Title
Fail and Retry: How Challenge Design in Platformer Games Relates to Player Experience and Traits

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Fail and Retry: How Challenge Design in Platformer Games Relates to Player Experience and Traits

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by

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Abstract

Fail and Retry: How Challenge Design in Platformer Games Relates to Player Experience and Traits

by

Marjorie Ann Mongado Cuerdo

Games are a unique interactive system in that failure is expected, and oftentimes, welcomed by its community. When playing a game, people enter a state where they must be open to accepting a role, a different world's rules, and the challenges that come with overcoming failures while working towards set goals. With the continued relevance of games that offer brutal punishments for player failure, such as roguelike games with permadeath mechanics, it was critical to examine the underexplored space of the design of failure and how it impacts the player experience. I then selected the genre of platformers for its high density of player death to observe 62 games to develop the Fail and Retry Taxonomy using grounded theory methodology. This was broken down into five major cyclical components, starting with Obstacles, Failure Conditions, Aesthetics, Player Progress Changes, and Reset Locations. To validate its use, I developed a simple platformer to conduct a study with four Respawn Location modifications: Permadeath/Reset to Start of Game, Reset to Start of Level, Reset to Checkpoint, and Reset to Savepoint. After quantitative analysis, I provided several failure design implications towards specific emphases on respective player experience

constructs and tailoring towards goal- and challenge-oriented players. I then conclude with potential applications and future research directions.

Acknowledgments

I want to give my appreciation to Dr. Edward Melcer for encouraging me to pursue my Games User Research interests by mentoring me, even back when I was an external master's student at DePaul University. I want to give thanks to him, Dr. Elin Carstensdottir, Dr. Angus Forbes, and my research assistant, Anika Mahajan, for their invaluable help throughout the research, development, and review in developing this thesis. I also want to thank and praise everyone who participated in my study for bearing through the pain and joys of player failure. Lastly, I want to thank my sister Jonavelle Cuerdo, my partner Taylor Kwon, and friends for their love and support throughout my graduate studies.

Chapter 1

Introduction

Failure is core to the player experience of most video games. Player failure is often represented through in-game death, the occurrence of which commonly determines whether a game is perceived to be difficult. Challenge is a major factor in the experience of game flow [22, 51], which is often used as a means to evaluate the overall player experience [92]. Consequently, the perceived difficulty both affects player behavior and has substantial positive and negative impacts on game enjoyment [42, 65].

While there have been various approaches to examining and manipulating this critical aspect of the gaming experience—e.g., dynamic difficulty adjustment [26, 37], challenge design and modeling [13, 74, 83, 98] — research understanding failure that explicitly relates to handling in-game death mechanics and other components and their relation to specific player experience constructs is surprisingly limited.

However, there has previously been interest in player death primarily from the humanistic game studies perspectives, such as regarding its representation and relationship to human experiences of mortality [33, 42, 50, 64, 72]. However, death and respawning mechanics themselves and perspectives from human-computer interaction and player experience are lesser examined. One notable exception is in the study of "permadeath" mechanics—the permanent in-game death of a playable character [21]—where there is interest in studying why players are drawn to these high-risk mechanics [4, 16, 21, 76]. This genre of games have also gained commercial popularity in recent years as demonstrated in games such as the Soulsborne series (Dark Souls, Bloodborne, Sekiro, and Elden Ring), Hades, Returnal, The Binding of Isaac, and Spelunky. I posit that this is a rich, underexplored space that is relevant to the design and study of classic to modern games.

I decided to use platformers as the source for my work, as they are generally designed with frequent player failure in mind towards pursuit of a goal. Since Mario was fated to repeatedly fall into pits and injured by turtles and fireballs during attempts to rescue Princess Peach from Bowser, platformers have been notorious for being challenging. Many of them led to the creation of the term "Nintendo hard" to describe the extreme difficulty of games from the Nintendo Entertainment System era [31]. The fairness of challenge in Nintendo hard games has been called into question, highlighting that such designs can sometimes serve more to infuriate players through frequent unfair death rather than provide an appropriate challenge [59]. This challenge clearly comes from the perspective that frequent death is detrimental to the player experience. However, I will discuss later how there are perspectives that challenge this notion.

To further study the complex relationship of game design, failure, and player experience in games, I developed a taxonomy of "Fail and Retry" in platformers to provide a tool to compare death and respawning mechanics across the genre. I then conducted a study that tested several modifications of respawn mechanics in a simple platformer to evaluate differences in relationship to player experience constructs, such as mastery, immersion, autonomy, curiosity, and challenge.

What follows is a detailed breakdown of my thesis: Chapter 2 will begin with a discussion on different perspectives of player failure and then address the development and breakdown of components in our Fail and Retry Taxonomy in Platformer Games. Chapter 3 will begin with a discussion of player experience and traits and then address the subsequent study in which I modified a specific component of Fail and Retry – reset locations – and examined its effect on player experience and relation to traits. Chapter 4 will discuss limitations and potential future directions of the work, and finally, Chapter 5 will discuss overall conclusions. Overall, I am optimistic that my research contributes to a space where further study needs to be done regarding player experiences of failure.

The work presented in this thesis is based on the following publications:

- [68] Edward F. Melcer and Marjorie Ann M. Cuerdo. (2020). "Death Rebirth in Platformer Games". In Game User Experience and Player-Centered Design. Springer.

- [24] Marjorie Ann Cuerdo and Edward Melcer. (2020). "'I'll Be Back': A Taxonomy of Death and Rebirth in Platformer Video Games". In Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems.

CHI ’20, Honolulu, HI, USA. ACM.

- [23] Marjorie Ann Cuerdo, Anika Mahajan, and Edward Melcer. (2021). “Die-r Consequences: Player Experience and the Design of Failure through Respawning Mechanics”. In Proceedings of the 3rd IEEE Conference on Games (CoG). IEEE.

Chapter 2

Study 1: A Taxonomy of Fail and Retry in Platformer Games

2.1 Player Death, Fiero, and Queer Failure

Player death and failure are often intrinsic parts of gameplay [72] and the player experience [50]. McAllister & Ruggill [64] argued that games use this human understanding of "mortality salience", or death awareness, as their "deepest mechanic". Players can be impacted by death in games when they are attached to characters at some emotional level or self-identify with the goals or events in the game [12, 69, 79, 85]. For instance, when players are immersed in gameplay, the risk of death produces anxiety and encourages more careful actions and decision-making. Despite this negative-leaning anxiety, that risk can also evoke strong positive emotions from players, resulting in enjoyment and player experience despite the frustration that comes with the territory

[12]. Juul [42] argued that failure in games leads to feelings of inadequacy that players feel they must overcome. “Fiero” is a term that describes the exhilarating feeling of victory after surpassing a difficult challenge [58], which in theory is more likely to be achieved by challenge- and goal-oriented players that persist past frequent failures. Similarly, McGonigal has argued that well-designed failures, even when painful, actually empowers players to persist [65].

Failure in games are not of one nature to players as there are also “positive failures” beyond feelings of fiero [12]. It has been argued that postulating failure in games as wholly undesirable or opaque is insufficient to study the phenomenon. For example, studying failure through the lens of queer game studies emerges the idea that failure could actually be seeked out by players instead of avoided, due to some dissatisfaction with abiding by the status quo [78]. In that sense, fun and winning in games is not restricted to simply achieving the game’s explicit goals. Halberstam in the Queer Art of Failure described this masochism as a desired “no-fun play experience” [35]. Players could enjoy throwing their characters into pits or simply avoid winning for their own entertainment. This form of play resists norms and encourages the embracement of queering play by valuing and chasing difficult experiences themselves.

Regarding terminology to discuss failure overall, Aytemiz [10] differentiated player failures into either in-loop or out-of-loop. In-loop failures are expected difficulties within the game loop, such as failing to solve a puzzle or failing to beat a boss. Out-of-loop failures are unexpected difficulties outside of the game loop, such as issues regarding approachability and accessibility. It is important to note that this work focuses on in-loop failures, in that when players encounter in-loop failures repeatedly by their characters dying, the motivation for gameplay is brought to life.

2.2 Death in Platformers

As expressed, the common difficulty of level design in platformers often results in player death [31], which generally impedes player progress, e.g., through the loss of inventory items, achievements, or game functionality [12]. At even greater extremes, in-game death can completely reset player progress such as through the popular high-risk death mechanic, permadeath, which forces the player to restart the entire game upon dying. Frequent and repetitive deaths have previously been found to increasingly reduce player enjoyment, as each occurrence of death compounds as a negative self-evaluation of the insufficiency of their skills [96]. However, as previously discussed, there are players that do enjoy death and failure as well [35, 78]. Therefore with these complex phenomenon, it is critical to examine the features that comprise in-game death for a broader understanding of its effects on player experience. I then developed the Fail and Retry Taxonomy to help elucidate common design choices in existing platformer games, as well as aid exploration of which mechanics and designs may impact on player experience.

2.3 Methodology

2.3.1 Game Taxonomies

Taxonomies provide a means to organize and classify concepts [9]. In terms of games, there have been a substantial number of taxonomies and frameworks ranging from general classifications of games themselves [1, 30, 97] to various aspects of games— such as core mechanics [86], bugs [60], embodiment [66], player modeling [89], and external factors [63]— to specific genres of games, e.g., serious games [62], games for dementia [18], exertion games [71], affective games [56], idle games [3], and games and simulations [49] to name a few. Of particular relevance to this work is the framework created by Smith and Whitehead [90] for analyzing 2D platformer levels. Their framework consists of components in the form of platforms, obstacles, movement aids, collectible items, and triggers; as well as structural representation for how the components fit together. While there are similarities of concepts in our coding scheme and taxonomy, their framework ultimately focuses on rhythm and pacing to evoke challenge, rather than components of player death that includes failure conditions and reset locations.

2.3.2 Grounded Theory Methodology

In this study, I employed grounded theory to analyze existing platformer games. Grounded theory methodology (GTM) is commonly used to explore new domains [3, 96]. For instance, within games, GTM has been used to analyze idle games [3], game immersion [14], and cooperative communication mechanics [94]. The GTM process

Positively Reviewed:	Mixed Reviewed:	Negatively Reviewed:
G6, G11, G14, G18, G19, G22, G27, G28, G30, G31, G35, G36, G39, G40, G43, G47, G52, G56, G57, G60, G62	G2, G4, G7, G8, G9, G10, G12, G13, G17, G21, G24, G26, G29, G33, G34, G45, G46, G49, G51 , G53, G55, G58	G1, G3, G5, G15, G16, G20, G23, G25, G32, G37, G38, G41, G42, G44, G48, G50, G54, G59, G61

Figure 2.1: The 62 platformer games in our corpus, categorized by corresponding critical reception: Positively, Mixed, and Negatively Reviewed. A ludography is included for our dataset.

starts with data collection, gradually building up categories and forming a theory, before linking that theory to previous literature at the end [36]. This effectively enables a researcher to simultaneously analyze a body of artifacts (in this case platformer video games) and develop a theory about what elements of these artifacts are salient [52]. For the creation of our taxonomy, we adopted the Constructivist Grounded Theory version of GTM. This GTM variant frames the researcher as co-creating meaning within the domain they are studying [17], focusing on providing lenses for analysis rather than a single objectively correct domain model [81].

Since there is a relatively limited amount of literature that address the actual mechanics around in-game death, games are a more useful information source and served as our main source of data for analysis. To fill in the research gaps in this space, we observed 62 relatively recent platformer games of varying qualities – determined by player ratings – and created a generalized taxonomy of Fail and Retry (renamed from “Death and Rebirth”) consisting of five key cyclical components: 1) obstacles, 2) failure conditions, 3) aesthetics, 4) player progress changes, and 5) reset locations.

