44]. In *Her Story*, the player watches a series of videos and can tag them with free-written labels to organize the experiences for themselves. This feature allows the player to take notes on what they have seen and group videos together with a shared label.

Sometimes reflective revisiting tools document the player’s performance, such as (4) post-game visualizations [129]. External software is sometimes used for spatio-temporal data visualizations [78], but these have yet to be integrated into the games themselves. One common type of post-game visualization is (5) omniscient game replays: some 4X and grand strategy games like *Civilization V* [G16] provide an end-game replay that allows players to see the entire map (whereas during play, enemy territory is hidden). Lastly, some games provide revisiting opportunities through (6) event logging. For example, *Dwarf Fortress* [G5] provides space for generative player narratives by logging all emergent behaviors [83]. Using this reflective revisiting tool, players can revisit actions and consequences to understand (or imagine) chains of causality.

The reflective revisiting pattern exists in various genres and forms to enable the player to revisit experiences, sometimes annotating or inspecting them, and putting them in dialogue with each other. In this way, players can more closely examine their past experiences to reflect on larger themes and trends across them.

Next, games can provide mechanics for reviewing experiences from **multiple perspectives**, re-contextualizing the story with each new perspective. An excellent example of this comes from *Nier: Automata* [G41] — after your first playthrough of the game, you can replay the game as a different character — an act which recontextualizes one’s first playthrough in light of the new information provided by the new character. Games can also take advantage of the fact that a player’s perspective is likely to change naturally through the course of a playthrough. Early on in *Undertale* [G17], the game provides you a *safe place* in the form of your mentor character’s house. The house contains a mirror, which, when clicked on, pops up the text “it’s you.” At the end of the game, the player finds themselves in a house with the exact same layout. If the accompanying mirror is inspected, the text says: “despite everything, it’s still you.” Now having completed the game, the player is viewing the house through a different perspective, where the mirror asks them to revisit their gameplay experience and the naiveté they may have had at the beginning of the game.

The next Revisiting pattern, the **killcam**, is any feature that provides a form of playback after failure. This is similar to the Slowdowns pattern of cutscenes, but has a different intended outcome. This pattern is named after the classic example from the franchise which popularized the mechanic, *Call of Duty*. In *Call of Duty* games (e.g., [G26]), after each death, the player is shown the last moments of their life from their killer’s perspective. This supports meta-cognition on how the player might avoid that death in the future. Killcams are a way to support self-recording and self-assessment for encouraging meta-cognitive strategies, similar to process displays, described below. However, unlike process displays, killcams are characterized by (1) forced inaction and (2) presentation after failure.

Although they have yet to see much practical use, Lin et al.’s proposed features of process displays, process prompts, and process models are all examples of Revisiting techniques [90]. These techniques are similar to several of the reflective revisiting tools described earlier, but with an increased emphasis on *process*, therefore we separate these patterns for enhanced ideation in a largely unexplored design space.

Process displays visualize problem-solving processes; a hypothetical example would be if grand strategy endgame replays also provided annotated explanations for why each agent made the choices that they made. **Process prompts** are UI elements which guide users in understanding their own processes; as a hypothetical example, imagine a fighting game recap screen which prompted “You were defeated by a grab attack. Would you like to go to the training arena to practice defending against grab attacks?” Lastly, **process models** are displays that allow players to compare their processes to that of experts. Consider, as a hypothetical example, a recap screen on a MOBA like *League of Legends* [G43] which compares the trajectory of your character (and relevant statistics)

to that of professional players who played that character, highlighting differences in items purchased, abilities used, and movement patterns.

4.5 Enhancers

What makes a reflection ‘critical’ [43] or ‘transformative’ [7]? As Khaled writes, reflection benefits from clarity — an emphasis on how the game’s experiences connect to the real world, rather than obscuring the intended meaning [76].

Enhancers, the final three patterns for designing for reflective play, are about *transfer* support for reflection: patterns that call attention to reflection and connect it to the real world to support exo-transformative reflection. Whereas Revisiting provides *systems* support for reflection and Slowdowns provide *cognitive* support for reflection, Enhancers provide *transformational* support — adding visibility to how the player’s game experiences relate to their real life. These patterns are the “bowling bumpers”² of a reflective experience: they can be used to catch players who may have missed the opportunities to reflect and “bump” them back toward noticing the reflective potential of their experiences. This section draws from research that emphasizes how explicit and social reflective prompts can aid reflection [76, 90]. Enhancers fall under reflection-on-action since they prompt players to reflect on previous experiences.

These are: Explicit Encouragement of Reflection, Breaking the Fourth Wall, Social Discourse.

The first pattern, **explicit encouragement of reflection**, is simply a direct invitation for the player to reflect. This pattern is usually accomplished via audio memoirs, quotes, and flavor texts, and unlike confrontation it does not involve discomfort. In the puzzle game *Antichamber* [G11], the game world is filled with signs depicting cartoons relevant to a nearby puzzle. Once the puzzle is solved, the sign reveals a moral to take away from the puzzle, such as “What looks out of reach may only be a few steps away.” These signs offer moments to reflect on how the puzzle relates to life, encouraging exo-transformative transfer. In particular, the last sign “We can appreciate the entire journey by looking back at how far we have come,” asks the player to reflect on their experience as a whole.

The pattern can be seen as a gentler version of confrontation, which has the benefit of avoiding psychological reactance (refer to the discussion in Section 4.1.1 on the potential for confrontation to backfire as a pattern). Moreover, when explicit encouragement of reflection comes through snippets of philosophy (audio memoirs, etc.), these snippets are often scattered throughout the play experience and tangential to the main plot (cf. intermixing and obfuscating, two techniques of embedded design [74]). Previous empirical research has shown that players do not feel negatively confronted by these snippets, making them more likely to engage with the topic [48].

Another way to ‘outmerge’ the player and connect their experiences to the real world is by **breaking the fourth wall** — explicitly bringing the game’s messaging into the player’s real world [76]. Breaking the fourth wall encourages the player to compare and contrast their game experience with their real life. Often done sparingly, or with humor, there are various examples of this in *Pathologic*

²rails used in bowling to stop balls going into the gutters

[G23] and its sequel: the player-character speaks with characters such as the Deviser and the Tragedian, stand-ins for the developers themselves, engaging in a player-developer dialogue rather than as character-to-character. These dialogues discuss the philosophical themes of the games, such as the role that the player plays in acting out the story by controlling the protagonist. *The Stanley Parable* [G20] also exemplifies breaking the fourth wall with humor. For example when the player attempts to earn the achievement “Click On Door 430 Five Times,” the narrator responds “Oh, please. Are you really just doing this for the achievement? Click a door five times? Is that all that you think an achievement is worth?”. The narrator then talks the player through several additional steps because he “want[s] this achievement to have meant something.” Like the rest of *The Stanley Parable*, this moment is a commentary on the nature of experiencing games as content, made successful by explicitly referencing the socio-ludic systems that the game cannot escape.

Encouraging **social discourse** can lead to transformation (both endo- and potentially exo-). Previous literature emphasizes that learning — integrating the experience — happens after the experience during debriefing [29, 87]. Outside of some serious applications (e.g., military training simulations), games do not typically debrief themselves, but social discourse can provide support this process. In this way, designing for reflective play is not only crafting an experience worth reflecting on, but also providing dedicated forums and other designed social spaces for players to discuss, interpret, reflect, and share with each other (cf. peer discussion [86] and affinity groups [53]). This pattern echoes Lin et al.’s notion of a reflective social discourse — providing a digital space for community discussion, exploring multiple perspectives, and receiving feedback [90]. While we note that exo-transformative discussion is probably rare [96, 133], there is potential to further explore this pattern in relation to supporting such transformation.

Social discourse can be triggered by other patterns. For example, Questioning can turn into a social experience. Much of hypothesis testing, too, can happen through others (cf. cognitive apprenticeship [23]). Brave spaces and emotionally challenging mechanics are often naturally something that players will want to discuss with each other, given that emotional challenge is closely linked to the need for relatedness [22].

Designing for social reflection within the game experience itself, on the other hand, is largely unexplored. Yet, we can see the infancy of this idea in games that let you share your game experiences via social media. For example, you can tweet your progress in *Sword and Sorcery EP* [G9] and share your daily *Wordle* [G31] results through a set of emojis that can be pasted anywhere. More to the point, the choice-based narrative games by Telltale have a forum website³ where players can discuss their playthroughs at length using tags such as “Speculation,” “Share Your Choices”, and “Analysis/Deep Discussion.” Based on these existing ideas, we can conceive of how social reflection mechanics might be developed further: an in-game button to share your choices on social media, or in-game spaces (e.g., forums, guilds) dedicated to discussion.

