# Chapter 12
# Death and Rebirth in Platformer Games

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## Contents



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**Abstract** Failure is a central aspect of almost every game experience, driving player perceptions of difficulty and impacting core game user experience concepts such as flow. At the heart of failure in many game genres is player death. While techniques such as dynamic difficulty adjustment have addressed tweaking game parameters to control the frequency of player death occurrence, there is a surprisingly limited amount of research examining how games handle what happens when a player actually dies. We posit that this is a rich, underexplored space with significant implications for player experience and related techniques. This chapter presents our exploration into the space of player death and rebirth through the creation of a generalized taxonomy of death in platformer games—one of the genres that features player death and respawning most heavily. In order to create this taxonomy, we collected and catalogued examples of death and respawning mechanics from 62 recent platformer games released on the digital distribution platform Steam after January 2018. Games selected varied equally across positive, mixed, and negative overall reviews in order to provide a broader range of mechanics, both good and bad. We observed gameplays of each individual game and noted the processes of death and rebirth, respectively. A grounded theory approach was then employed to develop the taxonomy of game death and respawning, resulting in five notable dimensions: (1) *obstacles*, (2) *death conditions*, (3) *aesthetics*, (4) *changes to player progress*, and (5) *respawn locations*. Finally, we discuss how the different dimensions and mechanics highlighted in our taxonomy have implications for key aspects of player experience, as well as how they could be used to improve the effectiveness of related techniques such as dynamic difficulty adjustment.

**Keywords** Taxonomy · Platformers · Games · In-game death · Respawning · Player experience

## 12.1 Introduction

Failure in video games, often represented through death, is a central element of the player experience (Klimmt et al. 2009). For instance, failure is well documented to have substantial positive and negative impacts on game enjoyment (Juul 2013).

It is also intrinsically linked to challenge, and consequently a major factor in the experience of game flow (Juul 2009). While there have been various approaches to examining and manipulating this critical aspect of the gaming experience—e.g., dynamic difficulty adjustment (Denisova and Cairns 2015; Hunicke 2005), difficulty design (Wehbe et al. 2017), and challenge design (Brandse 2017) and modeling (Sorenson et al. 2011)—research understanding failure explicitly as it relates to handling in-game death is surprisingly limited. We propose that how video games actually deal with in-game death is a rich, underexplored space with significant implications for player experience and related techniques such as dynamic difficulty adjustment. With that in mind, we created a taxonomy of player death and rebirth in platformer games to better understand the current design space.

Platformers are a video game genre where players typically control a game character to jump and climb between platforms while avoiding obstacles. We chose this as our genre of focus since platformer games are generally designed around constant player death and respawning in pursuit of a goal. They are also notorious for being difficult, with many such games leading to the creation of the term “Nintendo hard”—referring colloquially to the extreme difficulty of games (particularly platformers) from the Nintendo Entertainment System era (Enger 2012). Notably, the fairness of difficulty in Nintendo hard games has been called into question in recent years (Lessel 2013), highlighting that such designs can sometimes serve more to infuriate players through frequent unfair death rather than provide an appropriate challenge. A taxonomy of player death in this space provides a tool to systematically classify death and respawning mechanics across games—helping to elucidate which mechanics may evoke positive and negative player experiences, enhance or inhibit game flow, and provide sufficient challenge or create a feeling of unfairness.

In this chapter specifically, we want to understand the essential features and types of mechanics around death in video games. This is done by employing grounded theory to analyse existing platformer games of varying user rating. We chose games as our main source of data for analysis because there is a relatively limited amount of existing literature that addresses the actual mechanics around in-game death, making expert analysis of games as artefacts a more useful source of information (Alharthi et al. 2018). We start this chapter by providing background and related work on game taxonomies, game death, dynamic difficulty adjustment, and grounded theory. This is followed by an overview of our search and analysis procedure for the corpus of platformer games. We then present our **taxonomy of death and rebirth in platformer games** that is derived from the collected dataset. Finally, we conclude with a discussion of the implications and potential application areas of our framework, as well as provide insights obtained from its use on the current dataset of platformer games. It is also important to note that we provide a ludography for the 62 games included in our dataset. Therefore, when we cite a game, the reference will be prefixed with a “G” (e.g., [G7]).

## 12.2 Background

In this section, we discuss existing game taxonomies and the grounded theory methodology employed to create our taxonomy, as well as highlight relevant research examining death in video games and dynamic difficulty adjustment.