We conducted an analysis of 62 platformer games in order to identify the essential features and mechanics around death and respawning in platformer games. We

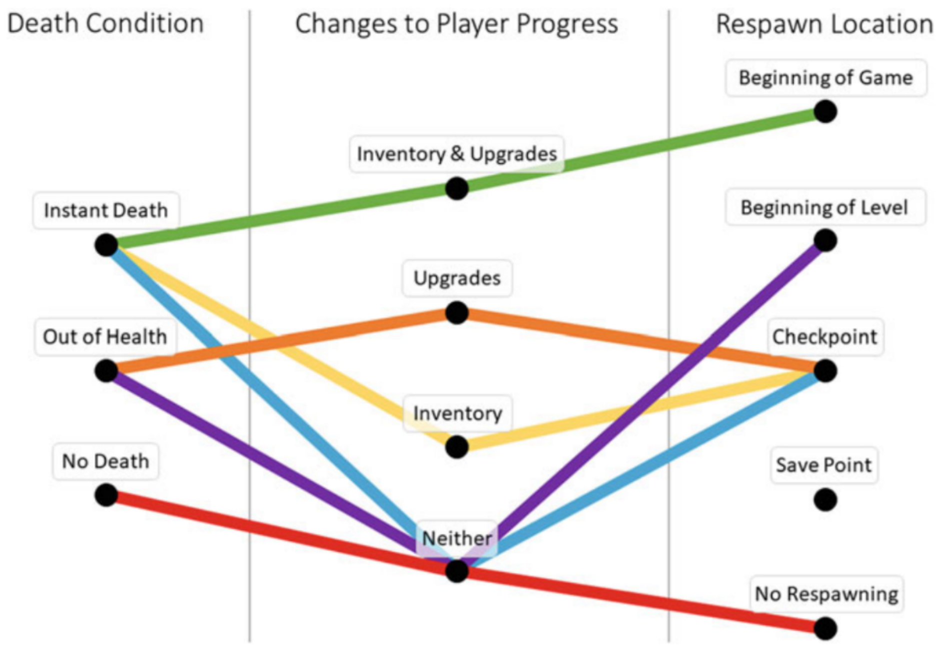

Figure 2.2: The top 6 combinations of design choices for failure conditions, changes to player progress, and reset locations.

utilized a constructivist grounded theory approach [17] that started with an iterative process of selecting platformer games. Games were then analyzed and coded by watching videos of gameplay, and playing when videos did not suffice to observe complete failure loops. Specifically, we employed open coding and conceptual memoing to identify the initial death and respawning concepts. Axial coding—i.e., identifying relationships among the open codes and initial concepts [3]—was then employed to determine our initial set of categories. Finally, selective coding—i.e., integrating initial categories to form a core category that describes the data comprehensively [3]—was used to determine the final categories of our taxonomy.

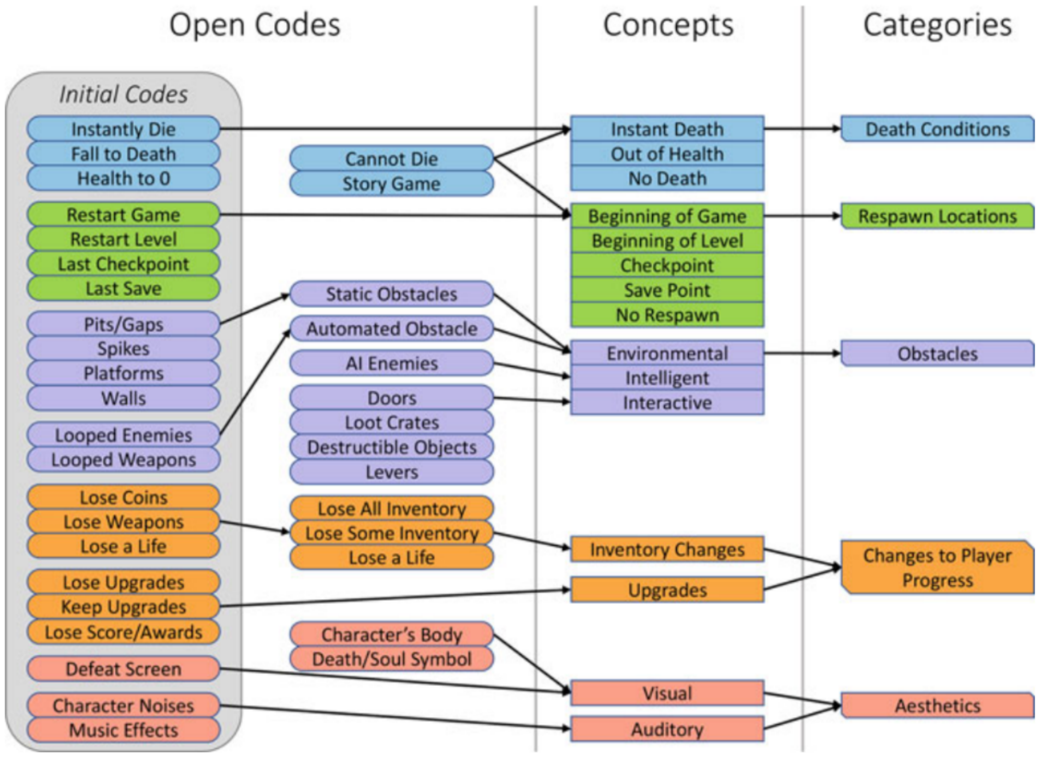

Figure 2.3: The coding process with 1) open coding, 2) related into concepts using axial coding, and 3) grouped using selective coding to create taxonomy categories.

2.3.3 Search Strategy

In order to obtain an accurate corpus of recent popular platformer games, I utilized the digital games distribution platform, Steam, for our search of games explicitly tagged as "Platformer". In an effort to observe characteristics of recent platformers, I restricted the search to video games that were released within the period of January 2018 to May 2019. I then selected the top twenty or so games with the highest number of user reviews for positive, mixed, and negative ratings (see Figure 2.1 and ludography for a breakdown). A total of 62 games were selected: (1) positively-reviewed, 21 collected; (2) mixed-reviewed, 22 collected; and (3) negatively-reviewed, 19 collected.

2.3.4 Analysis Procedure

2.3.4.1 Phase 1: Observations of Fail and Retry Mechanics in Platformers

We examined each game individually by watching a playthrough online or, if not available, obtaining the game to play it ourselves. We recorded each game's approach to handling player death with information on what conditions result in failure, where players were respawned afterwards, what components were lost and gained, obstacle types, and visual and auditory representations of player failure.

2.3.4.2 Phase 2: Open, Axial, and Selective Coding

We started this phase by performing open coding on our observations of the 62 platformer games from Phase 1. Axial coding was then employed to identify a set of emerging concepts and initial categories around failure and respawning. This was followed by multiple iterative discussion sessions to explore the relationships between the open codes, emergent concepts, and initial categories—resulting in selective coding of the five key categories for our taxonomy. See Figure 2.3 for our coding process.

2.4 "Death and Rebirth" → "Fail and Retry"

Based on the concepts and mechanics that emerged from our analysis, I formed what we previously called the Taxonomy of Death and Rebirth in Platformer Games. As later described, we found there to be a subset of games without explicit states of player death, so we renamed our taxonomy to be more inclusive of those without death and respawning: "A Taxonomy of Fail and Retry in Platformers". Games without explicit death typically include games that are meant to be more meditative like Gris [G27] or difficult in terms of getting past environmental obstacles rather than explicitly killing the player's character such as Golfing Over It [G26]. For those games, failure can simply refer to any instance that a player does not meet their personally defined goals, regardless of whether those directly align with explicit ones in the game [35]. This is a limitation of the current version of our taxonomy to be discussed later.

2.5 A Taxonomy of Fail and Retry in Platformers

Our taxonomy describes five major aspects of the cyclical process of failing and retrying in games: (1) Obstacles, which are the cause of (2) Failure Conditions being met and often results in player death, depicted through (3) Aesthetics, as well as causing (4) Player Progress Changes before being respawned at (5) Reset Locations. The cycle then repeats itself as gameplay continues on. This taxonomy provides the high-level structure necessary to understand, break down, and categorize the process of failing and retrying among a variety of platformer games. See Figure 2.4 for a diagram on the taxonomy.

2.5.1 Obstacles

Obstacles in platformers present challenges and difficulties for players to overcome [90, 91, 98]. They are also critical in existing literature for analyzing [90], dynamically adjusting [37], and generating [25, 87] platformer levels. The effects that obstacles have

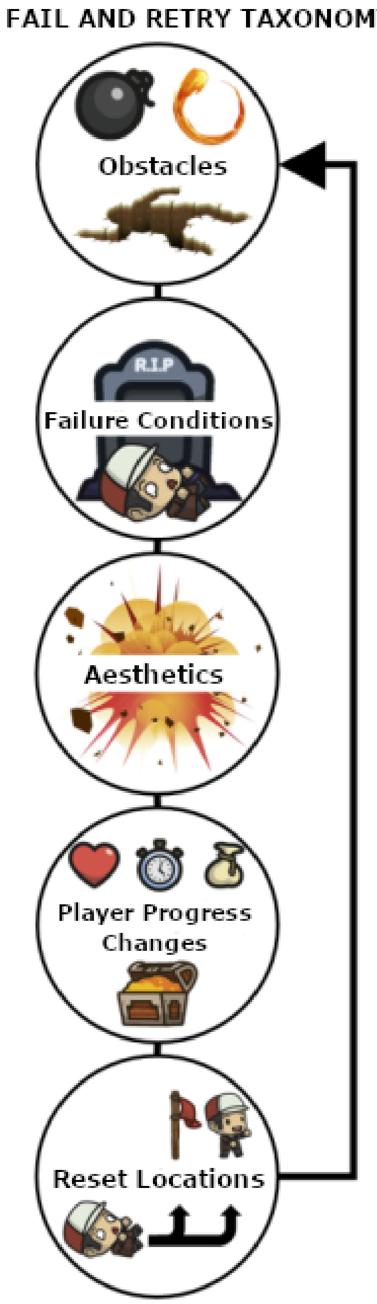

Figure 2.4: The Taxonomy of Fail & Retry in Platformer Games.

on player progress can either disrupt or encourage flow in gameplay [39, 61]. Ultimately, they are key factors that lead to player failure [98]. To analyze the role of obstacles in platformers, we determined what type of obstacle was the most prominent in each observed game. We identified three notably different types of obstacles that could lead to player failure.

- **Intelligent obstacles** are objects in the game that actively attempt to kill the player, and their movements/actions respond in real-time to player actions. Examples include enemy characters that intelligently follow a player and other deadly moving objects, such as projectiles that aim towards the player's location. An example of this in Super Mario Bros is Latiku, the turtle-type enemy that rides a cloud and throws projectiles at Mario. They're intelligent instead of automated because they change the direction of movement based on Mario's real-time movements. This contrasts the other obstacles in the game that are either fixed or looped in the environment.

- **Environmental obstacles** are embedded into the game environment and can lead to player failure. They can either be static obstacles that don't move or automated obstacles that move in fixed ways. There are two subtypes in this category: static and automated.