5 APPLYING THE TOOLKIT

The reflective toolkit associated with this paper (see the supplementary material) contains generative exercises, an evaluative exercise, guiding questions, pairings, etc., that allow for the practical applications of the patterns discussed. In this section, we provide examples of the toolkit in use. The toolkit is primarily designed for the *generation* of reflective games, but can also be used to understand an existing game’s reflective dynamics. To illustrate how the toolkit can be applied, we first present an example where we apply the toolkit to highlight the reflective elements of Brenda Braithwaite’s *Train* [G7] and generate ideas for other reflective patterns *Train* could have used. The example will also illustrate how different reflective patterns interact with each other within a single game, as opposed to highlighting them as disconnected units. In our second example, we generate ideas for a hypothetical game prototype about managing a hospital, showing how the toolkit can be used in a bottom-up, generative approach.

5.1 Evaluation: A Case Study of Train

In Braithwaite’s *Train* [G7], players must take passenger meeples to their destination via a model train, despite the game’s ambiguity about who the passengers are and where they are going. During play, some players may attempt to maximize their train’s capacity, such as by stuffing meeples in sideways to fit as many as possible. Some time into playing, the passengers’ destinations become known as Nazi concentration camps, forcing the players to confront their complicity with Nazi instructions by the game rules.

The narrative twist (Disruption) in combination with the weighting mechanic (Slowdown) of slowly putting meeples in a train leads players to think about the ambiguous instructions (Questioning) and ambiguous story (Questioning) they were provided with. As a board game, players are co-located, affording social discourse (Enhancers).

By having a narrative twist, *Train* removes its ambiguous instructions and ambiguous story, meaning that the reflective power of speculation is lost after the true narrative is revealed. In this way, *Train*’s reflection relies heavily on how the players play the game before the twist and how they discuss it afterward. Since *Train* has no explicit debriefing or reflective goals, it is up to the players what message they take away, and may be somewhat dependent on whether they experienced discomfort or not after the passengers’ destinations were revealed.

Beyond playing the game, the presentation of the game was also framed as an “art piece for [an] adult audience” [37]. In some play sessions, the entire game board was placed on a literal broken window (to represent the Night of Broken Glass). It could be argued that a non-traditional board could be prompt a dissonance (Disruptions) between typical board game play and how *Train* is presented. The fact that the broken glass is visible from the beginning encourages players to reflect on the *potential* actions a player might engage in. Once the narrative twist is revealed, the game implies the question “why did you participate, even when there were signs that something sinister was happening”?

Shifting from analysis to ideation, *Train* does not use any Revisiting patterns. What would the game be like if played from multiple perspectives (Revisiting), perhaps where some players are Jews or

³<https://community.telltale.com/>

German civilians? In this approach, the game could also add an element of projective stances (Questioning) — have each player take on their chosen role as a soldier, civilian, or prisoner, giving them some cognitive distance to reflect on their involvement without experiencing psychological reactance due to the game’s overt messaging [74].

Alternatively, the game could subvert the messaging and lean more heavily into an ambiguous story without the narrative twist. Without an explicit message, the players are more encouraged to reflect on the many ways the ambiguous story could transfer. Is the game about the Holocaust, or more generally about how easy it is to follow orders at other people’s expense? Or is it about how quick we are to sort others into different boxes? Or perhaps about the tension between optimizing (fitting as many people in a train as possible) and having an enjoyable experience (not being crowded on a train). If, on the other hand, *Train* is dedicated to the theme of complicity in the Holocaust, this game could be paired with a debriefing exercise for explicit encouragement of reflection (Enhancers).

5.2 Generation: A Hypothetical Case Study of Hospitality

In this example, a hypothetical game developer Nala is designing a strategy/simulation game about managing a hospital called *Hospitality*. Nala wants the game to encourage her players to think about the ethics of patient care, so she uses the generative exercise from our provided supplement of picking one pattern from each of the five categories and thinking about how they could be implemented together. Nala picks patterns and comes up with these implementation ideas:

- **System Dynamics and Emergent Behavior (Questioning)** — *Hospitality* will simulate patients’ insurance and billing, as well as the hospital’s reputation and staff’s opinion of the player/manager. The player can then make decisions about how to charge patients, which may impact the opinion of patients and staff and interact with other aspects of the hospital’s management. Players will be able to experiment with the consequences of cut-throat capitalism or trying to be generous to patients without insurance, for example.
- **Genre Subversion (Disruptions)** — In most strategy/simulation games, resources are passively gained through autonomous systems that the player builds. However, in *Hospitality*, the player must interact with each patient and choose how to bill them. This takes the form of a haggling mini-game, except the patient cannot haggle prices down; instead, the player can charge ludicrous amounts if they choose while the patient expresses their opinion about the current price. This subverts the common mechanic of strategy-simulation games about managing limited resources: in *Hospitality*, if you need money, you can simply charge patients more. The game remains non-trivial though: price ballooning may harm your reputation and lead to other failure states. Nevertheless, players will be surprised that they do not have to fail for lack of money.
- **Weighting Mechanics (Slowdowns)** — At the end of each game week (about 60 minutes of play), the player must sign paperwork approving each patient’s bill (shown next to the

patient’s medical information), typing their chosen name into a text field to watch an animation of their character scrawling their signature on the form. In this way, the player is encouraged to revisit how they charged each patient, remember that patient’s story, and then slowly (through weighty input and sluggish animation) accept the consequences of their decisions.

- **Process Displays (Revisiting)** — After signing the paperwork of the week, the player will be shown a visualization of their performance review. This will show not only crucial statistics such as their finances, reputation, and task progress, but will also summarize their decision-making back to them: for example, how many patients did they overcharge? Which patients did they waive fees for? This display will be designed to help players reflect on their decision-making strategies and evaluate if they want to change their strategy for the next week.
- **Explicit Encouragement of Reflection (Enhancers)** — To make sure that players reflect on their actions in the way Nala wants them to, *Hospitality* has a scripted event in which a journalist asks the player through a series of multiple-choice dialogues. The journalist’s questions invite the player to reflect on the ethics of their decision-making without making judgments or accusations. The player’s answers are “published” a few game-weeks later, allowing the player to revisit their previous thoughts and compare their current opinions to their past answers.

After coming up with these patterns, Nala looks for other patterns that might work well with this set. She chooses to add a projective stance (Questioning) by letting the player assume the role of a blank slate administrator that they can project themselves into. The player can customize this avatar only slightly (choosing from a set of existing characters), and all feedback is directed at the avatar, not the player. In this way, the player can play at a safe cognitive distance from their actions, roleplaying that their avatar is making decisions, not them (cf. [66, 74]). Occasionally, the game will have roleplayed dialogue moments with staff and patients to further emphasize that the player is playing a character, not inserting themselves directly into the game. Nala also creates a forum for her game which can serve as a space for social discourse (Enhancers).

6 DISCUSSION

6.1 The patterns

In this article, we synthesized previous literature on reflection in games into a framework and created a practical toolkit for game design patterns that encourage endo- and exo-transformative reflection. These patterns can be used for evaluating an existing game or generating ideas during prototyping — elaborating on the reflective potential of a core game concept. The reflections elicited can range from shallow endo-transformations to deep exo-transformations; we focus on the *process* of reflection and as the exact *content* will be up to the designers.

We present five approaches to instigating reflection: Disruptions create the triggering experience that can lead to endo- or exo-transformative reflection; Slowdowns provide *cognitive* support for

the reflection process; Questioning interprets Disruptions for endo-transformative reflection; Revisiting provides *systems* support for the reflection process; and Enhancers provide *transfer* support for encouraging reflection and triggering exo-transformative reflection. Despite these categories, there may be overlap in the purpose of each category. For example, Enhancers target exo-transformative reflection but could theoretically also support endo-transformative reflection. Similarly, Hypothesis Testing is often focused on (endo-transformative) in-game issues whilst Disruptions are more focused on wider societal or philosophical issues, but there can be instances where these roles are reversed.