  Static

  Static environmental obstacles are immovable components of the level. While platforms and walls do not necessarily directly result in death, their presence requires the player to make efforts to maneuver around them. The player can then be led to another deadly obstacle such as a pit or lose valuable resources like time as a result. Smith et al. (2008) similarly treated details such as the gaps between platforms as obstacles in their framework. Interestingly, spikes also appear to be fundamental to platformers, as they existed in some form across all of the games, regardless of their respective platformer subgenres.

Examples of static environmental obstacles include immovable components of the level, such as spikes, pits, platforms, walls, and cliffs.

Automated

Automated environmental obstacles are notably different from intelligent obstacles in that they only move in fixed patterns and do not respond or adapt to the player—therefore remaining a relatively fixed part of the environment that the player must navigate around. Examples of automated obstacles include moving platforms or enemy characters that follow a fixed path, looping their movement and actions. An example of this is in Super Mario Bros, where the enemy mushroom Goombas do not follow the player and move in their fixed trajectories. In this sense, enemies act more like objects that blend in with the environment and not as actively smart characters, reminiscent of most enemies from traditional platformers.

Examples of automated environmental obstacles include moving platforms, rising lava, or enemy characters that follow fixed paths, looping their movements.

Platforms, walls, and cliffs were found to be the most common causes of "partial failures" in games that did not feature explicit death. They were used to set back player progress but did not cause death, such as those that actively caused injury (e.g. spikes, pits, etc.).

- **Interactive**

  Interactive obstacles are objects in the game that can be activated or interacted with by the player. Examples of these include doors, levers, destructible objects, and treasure chests. While it was more common for goals in platformers to either focus on defeating enemy characters or utilizing the player's abilities to maneuver around a mostly static environment, platformers that were heavy on object interaction instead tended to focus on survival [G4, G40], strategy [G30], stealth [G31, G35], or simply had easily destructible objects almost everywhere in the game environment [G10, G13, G38, G53].

2.5.2 Failure/Death Conditions

Failure/death conditions and mechanics prevalent in platformers are critical elements of the taxonomy. Specifically, we identified three distinct types of death conditions:

- **Instant/One-Hit Death** describes games where the character dies immediately from a single injury, such as from colliding with an enemy. Most of the games that applied this concept were traditional 2D side-scrolling games with puzzles and environments that relied on timing and pixel perfect platforming. One such game in our corpus was Celeste [G11], which had gained a reputation for being difficult to beat and applied this instant death concept to much critical acclaim. While this death mechanic is slowly being phased out in more recent games, there is a nostalgia factor still driving interest, mirroring classic pixel perfect platformers such as Ninja Gaiden.

- **Out of Health/Health Bar** describes games where the life of a player's character is dependent on maintaining a health bar—usually located in a top corner of the screen or represented by the character in some way. When the player runs out of in-game health, the character dies. While health is always finite in this paradigm, players are given far more chances to escape death if they make a mistake. Furthermore, games that employed the out of health approach also provided the most visual feedback of progression towards death. Therefore, this death condition may be perceived by players as one that affords more control over in-game death.

- **No Death** describes games where death is not possible through the gameplay. While not prevalent in our corpus, the absence death also leads to fairly unique designs and mechanics in platformer games. For instance, two of the games [G23, G27] were heavily focused on narrative and sensory experiences instead of death. While two others [G26, G43] instead place focus on utilizing level design (rather than death) to enforce a high-risk potential loss of progress at all times—e.g., climbing up a mountain only to make a mistake and fall all the way down to where the game started [G26]. Interestingly, the game Poultry Panic [G43] features no death from the player's perspective, but instead makes the goal of the game to control multiple chickens simultaneously and turn them into food to earn points. Despite the heavy amount of death present in the game, the player's character (factory manager) never actually dies.

2.5.3 Aesthetics

Although there are a number of definitions and interpretations of game aesthetics, aesthetics in relation to this taxonomy refers purely to the sensory phenomena that players encounter in the game [75]. Aesthetics can greatly impact player emotion and the overall gaming experience [44, 45, 73, 82], and therefore is an important category to consider for the design of in-game death. Specifically, we focus on the different variations of Visual and Auditory aesthetics that occur during in-game death.

Visuals are a critical aspect of the aesthetic experience, where even fundamental elements, such as shape and color, can have a substantial impact on player emotions and overall experience [44, 67, 75, 77, 95]. With respect to visual aesthetics around in-game death, we observed that visual changes were primarily focused on character appearance and/or use of death screens. Iconography, such as blood, skulls, and souls, was also often used to indicate character death, and could remain in the environment through multiple death and rebirth iterations to indicate where the player had previously died.

Audio, in the form of music and sound effects, is another critical aspect of the aesthetic experience. For instance, both music and sound effects have been shown to impact player immersion and emotional response [43, 45, 73, 82]. In the corpus, a number of different sound effects were employed during and immediately after death, such as cries or grunts, squishing noises, and electronic sounds. Music was also often modified, such as by abruptly stopping the background music or playing unique melodies.

2.5.4 Player Progress Changes

After a player's character dies, aspects of their progress are either retained or lost. Changes to the player's progress are important to consider, as these types of changes have been shown to impact various aspects of player experience [53] and lead to strong emotional responses [12]. While these changes do take on a variety of forms, in an abstract sense, they can be categorized as Upgrades and Inventory Changes.

- **Upgrades**

  Many platformers enable retention of earned upgrades for a character after death. Examples of preserved upgrades observed in our corpus include power-ups, weapons, skill levels, and achievements. Prior work has shown that upgrades can have significant impact on enjoyment [48] and challenge [53], allowing players to customize their overall gaming experience [27].

- **Inventory Changes**

  Inventory systems in platformer games are another important feature as they contain various explicit indicators of player progress, such as currency, lives, and items. We observed that the changes to inventory ranged from players keeping all of their inventory after death to losing some or all of it. Notably, how much inventory is maintained or lost alters the consequence of in-game death for the player, and ultimately impacts the overall gameplay [47] and game experience [16].

2.5.5 Reset/Respawn Locations

Where there is death, there is also respawning in platformer games, i.e., when the character is brought back to life to continue gameplay. However, where the player can reappear varies wildly. Poor use of reset/respawn locations (e.g., too far away or too directly into action) can lead to negative player experience [19], and therefore is another important taxonomy category. We observed five distinct types of reset locations:

- **Permadeath/Start of Game** is when players are directly sent to the game's initial menu screen upon death, and have to restart the entire game. Consequently, players often replay all or some sections of the game. This respawn location usually means that it requires more of a player's time to attempt completing the game. One popular subgenre of games that focus entirely around this mechanic is *permadeath* [21].

- **Start of Level** occurs in games that are explicitly split into distinct levels or stages. When players die, they are respawned at the beginning of the level that they failed to successfully complete. Usually, this respawn location also means that any character progress achieved in the failed level is similarly lost upon death.

- **Checkpoints** occur when the character reaches a specific location in the game that automatically saves their progress. This was the most popular respawn mechanic in the corpus (30 out of 62 games), and most platformers with checkpoints increased their difficulty by expanding the distance between checkpoints as the game progressed. I.e., checkpoints break down levels into segments with smaller challenges for the player to overcome.

- **Save Points** differ from checkpoints in that they are consciously activated by the player. When players die, they are respawned at those exact locations where the save point was activated. As a result, players are given a greater level of autonomy and control in games that have save points.

- **No Respawning** also did not occur in the same games that featured No Death in their gameplay. The absence of death means there is no requirement for the player to respawn into the game.

Chapter 3

Study 2: Die-r Consequences: Player Experience and the Design of Failure through Respawning Mechanics

After developing the Fail and Retry Taxonomy in Platformers, I was motivated to explore how altering consequences of failure affected player experience constructs. Specifically, I investigated the relationship of failure and respawning mechanics – precisely the location of reset/respawn points – to player experience (PX) constructs, such as mastery, challenge, autonomy, curiosity, and immersion. I developed a simple 2D platformer game that only differed in reset/respawn point locations based on our Fail and Retry Taxonomy: the start of the game (permadeath), the start of a level, the last reached checkpoint, and the last manually saved point. I conducted a between-subjects study with 72 participants using the four reset/respawn point game versions. The results demonstrated modifying a single respawn mechanic can lead to both negative and surprisingly positive effects on PX. Additionally, certain reset point mechanics may be more effective for challenge- and goal-oriented players.

3.1 Psychosocial & Functional Aspects of Player Experience

Games are typically evaluated in an overall general sense, such as whether they are fun, hard, or have flow; however, it is often difficult to address the direct connection of those perceptions to specific game design mechanics. Therefore, it can be helpful to break the player experience down into narrower areas. The level of challenge is an aspect that is often looked at to determine whether a game is well-designed and balanced. However, challenge is just one aspect of PX; challenge is one example of a functional aspect of PX, whereas there are also psychosocial aspects such as meaning, mastery, immersion, autonomy, and curiosity [11].

While many player experience surveys exist such as PENS [80] and GEQ [38], Abeele et al. [2] argued that they tend to focus more on overall experiences, such as enjoyment, that are difficult to pin down to smaller game design elements. Secondly, they offer different perspectives on what constitutes a 'good' player experience" [2]. The Player Experience Inventory (PXI) was then developed to measure both functional and psychosocial aspects of player experience through one scale. Functional aspects refer to the "immediate and tangible consequences that are experienced directly by consumers", and psychosocial aspects refer to the more affective sides of the experience that "reach into the social or psychological levels". The breadth of concepts that PXI measures simultaneously enables game designers and researchers to more clearly understand how the selection of game design elements relate to certain player experiences. This type of measurement is useful in the context of experimental game design research study, which serves to observe how varying a controlled aspect of the game affects the subsequent experience from it [54, 55].

As failure is largely unavoidable when playing games, game designers and researchers should work to better understand how players are affected by it. So I then decided to use the PXI since it was particularly relevant in our case, as I was interested in how modifying a specific respawning element affected relevant PXI constructs, such as the psychosocial aspects of mastery, autonomy, curiosity, and immersion, and the functional aspect of challenge. We also examined whether players' affinity for challenge and goal achievement in games (i.e., their orientation traits) were related to their experience of those PX constructs.

For clarity, these were the following definitions given for our selected constructs: (a) **mastery** is a "sense of competence and skillfulness derived from playing the game", (b) **challenge** is "the extent to which the challenges in the game match the player's skill level" (not the same as difficulty level), (c) **autonomy** is "a sense of autonomy and freedom to play the game as desired", (d) **curiosity** is "a sense of interest and curiosity the game arouses in the player", and (e) **immersion** is "a sense of absorption and immersion experienced by the player" [26]. These were relevant as they addressed players' perception of their skills, interest, and presented challenges in the game as they face variations of setback punishments (i.e. respawning to different locations).

I selected those player experience constructs for the following: mastery-oriented individuals are often found to having better resilience to experiences of failure, such as working harder to find solutions to problems, as opposed to those who are helpless-oriented who are more easily discouraged [28, 29]. Anderson has previously examined the relationship between mastery orientation and failure-related behaviors in video games [5, 6, 7, 8]. Challenge and difficulty levels affect the intensity of those in-game failures and the skill level required to manage them [42]. As attribution theory explains that people tend to relate events to specific causes [46], it's crucial to examine whether players experience autonomy to understand what factors they attribute their failures to (e.g. their skills, the game's design, etc.). Lastly, games are supposed to be engaging regardless of difficulty level. Therefore, measuring curiosity and immersion can inform whether players feel compelled to keep playing despite experiencing failure. These constructs are conceptually related to the PENS definition of presence [2], which is often measured as a crucial component of player enjoyment [80].