Just as these categories overlap in purpose, many of these patterns support various levels of reflection depending on their implementation. For example, a confrontation could be intense and evocative, leading to a highly reflective exo-transformation. On the other hand, a confrontation could be as simple as a note to the player that they got a minor fact incorrect, leading to an act of “remembering without further thought” (level 1 [43]). That said, there are some ways in which different patterns support different levels of reflection: the literature on emotional challenge suggests that patterns that provide information (e.g. Killcams, non-critical Cutscenes) lead to lower levels of reflection, while more emotionally charged patterns (e.g. The Infinite Moment after a tense game section, Breaking the Fourth Wall in an uncomfortable way) lead to higher levels.

6.2 Design decisions in building the toolkit

We see this framework (and associated toolkit) as providing value to both the games industry and academia. For professional developers, the toolkit supports the generation of reflective play mechanics and iterating on a game’s reflective potential. For games researchers, the framework provides a shared vocabulary for comparing games on matters of reflection. Furthermore, experimental game designers can use the toolkit to generate reflective serious games or explore the empty spaces around and between existing patterns.

The motivation of this work was to build on the insights of Khaled’s reflective play agenda [76] and Culyba’s transformational framework [28] (both of which are excellent supplements to this article) – drawing on other academic literature which has explored reflection in games (e.g., [66, 96, 133]). In doing so, we aimed to synthesize actionable insights for generating new reflective play experiences, rather than analyzing how games are already succeeding or failing to elicit reflection. Our framework highlights many prior suggestions, such as breaking immersion [11, 76], providing cognitive distance [66, 74], and slowing down [47, 93, 118]. We extend these principles into concrete patterns organized so as to be practically applicable.

We note, however, that our categorization is not meant to be comprehensive, nor an orthogonal taxonomy such that each pattern is mutually exclusive from others – many game design patterns simultaneously touch upon many of the patterns in this framework. Instead, these patterns are meant to be approachable and practical for game developers to implement and for games researchers to analyze and expand on. We hope that by laying out what patterns exist already, developers and researchers can explore the design spaces not yet described by these patterns.

Because of our focus on practicality, some of our patterns span multiple categories. Killcams, for example, are both a Slowdown and a Revisiting technique in that they put an intentional pause after failure (stasis) while showing the player the action process (process display). We argue this overlap is a potential strength, suggesting possibility spaces for creating other hybrid mechanics: what would it look like to create a brave space seen from multiple perspectives? Or what if a system of emotional challenge had a variety of tools and solutions, or emergent dynamic behavior?

6.3 Social reflection

Social reflection is a cross-cutting theme which is difficult to capture in our framework despite, anecdotally, its abundant presence. For example, we know players who enjoy single-player games as multiplayer experiences, taking turns, advising each other, or working together “couch co-op” style – even sharing one controller simultaneously in some cases. Our framework cannot capture the intangible benefits of sharing a reflective moment on a vista together or waiting (cf. “weighting”) for your friend to sort their inventory while you plan out your next boss run. What we can do, however, is point to specific patterns and open up discussion around how they can be socially influenced.

In multiplayer games, the lingering defeat (Disruptions) can be the waiting moments between being defeated and waiting for the rest of the match to end or for your character to respawn. In eSports and MMOs, players engage in meta-cognitive strategies such as self-recording, modeling, and thinking aloud between matches [77]. In this way, Speed Bump patterns can even exist as the negative spaces between gameplay sessions or rounds within a session. Weighting mechanics can also be socially invoked: journeying with others often introduces some amount of waiting for another player, which can have a similar effect to designed ‘weighting.’ Although games have yet to take advantage of this dynamic, the moments of social waiting are ripe with reflective potential. Additionally, confrontation can happen as a multiplayer pattern, such as in MMORPGs and social deception games (e.g., *Mafia/Werewolf* [G12], and *Among Us* [G27]). Social deception games, however, do not use confrontation reflectively, instead using it as a core gameplay mechanic. And there are no MMORPGs to our knowledge which – in their design – *facilitate* confrontation between players. This kind of social reflection remains largely unexplored, opening up a space for further research and design.

Lastly, reflective revisiting features can be made into social learning activities. Instead of reviewing your own processes and playbacks, reviewing your friends’ gameplay can provide opportunities for comparison, mentorship, and other forms of social learning. When one views a screenshot or video from someone else’s gameplay, they can remember what it was like to be in that part of the game. Or, if the posted experience differs from their own, the viewer can see the game through another perspective (that of a different playthrough). Much of this kind of social reflection currently happens through Twitch streams and YouTube Let’s Plays which allow streamers and content creators to be the driving force of social learning. The beginnings of intrinsic social learning are visible with endgame recap screens which show statistics for all players (such

as in Zachtronics games like *SpaceChem* [G59]), but there remains much to explore in directly encouraging social gameplay review.

6.4 Mixed-affect disruptions

Disruptions have historically been negatively charged (e.g., confrontations) or pervasive (e.g., brave spaces that last the duration of the game). Yet there is potential in brief forays into a mixed-affect space and back out to rest, reflect, and integrate [95]. One can imagine a potential game in which the player experiences cycles of comfort and discomfort. Similar to the cycles of attention and rest or the cycles of probing, this game dynamic would attempt to repeatedly push players outside of their comfort into the zone of proximal development [128] before returning to a safe space using Slowdowns and “cozy” patterns [62, 130]. We can also imagine more knowledgeable others [128] as helping the player process these discomforts. For example, NPCs can provide guidance for the player on their reflections, similar to how advisers in 4X games might suggest tactical strategies. There are several confrontational characters to look to as examples — Milton in *The Talos Principle* [G10], Flowey in *Undertale* [G17], and The Narrator in *The Stanley Parable* [G20] — yet fewer characters who serve to help the player reflect while being genuinely supportive of their transformation.

6.5 Limitations and Future Work

Our approach was not exhaustive, and we note that the framework is not meant to be prescriptive or comprehensive. Rather, it is a synthesis of existing concepts in both academic research and industry practice, drawn together and oriented toward practical implementation or evaluation. Our aim is to give academics and practitioners the start of a shared language for further exploration of designing for reflective play.

The work presented here is limited in being theoretical, though aspects of the framework are based on prior research, where this could be found. Future work will be required for empirically testing the framework, including an examination of the relationships between patterns and a consideration of the extent to which they induce reflection, or indeed the type or quality of the reflection they result in. Although we suggest several examples of games that we believe encourage reflection (usually in the discussion of a particular design pattern), there is a need for further evidence (beyond anecdotal) that these games actually increase the likelihood of reflection. There may also be room to refine and extend the framework through further research. Future work can also explore dynamic reflection mechanics: because games are adaptable, it is theoretically possible to identify players who are not engaging with the themes of the game (based on their actions) and provide additional reflection support. Or, in support of Questioning, the game could, for example, provide scaffolded support which encourages new modes of thinking, breaking the player out of their functional fixedness [39] if they are failing to iterate on their hypotheses. This paper serves as a conceptual piece, where the efficacy of this toolkit has yet to be measured, e.g., through a designer workshop to test how easily and effectively developers can apply these ideas.

Future work will involve shoring up these limitations along with publishing the industry game developer focused toolkit on accessible platforms, such as Game Developer⁴.

7 CONCLUSION

In this work, we described a framework of common game patterns that evoke reflective play. These patterns focused on:

- Disruption tactics including dissonance and discomfort
- Questioning tactics including hypothesis testing and demanding self-explanation
- Slowdown tactics including speed bumps and stasis
- Revisiting tactics including process displays and multiple perspectives
- Enhancer tactics including social discourse and breaking the fourth wall

We simplified our framework into an accessible toolkit (see the supplementary material) that presents the patterns alongside generative and evaluative exercises in the form of a card deck. Based on further experiences of using the toolkit in practice, we intend to promote it in additional venues to share with non-academic game developers.

We discuss how reflective mechanics can work in combination with each other to support endo- and exo-transformative reflection, both in-action and on-action. Yet, although specific game elements have been identified, eliciting reflection — or indeed eliciting any specific player experience — is almost entirely dependent on the execution. The game idea is only one aspect, and many other game development principles are involved in making it successful. This framework aims to open up future work by offering a starting point for exploring new reflective play design patterns around and between the ones we’ve proposed and continuing to build a vocabulary of reflective play design patterns that can be shared across industry and academia. We hope this article will help to move the conversation from whether games can facilitate reflection to how we can catalyze a generation of new reflective play experiences.

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REFERENCES

- [1] Brian Arao and Kristi Clemens. 2013. *From safe spaces to brave spaces*. Stylus Publishing, Sterling, VA, USA, 135–150.
- [2] Byung-Chull Bae and R. Michael Young. 2008. A Use of Flashback and Foreshadowing for Surprise Arousal in Narrative Using a Plan-Based Approach. In *Interactive Storytelling*, Ulrike Spierling and Nicolas Szilas (Eds.). Vol. 5334. Springer Berlin Heidelberg, Berlin, Heidelberg, 156–167. https://doi.org/10.1007/978-3-540-89454-4_22 Series Title: Lecture Notes in Computer Science.
- [3] Nick Ballou and Sebastian Deterding. 2022. ‘I Just Wanted to Get it Over and Done With’: A Grounded Theory of Psychological Need Frustration in Video Games. *PsyArXiv. August 10 (2022)*, 1–19.
- [4] Elaine Barnett-Page and James Thomas. 2009. Methods for the synthesis of qualitative research: a critical review. *BMC medical research methodology* 9, 1 (2009), 1–11.
- [5] Christopher Barney. 2020. *Pattern language for game design*. CRC Press, Boca Raton, Florida, USA.
- [6] Anne Bartsch and Tilo Hartmann. 2017. The role of cognitive and affective challenge in entertainment experience. *Communication Research* 44, 1 (2017), 29–53.

⁴<https://www.gamedeveloper.com/>

- [7] Eric PS Baumer. 2015. Reflective informatics: conceptual dimensions for designing technologies of reflection. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 585–594.
- [8] Eric PS Baumer, Vera Khovanskaya, Mark Matthews, Lindsay Reynolds, Victoria Schwanda Sosik, and Geri Gay. 2014. Reviewing reflection: on the use of reflection in interactive system design. In *Proceedings of the 2014 conference on Designing interactive systems*. Association for Computing Machinery, New York, NY, USA, 93–102.
- [9] Pedro Beça, Mónica Aresta, Ana Isabel Veloso, Rita Santos, Eduardo Ferreira, Sofia Jervis, Gonçalo Gomes, Cláudia Ortet, Mariana Pereira, and Sofia Ribeiro. 2020. Developing a toolkit to game design: the Gamers4Nature project: from concept to artefact. In *International Conference on the Foundations of Digital Games*. Association for Computing Machinery, New York, NY, USA, 1–8.
- [10] Sabine Benoit, Sonja Klose, Jochen Wirtz, Tor Wallin Andreassen, and Timothy L Keiningham. 2019. Bridging the data divide between practitioners and academics: Approaches to collaborating better to leverage each other's resources. *Journal of Service Management* 30, 5 (2019), 524–548.
- [11] Ps Berge. 2021. Rotten and Possessed: Control and Hellblade: Senua's Sacrifice as Models of Outmersive Game Design. In *Proceedings of the 32st ACM Conference on Hypertext and Social Media*. ACM, Virtual Event USA, 35–44. <https://doi.org/10.1145/3465336.3475094>
- [12] Kirsten Berthold, Tessa HS Eysink, and Alexander Renkl. 2009. Assisting self-explanation prompts are more effective than open prompts when learning with multiple representations. *Instructional Science* 37, 4 (2009), 345–363.
- [13] Julia Ayumi Bopp, Elisa D Mekler, and Klaus Opwis. 2016. Negative emotion, positive experience? Emotionally moving moments in digital games. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 2996–3006.
- [14] David Boud, Rosemary Keogh, and David Walker. 2013. *Reflection: Turning experience into learning*. Routledge, England, UK.
- [15] Erica Bowen, Kate Walker, Matthew Mawer, Emma Holdsworth, Emma Sorbring, Bo Helsing, Annette Bolin, Eline Leen, Paul Held, Valère Awouters, et al. 2014. "It's like you're actually playing as yourself": Development and preliminary evaluation of 'Green Acres High', a serious game-based primary intervention to combat adolescent dating violence. *Psychosocial Intervention* 23, 1 (2014), 43–55.
- [16] Sarah Lynne Bowman. 2010. *The functions of role-playing games: How participants create community, solve problems and explore identity*. McFarland, Jefferson, NC, USA.
- [17] Sarah Lynne Bowman. 2014. Educational live action role-playing games: A secondary literature review. *The Wyrd Con Companion Book* 3 (2014), 112–131.
- [18] Jack W. Brehm. 1966. *A theory of psychological reactance*. Academic Press, Oxford, England. Pages: x, 135.
- [19] Paul Cairns, Christopher Power, Mark Barlet, and Greg Haynes. 2019. Future Design of Accessibility in Games: A Design Vocabulary. *International Journal of Human-Computer Studies* 131 (2019), 64–71.
- [20] Mark Chen. 2018. Absurdist Games. (2018). Meaningful Play.
- [21] Tom Cole, Paul Cairns, and Marco Gillies. 2015. Emotional and Functional Challenge in Core and Avant-garde Games. In *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play*. ACM, London United Kingdom, 121–126. <https://doi.org/10.1145/2793107.2793147>
- [22] Tom Cole and Marco Gillies. 2022. Emotional Exploration and the Eudaimonic Gameplay Experience: A Grounded Theory. In *CHI Conference on Human Factors in Computing Systems*. ACM, New Orleans LA USA, 1–16. <https://doi.org/10.1145/3491102.3502002>
- [23] Allan Collins. 1991. Cognitive apprenticeship and instructional technology. *Educational values and cognitive instruction: Implications for reform* 1991 (1991), 121–138.
- [24] Lucas Colusso, Cynthia L Bennett, Gary Hsieh, and Sean A Munson. 2017. Translational resources: Reducing the gap between academic research and HCI practice. In *Proceedings of the 2017 Conference on Designing Interactive Systems*. Association for Computing Machinery, New York, NY, USA, 957–968.
- [25] Lucas Colusso, Ridley Jones, Sean A. Munson, and Gary Hsieh. 2019. A Translational Science Model for HCI. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. ACM, Glasgow Scotland Uk, 1–13. <https://doi.org/10.1145/3290605.3300231>
- [26] Kate Compton, Edward Melcer, and Michael Mateas. 2017. Generominos: Ideation cards for interactive generativity. In *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*. Association for Computing Machinery, New York, NY, USA, 49–53.