3.2 Player Types and Orientation Traits

In addition to mastery-orientation, other scholars have defined other player types and traits to describe grouped characteristics of players. These are essential to study as player preferences affect their behavior and experience of games that they play [84]. To understand this more, it is crucial to remember that there are two types of player preference theories – types and traits. Bartle's taxonomy of player types [11] is one of the earliest breakdowns of different types of players based on activities that they most prefer while playing multiplayer online games. This taxonomy was based on four character theories: Achievers, Explorers, Socializers, and Killers. The names of these types describe exactly what one would assume. Achievers preferred to have explicit markers of achievements in games, such as scores, leveling up, skill points, and other similar features. Explorers preferred to immerse themselves in aspects of the game that do not necessarily tie to the game's explicit goals. They enjoy discovery and moving at their own pace. Socializers prefer the interactive aspects of the game that involve other players or intelligent non-playable characters. Lastly, Killers prefer the thrill of competition with and victory over other players.

Though Bartle's taxonomy has been referenced countless times, Tondello et al. [93] argues that categorizing people into distinct types is insufficient to describe the flexibility and wholeness of players' actual preferences. Consequently, player trait theories have been proposed to address this issue as they instead perceive people to be a combination of multiple characteristics. Following this train of thought, the Trait Scale of Game Playing Preferences was developed, which consisted of the following orientations: aesthetic, narrative, goal, social, and challenge. These traits are individually scored based on averages for each player. It is then possible for researchers to determine what every player's tendencies are towards all types of activities possible in games. This survey was useful for our purposes as it helped to examine the relationships of orientation traits to different reset/respawn point setups.

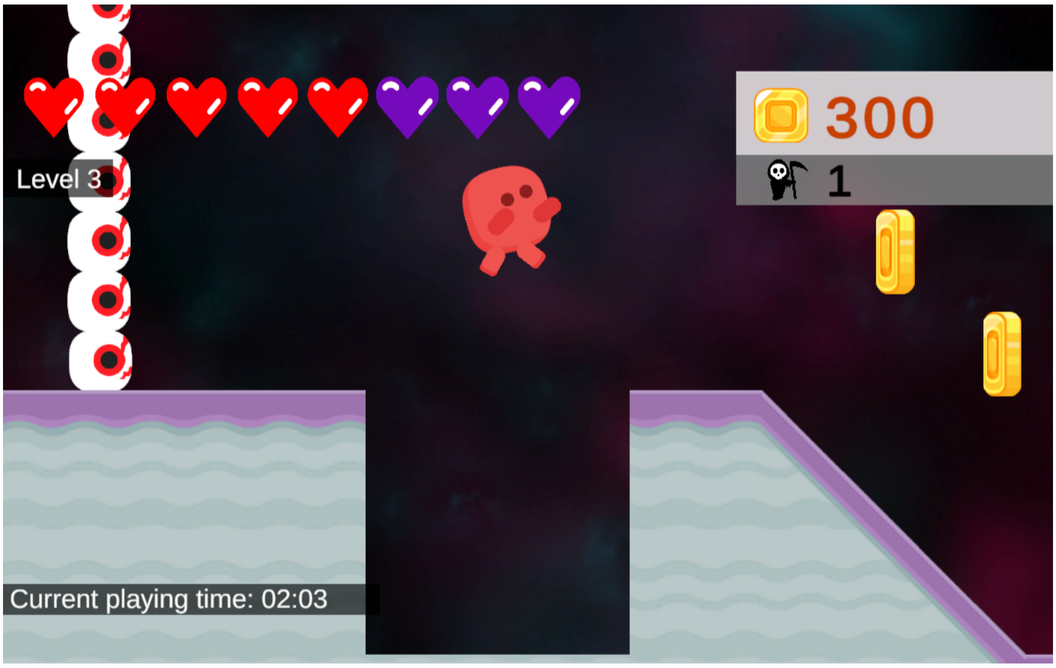

Figure 3.1: A screencap of Jumpy. Player progress stats (hearts, points, and deaths) were displayed on the game UI at all times.

3.3 "Jumpy" Platformer Game Design

I created a simple 2D platformer game Jumpy in four versions for each reset point location condition: (1) reset to start of game (permadeath), (2) reset to start of level, (3) reset to checkpoint, and (4) reset to savepoint. All versions of the game employed the same mechanics and only differed where the player respawned after they died in the game. I intentionally designed it so that other identified Fail and Retry Taxonomy components (failure/death conditions, player progress changes, aesthetics, and obstacles) were uniform to isolate the potential effects of specifically modifying respawn locations.

The game had a total of five levels that increased in difficulty. Implementing conventions from the platformer genre, the player moves across the level from left to right until they collide with a treasure chest, which represented the end of a level. As the only mechanics in Jumpy were to avoid *environmental obstacles* (move left, move right, jump, collect coins, and get hurt), I implemented a more forgiving failure/death condition called *out of health* which uses a health bar, as opposed to instant/one-hit death. The player started with five hearts and could earn up to three bonus hearts by collecting coins. Each coin was worth 10 points and every 50 points earned one bonus heart (max total health of eight hearts). Any player collision with an enemy or environmental obstacle resulted in the loss of a heart. The player died whenever they lost all their hearts (hence out of health) or fell into the water or spiky pits.

I also standardized *player progress* – both number of hearts and points – to save only up to the last reached reset point location and end of a level (e.g. when beating a level, the current number of hearts and points are saved). In other words, all player progress from the last reached reset point is lost upon death. For example, in the reset to start of game (permadeath) condition, all points and/or hearts earned are lost when you die before beating the entire game. The consequences for player death then ranged from low-risk (checkpoints and/or savepoints) to high-risk (permadeath).

Furthermore, the levels were identical across conditions and designed with two types of environmental obstacles [24, 68, 23] that hurt the player on collision: (1) *static* enemies and environmental objects, which stayed in place, and (2) *automated* enemies, which patrolled in consistent movement patterns. Additionally, to prevent the potential bias of aesthetic representations of death in this study, player death (failure) simply triggered a very short sequence of events where a glitch sound played, the player's character quickly faded out, and abruptly cut to the player being dropped to the last reached respawn point location.

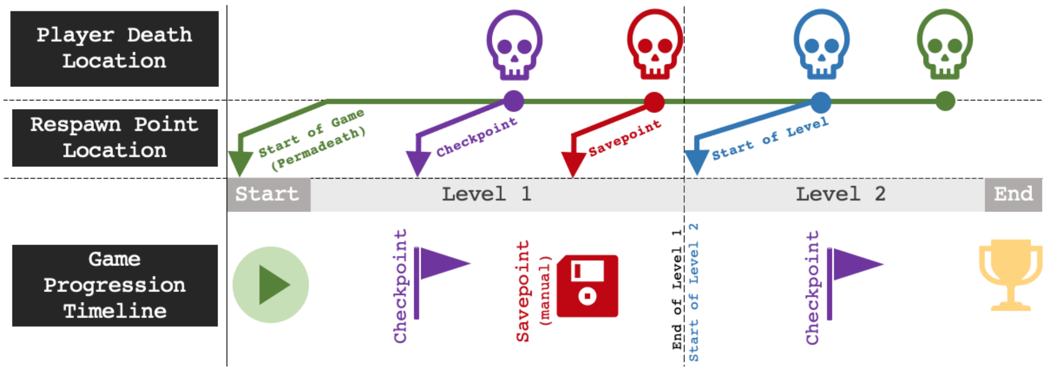

Figure 3.2: A timeline depicting where players will respawn upon dying in the game, depending on the respawn point location type: checkpoint, savepoint (manual), start of level, and start of game (permadeath).

3.4 Hypotheses

We hypothesized that altering reset/respawn locations would be a simple but effective way of varying the degrees of punishment after in-game death. Juul described this type of consequence as a "setback punishment" [41], where the player needs to replay parts of a game. The variation of punishment for player failure affects the perception of a game's difficulty and flow. However, Juul also found that the desires of players are often contradictory, as they simultaneously want to win (i.e. game should be easy) and to be challenged (i.e. game should be hard). Achieving this tricky balance in game design is a challenge in itself; therefore, we explored the nuances of that dynamic by examining other parts of the player experience in addition to challenge. We assumed that a small punishment for failure with respawning to regularly-set checkpoints—the most popular of respawning mechanics found in a previous study on platformer games [68]—would immerse players the most, leading to higher self-perception of skills (mastery) and motivation to keep exploring the game (curiosity). In contrast, we assumed that the most punishment for failure with the permadeath-like respawning to the start of the game would break immersion most, leading to lower self-perception of skills (mastery) and motivation to keep exploring (curiosity). As for other setback punishment variations, we assumed that giving the player agency to save the game whenever they wanted would afford the most autonomy, and that having the player respawn to the start of levels was a better balance for difficulty (checkpoints would be too easy and permadeath would be too hard). When used in the context of games, the conceptual differences between immersion and flow are still being debated, but it has been found that common measurements observe the same phenomenon [70]; therefore, we believe that our study also contributes to the understanding of how failure design relates to flow. We detail our hypotheses more specifically in the following. Our main hypothesis was that there will be significant differences among the four different respawn point location conditions in regards to player experience constructs. We further developed this notion into the following hypotheses to be more specific in our observation (see Figure 3.4 for a table):

Compared to other reset point location conditions, players in:

- Reset to checkpoint will experience: highest mastery PX (H1a), immersion PX (H1b), and curiosity PX (H1c).

- Reset to start of game (permadeath) will experience: lowest mastery PX (H2a), immersion PX (H2b), curiosity PX (H2c), autonomy PX (H2d), and challenge PX (H2e).
- Reset to savepoint will experience: highest autonomy PX (H3).
- Reset to start of level will experience: highest challenge PX (H4).

Regarding player death counts:

- Higher death counts will be significantly negatively related to all measured PX constructs, meaning lower: mastery PX (H5a), challenge PX (H5b), autonomy PX (H5c), curiosity (H5d), and immersion (H5e).

Regarding player orientation traits:

- Challenge orientation trait scores will be significantly positively related to mastery PX (H6a), immersion PX (H6b), and challenge PX (H6c).
- Goal orientation trait scores will be significantly positively related to mastery PX (H7a), immersion PX (H7b), autonomy PX (H7c), curiosity PX (H7d), and challenge PX (H7e).

3.5 Measurements

Participants completed surveys before (pre-test) and after (post-test) playing the game. In the pre-test survey, data was collected for demographics and player orientation trait scores through the Trait Model of Game Playing Preferences [93]. Tondello et al.'s player orientation traits included aesthetic, narrative, goal, and challenge orientation; our study focused on challenge and goal orientation scores. The game recorded final player progress statistics; our study focused on the total player death count. In the post-test survey, we used the Player Experience Inventory (PXI) [2] to measure functional and psychosocial PX constructs. Our study focused on mastery, immersion, autonomy, curiosity, and challenge. Abeele et al. [2] established the construct validity of the PXI using both exploratory and confirmatory analysis. Items across both surveys were measured on a 7-point Likert scale, ranging from 1-Strongly disagree to 7-Strongly agree.

3.6 Participant Recruitment

Participants were recruited through university students and social media sites (e.g. Twitter, Reddit, Facebook, Discord, and Slack). A total of 72 participants (age ranged from 18-44 years old; broken down into 18-24 years old group (43.5% of participants), 25-34 years old group (52.7%), and 35-44 years old group (4.2%)), completed the study fully online. Eighteen participants were assigned for each condition. The breakdown of gender was the following: 37 participants identified as female, 32 as male, and three as non-binary. Daily gaming frequency habits data was also collected, with 22.22% of participants playing less than one hour daily, 34.72% playing 1-2 hours daily, 34.72% playing 3-4 hours daily, 4.2% playing 5-6 hours daily, and 4.2% playing

7+ hours daily. All participants participated voluntarily, with only eligible university student participants receiving class credit.

3.7 Procedure

When participants clicked the invitation link, they were randomly assigned to one of the four test conditions: (1) respawn to start of game (permadeath), (2) respawn to start of level, (3) respawn to checkpoint, and (4) respawn to savepoint. Participants first took the pre-test survey regarding demographics and player orientation traits. They were then given up to 15 minutes to play a version of Jumpy, the platformer game. They weren't given information as to the death and respawning mechanics in their version. They were simply given the game controls (moving and jumping) and scoring rules – every 10 points earns a heart and beating the entire game within a certain time period earned a bronze, silver, or gold medal. If they finished the game faster than 15 minutes or didn't finish on time, the game stopped and their final gameplay statistics were displayed. Simple stats were displayed such as their total completion time, total score, total number of deaths, and earned medal. Then, they were automatically moved to the post-test survey where they took the PXI [2].

3.8 Results

Our results showed that there were significant differences among some of the respawn point location groups. Specifically, the use of checkpoints related to lower

PX ratings for autonomy and curiosity as opposed to using savepoints and respawn to start of game (permadeath). Players' final death counts also negatively related to most of the measured PX constructs (mastery, autonomy, curiosity, and challenge), meaning that the more times they died, the less they experienced those dimensions of PX. However, immersion was positively related, meaning that the more times players died, the more immersed they felt. Lastly, higher scores for players' challenge orientation traits positively related to higher PX ratings for mastery and immersion, while their goal orientation scores positively related to autonomy. Our results indicate that even modifying just one respawning mechanic in the same platformer game leads to differences in player experiences.

3.8.1 Statistics

We were interested in exploring how modifying the location of respawn point types related to PX constructs such as mastery, challenge, autonomy, curiosity, and immersion. With an alpha = 0.05 and power = 0.80, conducting an a priori power analysis for an ANOVA with effect size = 0.4 using G*Power [32] resulted in the projected sample size of a minimum of 68 participants with 17 participants in each test condition. Firstly, we conducted normality tests and found that we didn't have normal distribution. Data transformation techniques (square root and log10) also didn't normalize the data. Therefore, we decided to use the Kruskal-Wallis H test, or "one-way ANOVA on ranks", an alternative non-parametric method to analyze our data. Additionally, we were also interested in whether death count and players' orientation traits related to PX constructs. We used Spearman's Rank-Order Correlation to analyze those relationships. An alpha level of 0.05 was used for all statistical tests. See Figure 3.3 for a table of statistical tests results.

Figure 3.3: Player Experience Constructs in Relation to Death Counts, Respawn Types, and Player Trait Scores

	Mastery	**Challenge**	**Autonomy**	**Curiosity**	**Immersion**
Total Player Death Count	Spearman's Corr. **p = 0.037** **r_s = -0.367**	Spearman's Corr. **p = 0.027** **r_s = -0.261**	Spearman's Corr. **p = 0.023** **r_s = -0.268**	Spearman's Corr. **p = 0.032** **r_s = -0.253**	Spearman's Corr. **p = 0.017** **r_s = 0.554**
Respawn Point Location Types (Checkpoint, Savepoint, Level, Permadeath)	Kruskal-Wallis H p = 0.212	Kruskal-Wallis H p = 0.592	Kruskal-Wallis H **p = 0.021** **η^2 = 0.112**	Kruskal-Wallis H **p = 0.011** **η^2 = 0.134**	Kruskal-Wallis H p = 0.642
Challenge Orientation Trait Score	Spearman's Corr. **p = 0.048** **r_s = 0.234**	Spearman's Corr. p = 0.542 r_s = 0.073	Spearman's Corr. p = 0.120 r_s = 0.185	Spearman's Corr. p = 0.887 r_s = 0.017	Spearman's Corr. p = 0.788 r_s = -0.032
Goal Orientation Trait Score	Spearman's Corr. p = 0.683 r_s = -0.049	Spearman's Corr. p = 0.322 r_s = -0.118	Spearman's Corr. **p = 0.038** **r_s = 0.245**	Spearman's Corr. p = 0.069 r_s = 0.216	Spearman's Corr. p = 0.138 r_s = 0.177

3.8.2 Respawn Point Types and Player Experience (PX) Constructs

Significant differences of moderate effects were found in the medians among the respawn point location type groups for PX constructs of **autonomy** ($\chi^2(3,\ N = 72) = 9.757,\ p =\ 0.021,\ \eta^2 = 0.112$) with mean ranks scores of 36.89 for respawn to start of level, 42.86 for respawn to start of game, 23.86 for respawn to checkpoint, and 42.39 for respawn to savepoint, and **curiosity** ($\chi^2(3,\ N = 72) = 11.230,\ p = 0.011,\ \eta^2 = 0.134$) with mean ranks scores of 35.64 for respawn to start of level, 48.22 for respawn to start of game, 25.14 for respawn to checkpoint, and 37.00 for respawn to savepoint.

We then conducted post-hoc tests adjusted with Bonferroni correction to evaluate pairwise comparisons among the four groups. The results of these tests indicated the following significant differences:

- For *autonomy PX*, the respawn to start of game (permadeath) group slightly scored higher than the respawn to checkpoint group ($p =\ 0.037$).

- For *autonomy PX*, the respawn to savepoint group also slightly scored higher than the respawn to checkpoint group ($p =$ 0.046).
- For *curiosity PX*, the permadeath group significantly scored higher than the respawn to checkpoint group ($p =$ 0.005).

No significant differences were found among the respawn point location groups for mastery, immersion, and challenge.

3.8.3 Death Counts and PX Constructs

Significant correlations of varying effects were found between player death counts and all the measured PX constructs (mastery, immersion, autonomy, curiosity, and challenge). We detail the respective significant results:

- For **mastery** PX, death counts had a weak negative correlation across all respawn point location groups (r_s = -0.367, p = 0.037). However, the respawn to start of level group in particular had a strong negative correlation with death counts (r_s = -0.693, p = 0.001).
- For **challenge** PX, death counts also had a weak negative correlation across all respawn point location groups (r_s = -0.261, p = 0.027). However, the respawn to checkpoint in particular had a strong negative correlation with death counts (r_s = -0.610, p = 0.007).
- For **autonomy** PX, death counts had a weak negative correlation across all respawn point location groups (r_s = -0.268, p = 0.023).

- For **curiosity** PX, death counts had a weak negative correlation across all respawn point location groups (r_s = -0.253, p = 0.032).

- For **immersion** PX, death counts did not have significant correlations overall, but did show a moderate positive correlation for the respawn to start of game group (r_s = 0.554, p = 0.017).

Overall, it appears that examining results for respective respawn point location groups yielded stronger correlations, reinforcing their differences.

3.8.4 Player Orientation Traits and PX Constructs

Examining results for respective respawn point location groups similarly yielded stronger correlations made when analyzing player orientation traits and PX constructs. Significant correlations of varying effects were found between player orientation traits of challenge and goal and mastery, autonomy, and immersion. We detail the respective significant results:

- For **challenge orientation trait**, *mastery PX* had a weak positive correlation across all respawn point location groups (r_s = 0.234, p = 0.048). However, challenge orientation trait scores in the respawn to start of level group in particular had a strong positive correlation with mastery (r_s = 0.674, p = 0.002).

- Regarding *immersion PX*, the respawn to savepoint group in particular had a moderate positive correlation with challenge orientation trait score (r_s = 0.534, p = 0.022).

	Hypothesis	Actual	Correct?
		Among groups	
Checkpoint	**H1a** Mastery	No significance	X
	H1b Immersion	No significance	X
	H1c Curiosity	Checkpoint is sig. lowest	X
Permadeath	**H2a** Mastery	No significance	X
	H2b Immersion	No significance	X
	H2c Curiosity	Sig. higher than checkpoint	X
	H2d Autonomy	Sig. higher than checkpoint	X
	H2e Challenge	No significance	X
Savepoint	**H3** Autonomy	Savepoint is sig. highest	✓
Level	**H4** Challenge	No significance	X
Death counts	**H5a** Mastery	Neg. corr. for all groups	✓
		Strong for **Level group**	
	H5b Challenge	Neg. corr. for all groups	✓
		Strong for **Checkpoint group**	
	H5c Autonomy	Neg. corr. for all groups	✓
	H5d Curiosity	Neg. corr. for all groups	✓
	H5e Immersion	Strong pos. corr. **Permadeath**	X
Challenge trait	**H6a** Mastery	Weak pos. corr. for all groups	✓
		Strong for **Level group**	
	H6b Immersion	Moderate pos. corr. **Savepoint**	-
	H6c Challenge	No significance	X
Goal trait	**H7a** Mastery	No significance	X
	H7b Immersion	No significance	X
	H7c Autonomy	Weak neg. corr. for all groups	X
	H7d Curiosity	No significance	X
	H7e Challenge	No significance	X

	Highest/Positively Correlated
	Lowest/Negatively Correlated
	No Relationship

Figure 3.4: A summary of stated hypotheses and the subsequent results.

- For **goal orientation trait**, *autonomy PX* had a weak negative correlation across all respawn point location groups ($r_s = 0.245$, $p = 0.038$).

3.9 Discussion

I now discuss the observed effects of modifying the location of respawn points on each player experience (PX) construct respectively for clarity and their implications for game design towards specific types of players. See Figure 3.4 for a summary of whether hypotheses were rejected or accepted.

3.9.1 Autonomy: Transparency & Goal-Oriented Players

Our assumptions for effects on autonomy were partially supported. We assumed that players would experience the most autonomy in the respawn to savepoint condition (H3) and the least in respawn to start of game (permadeath) condition (H2d). In reality, permadeath condition actually had highest autonomy ratings (mean rank of 42.86) but the savepoint condition did follow very closely after (mean rank of 42.39). We found the high autonomy ratings in the savepoint group intuitive, as players had free will to save their current progress at any point in the game. This also accompanied our findings that players scored autonomy higher the less they died, and may have had some impact on the permadeath group's higher perceived autonomy since they experienced the least amount of deaths (mean of 25.06).

However, we initially expected the permadeath group to experience the least autonomy, because dying in that condition led to the greatest loss (all player progress). Therefore, we found it interesting that respawn to checkpoint actually scored the worst for autonomy ratings (mean rank of 23.86). We theorize that the checkpoint condition scored the least autonomy, because players couldn't have control over or be involved in the decision as to where they respawned after dying in the game. Though placements of respawn point locations may seem intuitive to game designer(s), those decisions may appear arbitrary or a frustratingly "bad" decision from the player's perspective. When designing the game for our study, we selected checkpoints around stretches of the game that could be more difficult to complete (e.g. a checkpoint right before a long jump that required precise timing or a checkpoint right after beating a challenging area). Regardless, the player may not have wanted their progress to be automatically and unexpectedly saved at a checkpoint. Despite the consequences of failure being the greatest in the permadeath condition, players knew exactly what to expect whenever they died.

Another finding showed that a player's goal orientation trait score – which indicates how much they enjoy completing goals in games – showed a slight relationship to their autonomy score (H7c). This suggests that if one were to target goal-oriented players, the game should afford a high degree of autonomy. A potential method to accomplish this is to pay careful attention to relaying as much information about the consequences of failure to the player. Though our game did not explicitly state what happens when a player dies, in the savepoint condition, the controls for saving the game were displayed as part of the start screen. Secondly, in the permadeath condition, the consistent reset to zero points, initial five hearts for health, and relocation to the very start of the game was explicit and obvious. These factors could have contributed to the experience of highest autonomy in those conditions. We suggest that more work could examine this phenomenon deeper, as something like a specific study that focused on the presence (and lack) of transparency around death and respawning mechanics could have an effect on player autonomy.