- [27] David Crookall. 2010. Serious Games, Debriefing, and Simulation/Gaming as a Discipline. *Simulation & Gaming* 41, 6 (Dec. 2010), 898–920. <https://doi.org/10.1177/1046878110390784>
- [28] Sabrina Culyba. 2018. *The Transformational Framework: A process tool for the development of Transformational games*. Carnegie Mellon University, Pittsburg, PA, USA.
- [29] Joe Cutting and Sebastian Deterding. 2022. The task-attention theory of game learning: a theory and research agenda. *Human-Computer Interaction* 0, 0 (April 2022), 1–31. <https://www.tandfonline.com/doi/full/10.1080/07370024.2022.2047971>
- [30] Stéphane Daniau. 2016. The transformative potential of role-playing games—: From play skills to human skills. *Simulation & Gaming* 47, 4 (2016), 423–444.
- [31] Joshua A Danish, Noel Enyedy, Asmalina Saleh, Christine Lee, and Alejandro Andrade. 2015. Science through technology enhanced play: Designing to support reflection through play and embodiment. In *Exploring the Material Conditions of Learning: The Computer Supported Collaborative Learning (CSCL) Conference*. International Society of the Learning Sciences, Inc.[ISLS], Gothenburg, Sweden, 332–339.
- [32] Samantha Davies. 2012. Embracing reflective practice. *Education for Primary Care* 23, 1 (March 2012), 9–12. <https://doi.org/10.1080/14739879.2012.11494064>
- [33] Stephanie De Smale, Martijn JL Kors, and Aleya M Sandovar. 2019. The case of This War of Mine: A production studies perspective on moral game design. *Games and Culture* 14, 4 (2019), 387–409.
- [34] W.E. Deming. 2000. *The New Economics: For Industry, Government, Education*. MIT Press, Cambridge, MA, USA. <https://books.google.com/books?id=RnsCXfhehEC>
- [35] Alena Denisova, Julia Ayumi Bopp, Thuy Duong Nguyen, and Elisa D Mekler. 2021. "Whatever the Emotional Experience, It's Up to Them": Insights from Designers of Emotionally Impactful Games. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. ACM, Yokohama Japan, 1–9. <https://doi.org/10.1145/3411764.3445286>
- [36] Wendy Despain and Lauryn Ash. 2016. *Designing for Ludonarrative Harmony*. Ph. D. Dissertation. Southern Methodist University, Plano, Texas, USA.
- [37] Sebastian Deterding. 2016. The mechanic is not the (whole) message: Procedural rhetoric meets framing in Train & Playing History 2. In *Proceedings of 1st International Joint Conference of DiGRA and FDG*. Association of Computing Machinery, New York, NY, USA, 2.
- [38] John Dewey. 1933. *How we think: a restatement of the relation of reflective thinking to the educative process*. D.C. Heath, Lexington, MA. OCLC: 813577978.
- [39] Karl Duncker and Lynne S Lees. 1945. On problem-solving. *Psychological monographs* 58, 5 (1945), i.
- [40] Charles Ecenbarger. 2016. "In war, not everyone's a soldier." A Review of This War of Mine. *Press Start* 3, 2 (2016), 70–73.
- [41] Magy Seif El-Nasr, Bardia Aghabeigi, David Milam, Mona Erfani, Beth Lameman, and Sang Mah. 2010. Cooperative Game Design Patterns and their Effect on Players' Behaviours. In *Proceedings of the 2010 CHI conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 10.
- [42] Rowanne Fleck. 2012. Rating reflection on experience: A case study of teachers' and tutors' reflection around images. *Interacting with computers* 24, 6 (2012), 439–449.
- [43] Rowanne Fleck and Geraldine Fitzpatrick. 2010. Reflecting on reflection: framing a design landscape. In *Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction*. Association for Computing Machinery, New York, NY, USA, 216–223.
- [44] Gonzalo Frasca. 2006. Immersion, outmersion & critical thinking.
- [45] Tracy Fullerton. 2018. Three Miles An Hour: Designing Games for the Speed of Thought. (2018). Meaningful Play.
- [46] Tracy Fullerton. 2019. walden, a game. *How to Play Video Games* 1 (2019), 333.
- [47] Tracy Fullerton. 2020. A Year at Play in the Woods of Walden Pond. *Art Journal* 79, 2 (2020), 95–104.
- [48] Kutub Gandhi, Josh Aaron Miller, and Seth Cooper. 2022. "Philosophy is Seeped into Every Brick" - Weaving Reflective Elements into Mass-Market Games. In *Proceedings of the 17th International Conference on the Foundations of Digital Games*. ACM, New York, NY, USA, 10.
- [49] Kutub Gandhi, Josh Aaron Miller, Sofia Eleni Spatharioti, Archana Apte, Borna Fatehi, Sara Wylie, and Seth Cooper. 2021. A Comparison of Augmented Reality and Browser Versions of a Citizen Science Game. In *The 16th International Conference on the Foundations of Digital Games (FDG) 2021*. Association for Computing Machinery, New York, NY, USA, 1–8.
- [50] Belén Garcia. 2020. Design Synthesis. <https://medium.com/design-thoughts-case-studies/design-synthesis-step-by-step-guide-1a46c73c503e>
- [51] James Paul Gee. 2005. Pleasure, Learning, Video Games, and Life: The Projective Stance. *E-Learning and Digital Media* 2, 3 (Sept. 2005), 211–223. <https://doi.org/10.2304/elea.2005.2.3.2>
- [52] James Paul Gee. 2007. *What video games have to teach us about learning and literacy* (rev. and updated ed.). Palgrave Macmillan, New York. OCLC: ocn172569526.
- [53] James Paul Gee. 2018. Affinity spaces: How young people live and learn on line and out of school. *Phi Delta Kappan* 99, 6 (2018), 8–13.
- [54] Anne M Goodall and Alexis H Truong. 2021. Pop culture and social insertion: How can play in adolescence and adulthood be "therapeutic"? *Journal of Community Safety and Well-Being* 6, 1 (2021), 17–21.
- [55] Chad Phoenix Rose Gowler and Ioanna Iacovides. 2019. "Horror, guilt and shame"—Uncomfortable Experiences in Digital Games. In *Proceedings of the Annual Symposium on Computer-Human Interaction in Play*. Association for Computing Machinery, New York, NY, USA, 325–337.

- [56] Lindsay D. Grace. 2012. Critical Gameplay: Designing Games to Critique Convention. In *Proceedings of the 20th ACM International Conference on Multimedia (Nara, Japan) (MM '12)*. Association for Computing Machinery, New York, NY, USA, 1185–1188. <https://doi.org/10.1145/2393347.2396414>
- [57] Jordan Greenwood, Leigh Achterbosch, Andrew Stranieri, and Grant Meredith. 2021. Understanding the gap between academics and game developers: An analysis of Gamasutra blogs. In *International Conferences Interfaces and Human Computer Interaction, online*. Interscience Publishers, Kent, Ohio, USA, 141–148.
- [58] Barbara Grosse-Hering, Jon Mason, Dzmitry Aliakseyeu, Conny Bakker, and Pieter Desmet. 2013. Slow design for meaningful interactions. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, Paris France, 3431–3440. <https://doi.org/10.1145/2470654.2466472>
- [59] Lars Hallnäs and Johan Redström. 2001. Slow Technology – Designing for Reflection. *Personal and Ubiquitous Computing* 5, 3 (Aug. 2001), 201–212. <https://doi.org/10.1007/PL00000019>
- [60] J Tuomas Harviainen. 2012. Ritualistic games, boundary control, and information uncertainty. *Simulation & Gaming* 43, 4 (2012), 506–527.
- [61] Lacey J Hilliard, Mary H Buckingham, G John Geldhof, Patricia Gansert, Caroline Stack, Erin S Geligoot, Marina U Bers, and Richard M Lerner. 2018. Perspective taking and decision-making in educational game play: A mixed-methods study. *Applied Developmental Science* 22, 1 (2018), 1–13.
- [62] Chelsea Howe, Daniel Cook, Jake Forbes, Dan Hurd, Tanya X Short, Squirrel Eislerloh, and Anthony Ordon. 2018. Cozy Games. *LOSTGARDEN*. <https://lostgarden.home.blog/2018/01/24/cozy-games/>.
- [63] Ioanna Iacovides and Anna L Cox. 2015. Moving beyond fun: Evaluating serious experience in digital games. In *Proceedings of the 33rd annual acm conference on human factors in computing systems*. Association for Computing Machinery, New York, NY, USA, 2245–2254.
- [64] Ioanna Iacovides, Anna L Cox, Ara Avakian, and Thomas Knoll. 2014. Player strategies: Achieving breakthroughs and progressing in single-player and cooperative games. In *Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play*. Association for Computing Machinery, New York, NY, USA, 131–140.
- [65] Ioanna Iacovides, Anna L Cox, Patrick McAndrew, James Aczel, and Eileen Scanlon. 2015. Game-play breakdowns and breakthroughs: exploring the relationship between action, understanding, and involvement. *Human-computer interaction* 30, 3-4 (2015), 202–231.
- [66] Ioanna Iacovides, Joe Cutting, Jen Beeston, Marta E. Cecchinato, Elisa D. Mekler, and Paul Cairns. 2022. Close but Not Too Close: Distance and Relevance in Designing Games for Reflection. *Proceedings of the ACM on Human-Computer Interaction* 6, CHI PLAY (Oct. 2022), 1–24. <https://doi.org/10.1145/3549487>
- [67] Colby Johanson, Carl Gutwin, Jason T Bowey, and Regan L Mandryk. 2019. Press pause when you play: comparing spaced practice intervals for skill development in games. In *Proceedings of the Annual Symposium on Computer-Human Interaction in Play*. Association for Computing Machinery, New York, NY, USA, 169–184.
- [68] Cheryl I Johnson and Richard E Mayer. 2010. Applying the self-explanation principle to multimedia learning in a computer-based game-like environment. *Computers in Human Behavior* 26, 6 (2010), 1246–1252.
- [69] Mina C Johnson-Glenberg, Caroline Savio-Ramos, Katherine K Perkins, Emily B Moore, Robb Lindgren, Douglas B Clark, Corey Brady, Pratim Sengupta, Mario M Martinez-Garza, Deanne Adams, et al. 2014. Science sims and games: Best design practices and fave flops. In *Proceedings of the 11th International Conference of the Learning Sciences*. Boulder, CO: International Society of the Learning Sciences, Boulder, CO, USA.
- [70] Kristine Jørgensen. 2016. The positive discomfort of spec ops: The line. *Game studies* 16, 2 (2016), unpaginated.
- [71] Kristine Jørgensen. 2019. *When Is It Enough? Uncomfortable Game Content and the Transgression of Player Taste*. MIT Press, Cambridge, MA, USA, 153.
- [72] Daniel Kahneman. 2011. *Thinking, fast and slow*. Macmillan, New York.
- [73] Sean HK Kang. 2016. Spaced repetition promotes efficient and effective learning: Policy implications for instruction. *Policy Insights from the Behavioral and Brain Sciences* 3, 1 (2016), 12–19.
- [74] Geoff Kaufman, Mary Flanagan, and Max Seidman. 2016. Creating Stealth Game Interventions for Attitude and Behavior Change: An "Embedded Design" Model. In *Transactions of the Digital Games Research Association*. ETCS Press, Pittsburgh, PA, USA, 173–193. <https://doi.org/10.26503/todigra.v2i3.57>
- [75] Itay Keren. 2017. Teaching by Design: Tips for Effective Tutorials from "Mushroom 11." <http://www.gdcvault.com/play/1024187/Teaching-by-Design-Tips-for>
- [76] Rilla Khaled. 2018. Questions over answers: Reflective game design. In *Playful disruption of digital media*. Springer, New York, NY, USA, 3–27.
- [77] Bokyeong Kim, Hyungsung Park, and Youngkyun Baek. 2009. Not just fun, but serious strategies: Using meta-cognitive strategies in game-based learning. *Computers & Education* 52, 4 (2009), 800–810.
- [78] Erica Kleinman, Nikitha Preetham, Zhaoqing Teng, Andy Bryant, and Magy Seif El-Nasr. 2021. "What Happened Here?": A Taxonomy for User Interaction with Spatio-Temporal Game Data Visualization. *Proc. ACM Hum.-Comput. Interact.* 5, CHI PLAY, Article 260 (oct 2021), 27 pages. <https://doi.org/10.1145/3474687>
- [79] Rune Klevjer. 2002. In Defense of Cutscenes.. In *Proceedings of Computer Games and Digital Cultures Conference*. Citeseer, Tampere University Press, Tampere University Foundation FI-33014 Tampere University, 12.
- [80] Jon Kolko. 2010. *Exposing the magic of design: a practitioner's guide to the methods and theory of synthesis* (first issued as an oxford university press paperback ed.). Oxford University Press, Oxford New York Auckland [und 13 andere].
- [81] Mehmet Kosa and Ahmet Uysal. 2022. Need frustration in online video games. *Behaviour & Information Technology* 41, 11 (2022), 2415–2426.
- [82] Rachel Kowert and Matthew Whitby. 2022. *Designing Games to Challenge the Stigma Around Mental Health*. White paper. Take This. 45 pages. <https://www.takethis.org/2022/02/designing-games-to-challenge-the-stigma-around-mental-health-white-paper/>
- [83] Max Kreminski and Noah Wardrip-Fruin. 2019. Generative games as storytelling partners. In *Proceedings of the 14th International Conference on the Foundations of Digital Games*. Association for Computing Machinery, New York, NY, USA, 1–8.
- [84] Ethan Kross. 2009. When the Self Becomes Other: Toward an Integrative Understanding of the Processes Distinguishing Adaptive Self-reflection from Rumination. *Annals of the New York Academy of Sciences* 1167, 1 (June 2009), 35–40. <https://doi.org/10.1111/j.1749-6632.2009.04545.x>
- [85] Shringi Kumari, Sebastian Deterding, and Gustav Kuhn. 2018. Why game designers should study magic. In *Proceedings of the 13th International Conference on the Foundations of Digital Games*. ACM, Malmö Sweden, 1–8. <https://doi.org/10.1145/3235765.3235788>
- [86] Diana Laurillard. 2013. *Teaching as a design science: Building pedagogical patterns for learning and technology*. Routledge, England, UK.
- [87] Linda Costigan Lederman. 1992. Debriefing: Toward a Systematic Assessment of Theory and Practice. *Simulation & Gaming* 23, 2 (June 1992), 145–160. <https://doi.org/10.1177/1046878192232003>
- [88] Joy Yeonjoo Lee, Adam Szulewski, John Q. Young, Jeroen Donkers, Halszka Jarodzka, and Jeroen J. G. Merriënboer. 2021. The medical pause: Importance, processes and training. *Medical Education* 55, 10 (Oct. 2021), 1152–1160. <https://doi.org/10.1111/medu.14529>
- [89] Ian Li, Anind Dey, and Jodi Forlizzi. 2010. A stage-based model of personal informatics systems. In *Proceedings of the SIGCHI conference on human factors in computing systems*. Association for Computing Machinery, New York, NY, USA, 557–566.
- [90] Xiaodong Lin, Cindy Hmelo, Charles K Kinzer, and Teresa J Secules. 1999. Designing technology to support reflection. *Educational Technology Research and Development* 47, 3 (1999), 43–62.
- [91] Siân E Lindley, Richard Harper, and Abigail Sellen. 2009. Desiring to be in touch in a changing communications landscape: attitudes of older adults. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1693–1702.
- [92] Andrés Lucero and Juha Arrasvuori. 2010. PLEX Cards: a source of inspiration when designing for playfulness. In *Proceedings of the 3rd International Conference on Fun and Games*. Association for Computing Machinery, New York, NY, USA, 28–37.
- [93] Tim Marsh. 2016. Slow serious games, interactions and play: Designing for positive and serious experience and reflection. *Entertainment computing* 14 (2016), 45–53.
- [94] Tim Marsh and Brigid Costello. 2012. Experience in Serious Games: Between Positive and Serious Experience. In *Serious Games Development and Applications*, Minhua Ma, Manuel Fradinho Oliveira, Jannicke Baalsrud Hauge, Heiko Duin, and Klaus-Dieter Thoben (Eds.). Springer Berlin Heidelberg, Berlin, Heidelberg, 255–267.
- [95] Tim Marsh and Brigid Costello. 2013. Lingering Serious Experience as Trigger to Raise Awareness, Encourage Reflection and Change Behavior. In *Persuasive Technology*, Shlomo Berkovsky and Jill Freyne (Eds.). Springer, Springer Berlin Heidelberg, Berlin, Heidelberg, 116–124.
- [96] Elisa D Mekler, Ioanna Iacovides, and Julia Ayumi Bopp. 2018. "A Game that Makes You Question..." Exploring the Role of Reflection for the Player Experience. In *Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play*. Association for Computing Machinery, New York, NY, USA, 315–327.
- [97] Jack Mezirow. 1991. *Transformative dimensions of adult learning* (1st ed ed.). Jossey-Bass, San Francisco.
- [98] Jack Mezirow et al. 1990. *Fostering critical reflection in adulthood*. Jossey-Bass Publishers San Francisco, San Francisco, CA, USA.
- [99] Markus Montola. 2010. The positive negative experience in extreme role-playing. *The Foundation Stone of Nordic Larp* (2010) 153 (2010), 1–8.
- [100] Jennifer A Moon. 1999. *Reflection in learning and professional development: Theory and practice*. Routledge, England, UK.
- [101] Dooley Murphy. 2023. While We Wait for the Holodeck; or, How Agency in VR Only Tells Half a Story. *The Velvet Light Trap* 91, 1 (2023), 65–70.
- [102] Susan Nolen-Hoeksema, Blair E. Wisco, and Sonja Lyubomirsky. 2008. Rethinking Rumination. *Perspectives on Psychological Science* 3, 5 (Sept. 2008), 400–424. <https://doi.org/10.1111/j.1745-6924.2008.00088.x>
- [103] Mary Beth Oliver and Anne Bartsch. 2010. Appreciation as audience response: Exploring entertainment gratifications beyond hedonism. *Human Communication*