3.9.2 Mastery: Frequency of Failure & Achievements and Challenge Traits

Though this study did not yield significant differences among the respawn point location groups for mastery (H1a, H2a, H7a), we did find that mastery significantly related to death count (H5a) and challenge orientation trait scores (H6a) — particularly in the respawn to start of level condition. As we expected, players scored mastery lower the more times they died. We argue this indicates game designers should try to minimize the occurrences of persistent unconquerable failure if they want to maximize their players' self-perception of mastery.

However, this experience could vary depending on players' orientation traits. Our findings showed that in the respawn to start of level group, players who were more challenge-oriented scored mastery higher. Challenge-oriented players prefer difficult challenges; therefore, this suggests that if one wanted to target challenge-oriented players, implementing middle-ground consequences for failure such as respawning to start of levels could afford better higher mastery. We hypothesize that designing a level that is too easy could actually backfire for challenge-oriented players, as they may perceive their in-game skills to be superficial due to the game's lack of difficulty. In our game, failing/dying in the respawn to start of level condition meant that the player didn't lose all of their player progress, yet still had to live with the periodically-saved consequences of their past actions, whether those were good or bad performances in previous levels. Beating a level seemed to be a fairer assessment of ability compared to the low risk, high reward situation in respawn to checkpoints and savepoints and extreme risk, no reward situation in permadeath.

3.9.2.1 Preventing Learned Helplessness in Educational Games

Game design that affords mastery could help engage players that are less mastery-oriented (i.e. prone to learned helplessness). This knowledge can also be particularly helpful in the case of educational game design, where failure experiences have been found to promote learning [8]. Future work could study setback punishment, such as in the form of respawn points and player progress changes, and its impact on effectiveness of educational games in different subject areas.

3.9.3 Curiosity: Pacing of Reveal Means More

We initially expected that players would rate curiosity highest in the checkpoint condition (H1c) and the least in start of game (permadeath) (H2c). However, our findings found the reverse to be true. We assumed that players would be overwhelmed with frustration in having to completely start over repeatedly every time they died, leading to less curiosity or motivation to finish the game. Our findings instead showed that designing for curiosity is based on how much is revealed to the player over time. Players were least curious when respawning at checkpoints, because it was more likely for them to save their progress and see more of a level rapidly. This contrasts players who respawned to the start of game (permadeath) who likely saw less of the levels, given that they had to play more slowly and carefully to avoid death because of higher-risk consequences. Our findings did show that the more times a player died, the lower they scored their curiosity, and permadeath had the least amount of deaths (mean rank of 21.19). Consequently, we suggest that game designers pay closer attention to what is revealed over time to their players to maximize a sense of curiosity in their games.

3.9.4 Challenge: Death Counts Affect Perception of Difficulty

To reiterate, a higher challenge score in the PXI [2] meant players perceived the game's difficulty to be appropriate (i.e. match their perceived skill level), not that they perceived the game to be the most difficult. We expected respawn point location groups to demonstrate differences in regards to challenge PX scores (*H2e*, *H4*, *H6c*, *H7e*) but did not find any. However, higher death counts did significantly relate to challenge PX scores (*H5b*), meaning that the more times a player died, the more they felt that that the game did not have an appropriate difficulty level (i.e. had unbalanced difficulty). This observation was particularly strongest in the respawn to checkpoint condition, which makes sense as players in it had the highest death counts (mean rank of 50.78, compared to 21.19 in permadeath). Arias & Larsson [57] previously found that players were more accepting of difficult gameplay when they felt that they had more influence in the game. A high level of difficulty would then be justified by a greater sense of autonomy in the eyes of the player. As previously discussed, the checkpoints group also experienced the least autonomy, which may have affected their perception of the game's challenge level.

Another possible factor is that similar to autonomy, the presence (or lack of) explicit internal or external information about the game's difficulty affects the perception of it. A game like *Jumpy* did not state its intended challenge level (e.g. difficulty selection screen) nor had reviews of it online that players had as a point of reference. Our findings do indicate that if game designers were to create an intentionally difficult game, they may need to be intentional with their failure design choices, as implementing checkpoints may make the game feel unbalanced. Overall, I do not necessarily want to state that respawn point locations have absolutely no effect on perceived challenge. Rather, we call for more research to be done on these nuances and how other aspects of PX and game design (i.e. beyond simply altering one mechanic, such as combining other failure conditions, balancing player progress changes, or differing representations of death/failure) influence the perception of difficulty in games.

3.9.5 Immersion: Raise the Stakes of Player Actions

Counter to our initial expectations, no significant differences were found among the respawn point location groups for immersion. We assumed that immersion would be most present for players that respawned to checkpoints because it would afford a more continuous experience for players (*H1b*), and least present for players that respawned to the start of game (permadeath) because it would afford a more disjointed experience (*H2b*).

However, it was within the respawn to start of game (permadeath) group where we observed that the more times a player died, the more immersed they actually felt. Instead of creating a disjointed player experience, it appears that players were more immersed playing the high stakes extreme-risk, no-reward game version. These findings were supported by the literature surrounding permadeath. Copcic et al. [21] summarized the shared sentiment of other permadeath scholars that the finality of dying in games provides more excitement and meaning to in-game death and player actions. Interestingly, we also found that the more challenge-oriented a player was, the higher they scored immersion (H6b). Within this context, it is more obvious to see the connection to the rising popularity of permadeath mechanics in roguelikes, RPGs, and other game genres. Scholars have argued that dying can lead to greater player satisfaction/enjoyment [96, 76, 15, 99]. The sunk cost fallacy [34] could also be relevant here, as players want to see some reward worthy of the time they spent playing the game. With the permadeath condition, they lose the reward (e.g. satisfaction of beating the game) every time they die, so it could affect their engagement (immersion) to persist past failure. Therefore, our findings indicate that if game designers wanted their challenge-oriented players to experience a higher degree of immersion, they should raise the stakes to afford more active focus compared to passive/casual attitudes during gameplay.

Overall, our findings clearly indicate that modifying the location of respawn points can affect respective aspects of the player experience, as opposed to simply measuring whether a game is fun, hard, or has flow. We believe this calls for more research into how game design elements – especially relating to functional/systematic failure and challenge mechanics – can be more intentionally used to create specific player experiences tailored to particular types of players.

Chapter 4

Limitations and Future Work

In developing the Fail and Retry in Platformers Taxonomy, it is important to acknowledge that the platformer game genre has now evolved to include multiple subgenres with distinct characteristics. This evolution of platformers may affect the way certain observed games with more “classic” designs were received by players and their resulting critical reception. It is also important to note that the game experience is composed of many layers beyond what the five dimensions of our taxonomy covers. Most importantly, when first developing the taxonomy, we initially didn’t account for the games we observed that did not have death and respawning featured. We renamed our taxonomy to ”Fail and Retry” to be more inclusive, but we realize that further research needs to be done to observe other patterns in the process of failing and retrying/replaying during gameplay in multiple contexts (e.g. other game genres that don’t feature player death).

When designing the subsequent reset point locations study, we anticipated facing difficulties with participant recruitment during the coronavirus pandemic, as we depended on remote online participation that required at least 30 minutes of a volunteer's time. While obviously uncertain, it is possible that our results could've trended towards more significant results with more participants. Additionally, quantitative data from surveys is useful but still only one type of tool to tell the story of player experience. A mixed-methods approach incorporating qualitative methods – such as obtaining live player reactions to failure and/or recorded in-game behaviors – would be useful to accompany survey data, and this is work that we hope continues in the future.

As they stand, our findings demonstrate the relevance of studying the relationship of failure and respawning mechanics to functional and psychosocial aspects of player experience. We hope that our work can be used to motivate other games researchers and designers to experiment with designing player failure, as well as provide a starting point for further studies on the experience of failure (or lack thereof) in other game genres (e.g. RPGs, narrative-based games), modes (e.g. cooperative versus competitive multiplayer), and platforms (e.g. console, mobile, VR/AR). It is probable that there are other versions of failure loops and their components that do not feature death and respawning mechanics that require further study.

Chapter 5

Conclusions

We utilized constructivist grounded theory to develop a Taxonomy of Fail and Retry in Platformer Games. We observed various platformer games to concepts for our taxonomy. It highlights that there are a substantial number of mechanics, design decisions, and aesthetics that go into death and respawning in games, despite the limited amount of literature examining these features. Our goal is to provide a means for game designers and researchers to better design/analyze how games handle failure. We identified five key categories as the basis of our taxonomy: Obstacles, Failure/Death Conditions, Aesthetics, Player Progress Changes, and Reset/Respawn Locations.

We then explored the effects of modifying the location of reset points in a platformer game on the player experience (PX). Upon dying in the game, players were respawned to one of the following locations: start of the game (permadeath), start of the level, checkpoint, and savepoint. Altering those conditions were tested for their effects on PX constructs, such as mastery, challenge, autonomy, curiosity, and immersion.

We also studied the relationship of player death counts and player orientation traits – challenge and goal – with those PX constructs.

We found that there were significant differences among the respawn point location groups. Players who respawned to checkpoints typically experienced less autonomy and curiosity compared to players that respawned to start of game (permadeath) and those who respawned to savepoint. Player death counts also had significant negative relationships with all measured PX constructs, except for, surprisingly, immersion. Additionally, players' challenge orientation trait scores positively related to their experience of mastery and immersion, whereas their goal orientation trait scores positively related to their experience of autonomy. These findings suggest that modifying death and respawning mechanics has the ability to affect respective aspects of the player experience. Our findings indicate that more work can be done to further explore how to tailor experiences of failure towards specific types of players in various contexts such as entertainment and/or education (serious games).

Bibliography

[1] Espen Aarseth, Solveig Smedstad, and Lise Sunnanå. A multidimensional typology of games. In *In Proceedings of the 2003 DiGRA International Conference: Level Up*, Utrecht, The Netherlands, 01 2003. DiGRA.

[2] Vero Vanden Abeele, Katta Spiel, Lennart Nacke, Daniel Johnson, and Kathrin Gerling. Development and validation of the player experience inventory: A scale to measure player experiences at the level of functional and psychosocial consequences. *International Journal of Human-Computer Studies*, 135:102370, 2020.

[3] Sultan Alharthi, Olaa Alsaedi, Zachary Toups, Theresa Tanenbaum, and Jessica Hammer. Playing to wait: A taxonomy of idle games. pages 1–15, 04 2018.

[4] Fraser Allison, Marcus Carter, and Martin Gibbs. Good frustrations: The paradoxical pleasure of fearing death in dayz. In *Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction*, pages 119–123, 2015.

[5] Craig Anderson. Game on: Mastery orientation through the lens of a challenging video game. In *CogSci*, 2020.

[6] Craig G Anderson. Hits, quits, and retries-player response to failure in a challenging video game. In *International Conference on the Foundations of Digital Games*, pages 1–7, 2020.

[7] Craig G Anderson, Kathryn Campbell, and Constance Steinkuehler. Building persistence through failure: the role of challenge in video games. In *Proceedings of the 14th International Conference on the Foundations of Digital Games*, pages 1–6, 2019.