- Research 36, 1 (2010), 53–81.
- [104] Dan Olsen. 2019. Minecraft, Sandboxes, and Colonialism. <https://www.youtube.com/watch?v=d6i5Ylu0mgM>
- [105] Cory Ondrejka. 2006. Finding common ground in new worlds. *Games and Culture* 1, 1 (2006), 111–115.
- [106] Pablo Ortiz and D Fox Harrell. 2018. Enabling critical self-reflection through roleplay with chimeria: Grayscale. In *Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play*. Association for Computing Machinery, New York, NY, USA, 353–364.
- [107] Marcello Passarelli, Jeffrey Earp, Francesca Maria Dagnino, Flavio Manganello, Donatella Persico, Francesca Pozzi, Thomas Buijtenweg, Mata Haggis, Chris Bailey, and Carlo Perrotta. 2020. The distant horizon: investigating the relationship between social sciences academic research and game development. *Entertainment Computing* 34 (2020), 100339.
- [108] Razbuten. 2019. What Games Are Like For Someone Who Doesn't Play Games. <https://www.youtube.com/watch?v=ax7f3ZJHsw>
- [109] Carol Rodgers. 2002. Defining Reflection: Another Look at John Dewey and Reflective Thinking. *Teachers College Record: The Voice of Scholarship in Education* 104, 4 (June 2002), 842–866. <https://doi.org/10.1111/1467-9620.00181>
- [110] Marguerite Roy and Michelene TH Chi. 2005. *The self-explanation principle in multimedia learning*. Cambridge University Press, Cambridge, England, 271–286.
- [111] Doris Rusch and Andrew Phelps. 2020. Games of the Soul. <https://www.youtube.com/watch?v=4UZOaK1kN5k>
- [112] Angela K Salmon. 2016. Learning by thinking during play: The power of reflection to aid performance. *Early Child Development and Care* 186, 3 (2016), 480–496.
- [113] Gavriel Salomon. 1998. Novel constructivist learning environments and novel technologies: Some issues to be concerned with. *Learning and Instruction* 8 (1998), 3–12.
- [114] Jesse Schell. 2008. *The Art of Game Design: A book of lenses*. CRC press, Boca Raton, Florida, USA.
- [115] Donald A Schön. 1984. *The reflective practitioner: How professionals think in action*. Basic books, New York, NY, USA.
- [116] Karen Schrier. 2016. *Knowledge games: How playing games can solve problems, create insight, and make change*. JHU Press, Baltimore, MD, USA.
- [117] Karen Schrier, David Gibson, and Robert Tennyson (Eds.). 2010. *Ethics and Game Design: Teaching Values through Play*. Information Science Reference, Hershey, PA. <https://doi.org/10.4018/978-1-61520-845-6>
- [118] Rainforest Scully-Blaker. 2018. Stasis and Stillness: Moments of Inaction in Videogames. In *DiGRA Conference*. DiGRA, Turin, Italy, 1–15.
- [119] Joan Solomon. 1987. New thoughts on teacher education. *Oxford Review of Education* 13, 3 (1987), 267–274.
- [120] Sigmund Tobias, J Dexter Fletcher, and Alexander P Wind. 2014. *Game-based learning*. Springer, New York, NY, USA, 485–503.
- [121] Vera Tobin. 2009. Cognitive bias and the poetics of surprise. *Language and Literature: International Journal of Stylistics* 18, 2 (May 2009), 155–172. <https://doi.org/10.1177/0963947009105342>
- [122] Evan Torner and William J White. 2012. *Immersive gameplay: Essays on participatory media and role-playing*. McFarland, Jefferson, NC, USA.
- [123] April Tyack and Elisa D Mekler. 2021. Off-Peak: An Examination of Ordinary Player Experience. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–12.
- [124] Jeroen JG Van Merriënboer, Otto Jelsma, and Fred GWC Paas. 1992. Training for reflective expertise: A four-component instructional design model for complex cognitive skills. *Educational Technology Research and Development* 40, 2 (1992), 23–43.
- [125] Jeroen JG Van Merriënboer and Liesbeth Kester. 2014. *The four-component instructional design model: Multimedia principles in environments for complex learning*. Cambridge University Press, Cambridge, England, 104–148.
- [126] Maarten Vansteenkiste and Richard M Ryan. 2013. On psychological growth and vulnerability: basic psychological need satisfaction and need frustration as a unifying principle. *Journal of psychotherapy integration* 23, 3 (2013), 263.
- [127] Asher Vollmer. 2014. How to Make Great Game Tutorials. <https://www.youtube.com/watch?v=Uf7xLHUpKHE>
- [128] Lev Vygotsky. 1978. Interaction between learning and development. *Readings on the development of children* 23, 3 (1978), 34–41.
- [129] Günter Wallner, Marnix van Wijland, Regina Bernhaupt, and Simone Kriglstein. 2021. What Players Want: Information Needs of Players on Post-Game Visualizations. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) (CHI '21). Association for Computing Machinery, New York, NY, USA, Article 330, 13 pages. <https://doi.org/10.1145/3411764.3445174>
- [130] Agata Waszkiewicz and Martyna Bakun. 2020. Towards the aesthetics of cozy video games. *Journal of Gaming & Virtual Worlds* 12, 3 (2020), 225–240.
- [131] Jeffrey Dean Webster. 1993. Construction and validation of the Reminiscence Functions Scale. *Journal of gerontology* 48, 5 (1993), P256–P262.
- [132] Matthew Alexander Whitby, Sebastian Deterding, and Ioanna Iacovides. 2019. “One of the baddies all along”: Moments That Challenge a Player’s Perspective. In *Proceedings of the Annual Symposium on Computer-Human Interaction in Play* (Barcelona, Spain) (CHI PLAY '19). Association for Computing Machinery, New York, NY, USA, 339–350. <https://doi.org/10.1145/3311350.3347192>
- [133] Matthew Alexander Whitby, Sebastian Deterding, and Ioanna Iacovides. 2023. “Conversations with pigeons”: Capturing Players’ Lived Experience of Perspective Challenging Games. In *Proceedings of the Annual Symposium on Computer-Human Interaction in Play* (Stratford, Canada) (CHI PLAY '23). Association for Computing Machinery, New York, NY, USA, 23 pages. <https://doi.org/10.1145/3611051>
- [134] Chris Wilson. 2017. Jumping to Conclusions - How to Teach a Player Something They Think They Already Know. <https://www.youtube.com/watch?v=bN4qkGHZYLg>
- [135] Douglas Wilson and Miguel Sicart. 2010. Now it’s personal: on abusive game design. In *Proceedings of the International Academic Conference on the Future of Game Design and Technology*. Association for Computing Machinery, New York, NY, USA, 40–47.
- [136] George Wilson. 2006. Transparency and Twist in Narrative Fiction Film. *The Journal of Aesthetics and Art Criticism* 64, 1 (2006), 81–95. <http://www.jstor.org/stable/3700494>
- [137] Geoff Wong, Trish Greenhalgh, Gill Westhorp, Jeanette Buckingham, and Ray Pawson. 2013. RAMESES publication standards: Meta-narrative reviews. *Journal of Advanced Nursing* 69, 5 (2013), 987–1004.
- [138] Stephen Worchel and Jack W. Brehm. 1970. Effect of threats to attitudinal freedom as a function of agreement with the communicator. *Journal of Personality and Social Psychology* 14, 1 (1970), 18–22. <https://doi.org/10.1037/h0028620>

LUDOGRAPHY

- [G1] 11 bit studios. 2014. *This War of Mine*. Game [Windows, macOS, Linux, Android, iOS, PlayStation 4, Xbox One, Nintendo Switch, PlayStation 5, Xbox Series X/S]. 11 bit studios, Warsaw, Poland.
- [G2] 2K Boston. 2007. *BioShock*. Game [Windows, Xbox 360, PlayStation 3, macOS, iOS]. 2K Games, California, USA.
- [G3] Adam Afghan, Natasha Trotman, and Jining (Kea) Zhang. 2014. *Nurse’s Dilemma*. Submitted to the CHI+MED 2014 student game design competition..
- [G4] Arkane Austin. 2017. *Prey*. Game [PlayStation 4, Windows, Xbox One]. Bethesda Softworks, Rockville, Maryland.
- [G5] Bay 12 Games. 2006. *Dwarf Fortress*. Game [Windows, macOS, Linux]. Bay 12 Games, Kitfox Games.
- [G6] BioWare. 2010. *Mass Effect 2*. Game [Windows, Xbox 360, PlayStation 3]. Electronic Arts.
- [G7] Brenda Romero. 2009. *Train*. Game [Board game].
- [G8] Capcom. 1996. *Resident Evil*. Game [PlayStation, Windows, Sega Saturn, Nintendo DS]. Capcom.
- [G9] Superbrothers Capybara Games. 2011. *Superbrothers: Sword & Sworcery EP*. Game [iOS, Microsoft Windows, Mac OS X, Linux, Android, Nintendo Switch]. Capybara Games.
- [G10] Croteam. 2014. *The Talos Principle*. Game [Windows, MacOS, Linux]. Devolver Digital.
- [G11] Demruth. 2013. *Antichamber*. Game [Windows, macOS, Linux]. Demruth.
- [G12] Dimitry Davidoff. 1986. *Mafia*. Party game.
- [G13] Dontnod Entertainment. 2015. *Life is Strange*. Game [PlayStation 3, PlayStation 4, Windows, Xbox 360, Xbox One, macOS, Linux, iOS, Android, Google Stadia, Nintendo Switch]. Square Enix Europe.
- [G14] Nintendo EAD. 2012. *Animal Crossing: New Leaf*. Nintendo.
- [G15] Epic Games. 2017. *Fortnite*. Game [Windows, macOS, Nintendo Switch, PlayStation 4, PlayStation 5, Xbox One, Xbox Series X/S, iOS, Android]. Epic Games.
- [G16] Firaxis Games. 2010. *Sid Meier’s Civilization V*. Game [Windows, macOS, Linux]. 2K Games, Aspyr.
- [G17] Toby Fox. 2015. *Undertale*. Game [macOS, Windows, Linux, PlayStation 4, PlayStation Vita, Nintendo Switch, Xbox One]. <https://undertale.com/> Toby Fox, 8-4.
- [G18] Frictional Games. 2015. *Soma*. Game [Linux, macOS, PlayStation 4, Windows, Xbox One]. Frictional Games, Malmö, Sweden.
- [G19] FromSoftware. 2011. *Dark Souls*. Game [PlayStation 3, Xbox 360, Windows, PlayStation 4, Xbox One, Nintendo Switch]. Namco Bandai Games, Tokyo, Japan.
- [G20] Galactic Cafe. 2013. *The Stanley Parable*. Game [Windows, macOS, Linux]. Galactic Cafe.
- [G21] George Prosser. 2016. *Sisyphus*. Game [Windows, macOS, Linux]. <https://gprosser.itich.io/sisyphus>.
- [G22] Guerrilla Games. 2017. *Horizon Zero Dawn*. Game [PlayStation 4, Windows]. Sony Interactive Entertainment.
- [G23] Ice-Pick Lodge. 2005. *Pathologic*. Game [Windows]. Buka Entertainment, G2 Games, GMX Games.
- [G24] id Software. 2016. *Doom*. Game [PlayStation 4, Windows, Xbox One, Nintendo Switch, Stadia]. Bethesda Softworks.

- [G25] id Software. 2020. *Doom Eternal*. Game [PlayStation 4, Windows, Xbox One, Nintendo Switch, Stadia, PlayStation 5, Xbox Series X/S]. Bethesda Softworks.
- [G26] Infinity Ward. 2009. *Call of Duty: Modern Warfare 2*. Game [Windows, macOS, PlayStation 3, Xbox 360, PlayStation 4, Xbox One]. Activision.
- [G27] Innersloth. 2018. *Among Us*. Game [Android, iOS, Windows, Nintendo Switch, PlayStation 4, PlayStation 5, Xbox One, Xbox Series X/S]. Innersloth, Washington, USA..
- [G28] Jack King-Spooner. 2017. *Dujanah*. Game [Windows].
- [G29] Jagex. 2001. *RuneScape*. Game [Windows, macOS, Linux, Android, iOS]. Jagex.
- [G30] Team Ico Japan Studio. 2005. *Shadow of the Colossus*. Game [PlayStation 2, PlayStation 4]. Sony Computer Entertainment, Tokyo, Japan..
- [G31] Josh Wardle. 2021. *Wordle*. Game [Web Browser]. Josh Wardle, The New York Times Company.
- [G32] Konami Computer Entertainment Japan. 2004. *Metal Gear Solid 3: Snake Eater*. Game [PlayStation 2]. Konami.
- [G33] Lindsay Grace. 2009. *Wait*. Game [PC]. <http://www.lgrace.com/wait/>.
- [G34] Minority Media Inc. 2012. *Papo & Yo*. Game [PlayStation 3, Windows, macOS, Linux]. Minority Media Inc., Montreal, Canada.
- [G35] Mojang Studios. 2011. *Minecraft*. Game [Windows, macOS, Linux Android, iOS, iPadOS, Xbox 360, Raspberry Pi, Windows Phone, PlayStation 3, Fire OS, PlayStation 4, Xbox One, PlayStation Vita, Wii U, Apple TV, tvOS, Nintendo Switch, New Nintendo 3DS]. Mojang Studios, Stockholm, Sweden.
- [G36] Monolith Soft. 2010. *Xenoblade Chronicles*. Game [Wii, New Nintendo 3DS, Nintendo Switch]. Nintendo.
- [G37] Nintendo EPD. 2017. *The Legend of Zelda: Breath of the Wild*. Game [Nintendo Switch, Wii U]. Nintendo Co. Ltd., Kyoto, Japan.
- [G38] Nomada Studio. 2018. *Gris*. Game [macOS, Nintendo Switch, Windows, iOS, PlayStation 4, Android, PlayStation 5, Xbox One, Xbox Series X/S]. Devolver Digital.
- [G39] Paper Castle Games. 2018. *Underhero*. Game [Windows, macOS, Linux, SteamOS]. Paper Castle Games.
- [G40] Pippin Barr. 2013. *Art Game*. Game [Web browser]. <https://pippinbarr.com/art-game/info/>.
- [G41] PlatinumGames. 2017. *Nier: Automata*. Game [PlayStation 4, Windows, Xbox One, Nintendo Switch]. Square Enix.
- [G42] Playdead. 2010. *Limbo*. Game [Xbox 360, PlayStation 3, Windows, macOS, Linux, Xbox One, PlayStation 4, PlayStation Vita, Nintendo Switch, iOS, Android]. Microsoft Game Studios.
- [G43] Riot Games. 2009. *League of Legends*. Game [Windows, macOS]. Riot Games.
- [G44] Sam Barlow. 2015. *Her Story*. Game [Windows, macOS, iOS, Android]. Sam Barlow.
- [G45] Infinite Fall Secret Lab. 2017. *Night in the Woods*. Game [Windows, macOS, Linux, PlayStation 4, Xbox One, Nintendo Switch, iOS]. Finji.
- [G46] Sony Interactive Entertainment. 2020. *The Last of Us Part II*.
- [G47] Squad. 2015. *Kerbal Space Program*. Game [Windows, macOS, Linux, PlayStation 4, Xbox One, PlayStation 5, Xbox Series X/S]. Private Division.
- [G48] Students at the IT University of Copenhagen for the Nordic Game Jam. 2008. *Dark Room Sex Game*. Game [Windows, MacOS].
- [G49] Supermassive Games. 2015. *Until Dawn*. Game [PlayStation 4]. Sony Computer Entertainment.
- [G50] Telltale Games. 2013. *The Wolf Among Us*. Game [Android, iOS, macOS, PlayStation 3, PlayStation 4, PlayStation Vita, Windows, Xbox 360, Xbox One]. Telltale Games.
- [G51] The Fullbright Company. 2013. *Gone Home*. Game [Windows, macOS, Linux]. The Fullbright Company, Portland, Oregon.
- [G52] The Fullbright Company. 2017. *Tacoma*. Game [Linux, macOS, Windows, Xbox One]. The Fullbright Company, Portland, Oregon.
- [G53] Thekla Inc. 2016. *The Witness*. Game [PlayStation 4, Windows, Xbox One, Nvidia Shield, macOS, iOS]. Jonathan Blow.
- [G54] Toast. 2017. *Richie's Plank Experience*. Game [Windows]. Toast.
- [G55] Toys for Bob, XPEC Entertainment, Vicarious Visions, n-Space, and Com2Us Beenox. 2011. *Skylanders*. Game [Android, iOS, Microsoft Windows, Nintendo 3DS, macOS, PlayStation 3, PlayStation 4, Wii, Wii U, Nintendo Switch, Xbox 360, Xbox One]. Activision.
- [G56] Ubisoft Montreal. 2014. *Watch Dogs*. Game [Windows, PlayStation 3, PlayStation 4, Xbox 360, Xbox One, Wii U, Stadia]. Ubisoft, Montreal, Canada..
- [G57] USC Game Innovation Lab. 2017. *Walden, a game*. Game [Windows, macOS, PlayStation 4, Xbox One]. USC Games.
- [G58] Yager Development. 2012. *Spec Ops: The Line*. Game [Windows, PlayStation 3, Xbox 360, macOS, Linux]. 2K Games, Novato, California, USA.
- [G59] Zachtronics Industries. 2011. *SpaceChem*. Game [Windows, macOS, Linux, iOS, Android]. Zachtronics Industries, Washington, United States.