[8] Craig G Anderson, Jen Dalsen, Vishesh Kumar, Matthew Berland, and Constance Steinkuehler. Failing up: How failure in a game environment promotes learning through discourse. *Thinking Skills and Creativity*, 30:135–144, 2018.

[9] Alissa N Antle and Alyssa F Wise. Getting down to details: Using theories of cognition and learning to inform tangible user interface design. *Interacting with Computers*, 25(1):1–20, 2013.

[10] Batu Aytemiz and Adam M Smith. A diagnostic taxonomy of failure in videogames. In *International Conference on the Foundations of Digital Games*, pages 1–11, 2020.

[11] Richard Bartle. Hearts, clubs, diamonds, spades: Players who suit muds. *Journal of MUD research*, 1(1):19, 1996.

[12] Julia A. Bopp, Elisa D. Mekler, and Klaus Opwis. Negative emotion, positive experience?: Emotionally moving moments in digital games. In *Proceedings of the*

SIGCHI Conference on Human Factors in Computing Systems, CHI '16, pages 2996–3006, New York, NY, USA, 2016. ACM.

[13] Michael Brandse. The shape of challenge. In *International Conference of Design, User Experience, and Usability*, pages 362–376. Springer, 2017.

[14] Emily Brown and Paul Cairns. A grounded investigation of game immersion. In *CHI'04 extended abstracts on Human factors in computing systems*, pages 1297–1300, 2004.

[15] Marcus Carter and Fraser Allison. Fear, loss and meaningful play: Permadeath in dayz. *Journal of Gaming & Virtual Worlds*, 9(2):143–158, 2017.

[16] Marcus Carter, Martin Gibbs, and Greg Wadley. Death and dying in dayz. In *Proceedings of The 9th Australasian Conference on Interactive Entertainment: Matters of Life and Death*, pages 1–6, 2013.

[17] Kathy Charmaz. *Constructing Grounded Theory: A Practical Guide through Qualitative Analysis*. SAGE, London, Thousand Oaks, New Delhi, 2006.

[18] Dormann Claire. Toward ludic gerontechnology: a review of games for dementia care. In *1st International Joint Conference of DiGRA and FDG*, DiGRA/FDG '16, 2016.

[19] Delwin Clarke and P. Robert Duimering. How computer gamers experience the game situation: a behavioral study. *Computers in Entertainment (CIE) - Theoretical and Practical Computer Applications in Entertainment*, 4(3), 2006.

[20] Thomas Constant and Guillaume Levieux. Dynamic difficulty adjustment impact on players' confidence. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '19, New York, NY, USA, 2019. ACM.

[21] Amra Copcic, Sophie McKenzie, and Michael Hobbs. Permadeath: A review of literature. In *2013 IEEE International Games Innovation Conference (IGIC)*, pages 40–47. IEEE, 2013.

[22] Mihaly Csikszentmihalyi, Sami Abuhamdeh, and Jeanne Nakamura. Flow. In *Flow and the foundations of positive psychology*, pages 227–238. Springer, 2014.

[23] Marjorie Ann M Cuerdo, Anika Mahajan, and Edward F Melcer. Die-r consequences: Player experience and the design of failure through respawning mechanics. In *2021 IEEE Conference on Games (CoG)*, pages 01–08. IEEE, 2021.

[24] Marjorie Ann M Cuerdo and Edward F Melcer. I'll be back": A taxonomy of death and rebirth in platformer video games. In *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems*, pages 1–13, 2020.

[25] Steve Dahlskog and Julian Togelius. Patterns and procedural content generation: revisiting mario in world 1 level 1. In *Workshop on Design Patterns in Games*, DPG '12, New York, NY, USA, 2012. ACM.

[26] Alena Denisova and Paul Cairns. Adaptation in digital games: the effect of challenge adjustment on player performance and experience. In *Proceedings of the*

2015 Annual Symposium on Computer-Human Interaction in Play, pages 97–101, 2015.

[27] Alena Denisova and Eliott Cook. Power-ups in digital games: The rewarding effect of phantom game elements on player experience. In *In Proceedings of the 2019 Annual Symposium on Computer-Human Interaction in Play*, CHI PLAY '19, 10 2019.

[28] Carol S Dweck and Ellen L Leggett. A social-cognitive approach to motivation and personality. *Psychological review*, 95(2):256, 1988.

[29] Carol S Dweck and N Dickon Reppucci. Learned helplessness and reinforcement responsibility in children. *Journal of personality and social psychology*, 25(1):109, 1973.

[30] Christian Elverdam and Espen Aarseth. Game Classification and Game Design: Construction Through Critical Analysis. *Games and Culture*, 2(1), 2007.

[31] M Enger. What is "nintendo hard", 2011.

[32] Franz Faul, Edgar Erdfelder, Axel Buchner, and Albert-Georg Lang. Statistical power analyses using g* power 3.1: Tests for correlation and regression analyses. *Behavior research methods*, 41(4):1149–1160, 2009.

[33] E Flynn-Jones. Death smiles: A study of the function, nature and player experience of in-game death. *Unpublished PhD Thesis: University of Wales*, 2013.

[34] Daniel Friedman, Kai Pommerenke, Rajan Lukose, Garrett Milam, and Bernardo A Huberman. Searching for the sunk cost fallacy. *Experimental Economics*, 10(1):79–104, 2007.

[35] Jack Halberstam. The queer art of failure. In *The queer art of failure*. Duke University Press, 2011.

[36] Nathan Hook. *Game Research Methods*, chapter Grounded Theory, pages 309–320. ETC Press, Pittsburgh, PA, USA, 2015.

[37] Robin Hunicke. The case for dynamic difficulty adjustment in games. In *Proceedings of the 2005 ACM SIGCHI International Conference on Advances in computer entertainment technology*, pages 429–433, 2005.

[38] Wijnand A IJsselsteijn, Yvonne AW de Kort, and Karolien Poels. The game experience questionnaire. *Eindhoven: Technische Universiteit Eindhoven*, 46(1), 2013.

[39] Aaron Isaksen, Dan Gopstein, Julian Togelius, and Andy Nealen. Exploring game space using survival analysis. In *In Proceedings of the 10th International Conference on the Foundations of Digital Games*, FDG '15, 2015.

[40] Martin Jennings-Teats, Gillian Smith, and Noah Wardrip-Fruin. Polymorph: Dynamic difficulty adjustment through level generation. 06 2010.

[41] Jesper Juul. Fear of failing? the many meanings of difficulty in video games. *The video game theory reader*, 2(237-252), 2009.

[42] Jesper Juul. *The art of failure: An essay on the pain of playing video games*. MIT press, 2013.

[43] Kari Kallinen. The effects of background music on using a pocket computer in a cafeteria: Immersion, emotional responses, and social richness of medium. In *In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '04, pages 1227–1230, New York, NY, USA, 01 2004. ACM.

[44] Dominic Kao and D. Harrell. Exploring the impact of avatar color on game experience in educational games. In *2016 CHI Conference Extended Abstracts*, pages 1896–1905, 05 2016.

[45] Oleksandra Keehl and Edward Melcer. Radical tunes: Exploring the impact of music on memorization of stroke order in logographic writing systems. In *In Proceedings of the 13th International Conference on the Foundations of Digital Games*, FDG 2019, 08 2019.

[46] Harold H Kelley and John L Michela. Attribution theory and research. *Annual review of psychology*, 31(1):457–501, 1980.

[47] Brendan Keogh. When game over means game over: Using permanent death to craft living stories in minecraft. In *In Proceedings of The 9th Australasian Conference on Interactive Entertainment: Matters of Life and Death*, 09 2013.

[48] Mallory Ketcheson, Zi Ye, and T.C. Nicholas Graham. Designing for exertion: how heart-rate power-ups increase physical activity in exergames. In *In Proceedings of*

the 2015 Annual Symposium on Computer-Human Interaction in Play, CHI PLAY '15, pages 79–89, 2015.

[49] Jan Klabbers. The gaming landscape: A taxonomy for classifying games and simulations. In *Digital Games Research Conference 2003*, 01 2003.

[50] Lisbeth Klastrup. Death matters: understanding gameworld experiences. In *Proceedings of the 2006 ACM SIGCHI international conference on Advances in computer entertainment technology*, pages 29–es, 2006.

[51] Christoph Klimmt, Christopher Blake, Dorothée Hefner, Peter Vorderer, and Christian Roth. Player performance, satisfaction, and video game enjoyment. In *International conference on entertainment computing*, pages 1–12. Springer, 2009.

[52] Max Kreminski, Ben Samuel, Edward Melcer, and Noah Wardrup-Fruin. Evaluating ai-based games through retellings. In *In Proceedings of the Fifteenth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, AIIDE-19, 2019.

[53] Filip Lange-Nielsen. The power-up experience: A study of power-ups in games and their effect on player experience. In *In Proceedings of the Digital Games Research Association (DiGRA) Conference*, DiGRA '11, 2011.

[54] Patri Lankoski, Staffan Björk, et al. Game research methods: An overview. 2015.

[55] Petri Lankoski and Jussi Holopainen. *Game design research.* ETC Press Pittsburgh, PA, 2017.

[56] Raul Lara-Cabrera and David Camacho. A taxonomy and state of the art revision on affective games. *Future Generation Computer Systems*, 01 2018.

[57] Jonathan Larsson and Alberto Amigo Arias. Fun with death and failure: An exploration of player experiences in a decentralized open world rpg, 2014.

[58] Nicole Lazzaro. Why we play: affect and the fun of games. *Human-computer interaction: Designing for diverse users and domains*, 155:679–700, 2009.

[59] Alon Lessel. Nintendo hard, or hardly working?, 2013. https://venturebeat.com/community/ 2013/09/27/nintendo-hard-or-hardly-working/.

[60] Chris Lewis, Jim Whitehead, and Noah Wardrip-Fruin. What went wrong: A taxonomy of video game bugs. In *In Proceedings of the 5th International Conference on the Foundations of Digital Games*, FDG '09, 2009.

[61] Derek Lomas, Kishan Patel, Jodi L. Forlizzi, and Kenneth R. Koedinger. Optimizing challenge in an educational game using large-scale design experiments. In *In Proceedings of the 2013 SIGCHI Conference on Human Factors in Computing Systems*, CHI '13, 2013.

[62] Rafael P. De Lope and Nuria Medina-Medina. A comprehensive taxonomy for serious games. *Journal of Educational Computing Research*, 55(5):629–672, 2016.

[63] Ville Mäkelä, Sumita Sharma, Jaakko Hakulinen, Tomi Heimonen, and Markku Turunen. Challenges in public display deployments: A taxonomy of external

factors. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, CHI '17, pages 3426–3475, 2017.

[64] Ken S McAllister and Judd Ethan Ruggill. Playing to death. *American journal of play*, 11(1):85–103, 2018.

[65] Jane McGonigal. *Reality is broken: Why games make us better and how they can change the world*. Penguin, 2011.

[66] Edward Melcer and Katherine Isbister. Bridging the physical divide: A design framework for embodied learning games and simulations. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, CHI '16, 2016.

[67] Edward Melcer and Katherine Isbister. Motion, emotion, and form: Exploring affective dimensions of shape. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, pages 1430–1437. ACM, 2016.

[68] Edward F Melcer and Marjorie Ann M Cuerdo. Death and rebirth in platformer games. In *Game User Experience And Player-Centered Design*, pages 265–293. Springer, 2020.

[69] Diana Melnic and Vlad Melnic. Saved games and respawn timers: The dilemma of representing death in video games. *University of Bucharest Review: Literary and Cultural Studies Series*, 7(07):2018, 2018.

[70] Lazaros Michailidis, Emili Balaguer-Ballester, and Xun He. Flow and immersion

in video games: The aftermath of a conceptual challenge. *Frontiers in Psychology*, 9:1682, 2018.

[71] Florian Mueller, Martin Gibbs, and Frank Vetere. Taxonomy of exertion games. In *Proceedings of the 20th Australasian Computer-Human Interaction Conference*, OZCHI '08, pages 263–266, 2008.

[72] Souvik Mukherjee. 'remembering how you died': Memory, death and temporality in videogames. In *DiGRA Conference*, 2009.

[73] Lennart Nacke and Mark Grimshaw-Aagaard. Player-game interaction through affective sound. *Games Computing and Creative Technologies: Book Chapters*, 2010.

[74] Pravin Nair, Ruturaj G Gavaskar, and Kunal Narayan Chaudhury. Fixed-point and objective convergence of plug-and-play algorithms. *IEEE Transactions on Computational Imaging*, 7:337–348, 2021.

[75] Simon Niedenthal. What we talk about when we talk about game aesthetics. In *Breaking New Ground: Innovation in Games, Play, Practice and Theory - Proceedings of DiGRA 2009*, DiGRA '09, 09 2009.

[76] Serge Petralito, Florian Brühlmann, Glena Iten, Elisa D Mekler, and Klaus Opwis. A good reason to die: how avatar death and high challenges enable positive experiences. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, pages 5087–5097, 2017.

[77] Jan Plass, Steffi Heidig, Elizabeth Hayward, Bruce Homer, and Enjoon Um. Emotional design in multimedia learning: Effects of shape and color on affect and learning. *Learning and Instruction*, 29:128–140, 02 2014.

[78] Bonnie Ruberg. No fun: The queer potential of video games that annoy, anger, disappoint, sadden, and hurt. *QED: A Journal in GLBTQ Worldmaking*, 2(2):108–124, 2015.

[79] Doris C. Rusch. Mechanisms of the soul: Tackling the human condition in videogames. In *In Proceedings of the 2009 DiGRA International Conference: Breaking New Ground: Innovation in Games, Play, Practice and Theory*, DiGRA '09, 09 2009.

[80] Richard Ryan, C. Rigby, and Andrew Przybylski. The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion*, 30:344–360, 12 2006.

[81] John Salisbury and Tom Cole. Grounded theory in games research: Making the case and exploring the options. In *International Joint Conference of DiGRA and FDG*, DiGRA-FDG '16, 08 2016.

[82] Timothy Sanders and Paul Cairns. Time perception, immersion and music in videogames. In *Proceedings of the 24th BCS Interaction Specialist Group Conference*, pages 160–167, 10 2010.

[83] Anurag Sarkar and Seth Cooper. Transforming game difficulty curves using function

composition. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, pages 1–7, 2019.

[84] Mika Savolainen. Adapting game content with a player typology. 2019.

[85] E.F. Schneider. Death with a story: How story impacts emotional, motivational, and physiological responses to first-person shooter video games. 30:361–375, 2004.

[86] Kamran Sedig, Paul Parsons, and Robert Haworth. Player-game interaction and cognitive gameplay: A taxonomic framework for the core mechanic of videogames. *Informatics*, 4:4, 2017.

[87] Noor Shaker, Julian Togelius, and Mark J Nelson. *Procedural content generation in games*. Springer, 2016.

[88] Jan Smeddinck, Regan Mandryk, Max Birk, Kathrin Gerling, Dietrich Barsilowski, and Rainer Malaka. How to present game difficulty choices?: Exploring the impact on player experience. In *In Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, CHI '16, pages 5595–5607, 05 2016.

[89] Adam Smith, Chris Lewis, Kenneth Hullett, Gillian Smith, and Anne Sullivan. An inclusive taxonomy of player modeling. 03 2011.

[90] Gillian Smith and Jim Whitehead. A framework for analysis of 2d platformer levels. In *In Proceedings of the 2008 ACM SIGGRAPH Symposium on Video Games*, pages 75–80, 2007.

[91] Nathan Sorenson, Philippe Pasquier, and Steve Dipaola. A generic approach to challenge modeling for the procedural creation of video game levels. *IEEE Trans. Comput. Intellig. and AI in Games*, 3:229–244, 09 2011.

[92] Penelope Sweetser and Peta Wyeth. Gameflow: a model for evaluating player enjoyment in games. *Computers in Entertainment (CIE)*, 3(3):3–3, 2005.

[93] Gustavo F Tondello, Karina Arrambide, Giovanni Ribeiro, Andrew Jian-lan Cen, and Lennart E Nacke. "i don't fit into a single type": A trait model and scale of game playing preferences. In *IFIP Conference on Human-Computer Interaction*, pages 375–395. Springer, 2019.

[94] Zachary O Toups, Jessica Hammer, William A Hamilton, Ahmad Jarrah, William Graves, and Oliver Garretson. A framework for cooperative communication game mechanics from grounded theory. In *Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play*, pages 257–266, 2014.

[95] Eunjoon Um, Jan Plass, Elizabeth Hayward, and Bruce Homer. Emotional design in multimedia learning. *Journal of Educational Psychology*, 104:485–498, 05 2012.

[96] Wouter Van den Hoogen, Karolien Poels, Wijnand IJsselsteijn, and Yvonne De Kort. Between challenge and defeat: Repeated player-death and game enjoyment. *Media Psychology*, 15(4):443–459, 2012.

[97] D.P. Vossen. The nature and classification of games. *Avante*, 10:53–68, 01 2004.

[98] Rina R Wehbe, Elisa D Mekler, Mike Schaekermann, Edward Lank, and Lennart E

Nacke. Testing incremental difficulty design in platformer games. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, pages 5109–5113, 2017.

[99] MS James Bowie Wilson. Playing with permadeath. In *2020 IEEE Games, Multimedia, Animation and Multiple Realities Conference (GMAX)*, pages 1–5. IEEE, 2020.

Appendix A

Ludography

G1 Adventures of Hendri. (Mar 7, 2018). Developed by LionAnt.

G2 Another Sight: Hodge's Journey. (Nov 14, 2018). Developed by Lunar Great Wall Studios.

G3 Ascendance. (Mar 27, 2018). Developed by ONEVISION GAMES.

G4 Away from Earth: Mars. (Aug 23, 2018). Developed by Only Voxel Games.

G5 Block Shock. (Feb 6, 2018). Developed by VoxStudios.

G6 Bloodstained: Curse of the Moon. (May 24, 2018). Developed by INTI CREATES CO., LTD.

G7 Bloody Trapland 2: Curiosity. (Feb 1, 2019). Developed by 2Play Studios & Prasius.

G8 Bombix. (Mar 2, 2018). Developed by Pragmatix Ltd.

G9 Bouncers. (Jun 1, 2018). Developed by Firehawk Studios.

G10 Castlevania Anniversary Collection. (May 16, 2019). Developed by Konami Digital Entertainment.

G11 Celeste. (Jan 25, 2018). Developed by Matt Makes Games Inc.

G12 Chamber of Darkness. (Oct10,2018). Developed by The Crow Studios.

G13 Chasm. (Jul 31, 2018). Developed by Bit Kid, Inc.

G14 Crash Bandicoot N. Sane Trilogy. (Jun 29, 2018). Developed by Vicarious Visions & Iron Galaxy.

G15 Cube - The Jumper. (May 15, 2018). Developed by DZEJK.

G16 Cube XL. (Mar 12, 2018). Developed by Timberwolf Studios.

G17 Cybarian: The Time Travelling Warrior. (Nov 9, 2018). Developed by Ritual Games.

G18 Dead Cells. (Aug 6, 2018). Developed by Motion Twin.

G19 Death's Gambit. (Aug 13, 2018). Developed by White Rabbit.

G20 DeepWeb. (Sep 20, 2018). Developed by ImageCode.

G21 Dream Alone. (Jun 28, 2018). Developed by WarSaw Games.

G22 Dungreed. (Feb 14, 2018). Developed by TEAM HORAY.

G23 Everything Will Flow. (Jul 28, 2018). Developed by Hont.

G24 Freezeer. (Jun 21, 2018). Developed by NedoStudio.

G25 Frog Demon. (Dec 11, 2018). Developed by White Dog Games.

G26 Golfing Over It with Alva Majo. (Mar 28, 201). Developed by Majorariatto.

G27 Gris. (Dec 13, 2018). Developed by Nomada Studio.

G28 Guacamelee! 2. (Aug 21, 2018). Developed by DrinkBox Studios.

G29 I was rebuilt. (Jun 28, 2018). Developed by Gurila Ware Games.

G30 Iconoclasts. (Jan 23, 2018). Developed by Joakim Sandberg.

G31 Katana ZERO. (Apr 18, 2019). Developed by Askiisoft.

G32 Lightform. (Feb 19, 2018). Developed by Shadow Motion.

G33 Little Marisa's Disaster Journey. (Apr 28, 2018). Developed by Dark Sky Empire.

G34 MagiCats Builder (Crazy Dreamz). (Jul 10, 2018). Developed by Dreamz Studio.

G35 Mark of the Ninja: Remastered. (Oct 9, 2018). Developed by Klei Entertainment.

G36 Mega Man 11. (Oct 2, 2018). Developed by CAPCOM CO., LTD.

G37 Mind Twins - The Twisted Co-op Platformer. (Jan 19, 2018). Developed by DRUNKEN APES.

G38 Mines of Mars. (Sep 10, 2018). Developed by Wickey Ware.

G39 Neon Beats. (May 3, 2019). Developed by OKYO GAMES.

G40 Niffelheim. (Sep 26, 2018). Developed by Ellada Games.

G41 Night Fly. (Jan 24, 2018). Developed by ARGames.

G42 Order No. 227: Not one step back!. (Jul 3, 2018). Developed by High Wide.

G43 Pogostuck: Rage with Your Friends. (Feb 28, 2019). Developed by Hendrik Felix Pohl.

G44 Poultry Panic. (Jan 17, 2018). Developed by Virtual Top.

G45 Razed. (Sep 14, 2018). Developed by Warpfish Games.

G46 ReCore: Definitive Edition. (Sep 14, 2018). Developed by Armature Studio Comcept.

G47 Return. (Aug 3, 2018). Developed by Breadmeat.

G48 Richy's Nightmares. (Jul 10, 2018). Developed by Unreal Gaming.

G49 Rift Keeper. (Jan 14, 2019). Developed by Frymore.

G50 Riverhill Trials. (Apr 12, 2018). Developed by Watercolor Games.

G51 Running Man 3D. (Aug 21, 2018). Developed by GGaming.

G52 Slap City. (Mar 5, 2018). Developed by Ludosity.

G53 Steel Rats. (Nov 7, 2018). Developed by Tate Multimedia.

G54 Sure Footing. (Mar 30, 2018). Developed by Table Flip Games.

G55 The Cursed Tower. (Feb 6, 2018). Developed by Mohsin Rizvi.

G56 The Messenger. (Aug 30, 2018). Developed by Sabotage.

G57 Touhou Luna Nights. (Feb 25, 2019). Developed by Vaka Game Magazine & Team Ladybug.

G58 Trials of the Gauntlet. (Mar 16, 2018). Developed by Broken Dinosaur Studios.

G59 Trials Rising. (Feb 26, 2019). Developed by RedLynx.

G60 Vagante. (Feb 21, 2018). Developed by Nuke Nine.

G61 Viral Cry. (Mar 7, 2018). Developed by Strategy Empire.

G62 Wandersong. (Sep 27, 2018). Developed by Greg Lobanov.