### *12.2.1 Game Taxonomies and Frameworks*

Although they are used rather interchangeably in the literature, there are some notable differences between taxonomies and frameworks. Taxonomies provide a means to organize and classify concepts while frameworks are composed of a number of concepts and the interrelations between them (Antle and Wise 2013). There can even be overlap between the two in the form of taxonomical design frameworks (e.g., Ens et al. 2014; Melcer and Isbister 2016), which treat a set of taxonomical terms as orthogonal dimensions in a design space—resulting in a matrix that provides structure for classification and comparison of designs (Robinett 1992).

In terms of games, there have been a substantial number of taxonomies and frameworks ranging from general classifications of games themselves (Aarseth et al. 2003; Elverdam and Aarseth 2007; Vossen 2004) to various aspects of games—such as core mechanics (Sedig et al. 2017), bugs (Lewis et al. 2010), player modeling (Smith et al. 2011), and external factors (Mäkelä et al. 2017)—to (most commonly) specific genres of games. E.g., serious games (De Lope and Medina-Medina 2017; Rego et al. 2010), games for dementia (Dormann 2016; McCallum and Boletsis 2013), exertion games (Mueller et al. 2008), affective games (Lara-Cabrera and Camacho 2019), idle games (Alharthi et al. 2018), and games and simulations (Klabbers 2003) to name a few. Of particular relevance to this work is the framework created by Smith et al. (2008) for analysing 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. We utilize many of these concepts in our coding scheme and taxonomy; however, their framework ultimately focuses on rhythm and pacing to evoke challenge, rather than player death.

### *12.2.2 In-Game Death*

Players are ultimately humans, and therefore, the player experience is tied to the human experience (Melnic and Melnic 2018). With respect to death, a notable fascination exists regarding the relationship between players' perception of in-game death and actual death. Some have argued that in-game death trivializes the seriousness of actual death (Frasca 2007). However, others believe that the inherent interactive nature of games is powerful in expressing meaningful facets of the human experience of life and death (Chittaro and Sioni 2018; Harrer 2013; Rusch 2009).

Players in particular can be impacted by death in games when they are attached to characters (their avatars or NPCs) at some emotional level or self-identify with the goals or events in the game (Bopp et al. 2016; Melnic and Melnic 2018; Rusch 2009; Schneider et al. 2004). For instance, when players are immersed in gameplay, the risk of death produces anxiety and encourages more careful decision-making, but can also evoke strong emotions from players that result in enjoyment and positive player experience despite the frustration that comes with the territory (Bopp et al. 2016).

Death is also an intrinsic part of gameplay (Mukherjee 2009) and the player experience (Klastrup 2006), with notoriously difficult level design in platformers resulting in frequent occurrences of player death (Enger 2012). These instances of in-game death generally impede player progress, e.g., through the loss of inventory items, achievements, or game functionality (Bopp et al. 2016). Notably, repetitive deaths have been found to increasingly reduce player enjoyment, as each death occurrence compounds as an evaluation of the insufficiency of a player's skills (Van Den Hoogen 2012). At even greater extremes, in-game death can completely reset player progress such as through the popular high-risk death mechanic, permadeath—i.e., the permanent in-game death of a playable character (c.f., Copcic et al. 2013)—which forces the player to restart the entire game upon dying. While the ability to have save states in some platformers has alleviated the difficulty of death and altered player strategy, the majority of platformer games still operate using linear, sequential checkpoints. As such, it is critical to examine the aesthetics and mechanics that comprise in-game death for a broader understanding of its overall effects on player experience.

### *12.2.3 Dynamic Difficulty Adjustment*

Dynamic difficulty adjustment (DDA) describes a challenge design strategy that continuously and automatically adapts a game's difficulty level to a player's current skill level (Jennings-Teats et al. 2010; Smeddinck et al. 2016; Zohaib 2018), and as such attempts to keep the player in a constant state of flow (Denisova and Cairns 2015). There is evidence that dynamically adjusting components in games affects their perceived difficulty (Denisova and Cairns 2015; Jennings-Teats et al. 2010; Wehbe et al. 2017) and boosts player confidence (Constant and Levieux 2019). Other advantages of DDA include a decrease in the risk of players quitting a game due to frustration from constant deaths as well as an increase in a players' perceived self-efficacy (Constant and Levieux 2019; Gilleade and Dix 2004). Furthermore, it has been argued that player engagement and enjoyment can be maximized with DDA in games (Denisova and Cairns 2015; Sarkar and Cooper 2019; Xue et al. 2017). However, one notable criticism of most current DDA techniques is that they are based on designer intuition, which may not reflect actual play patterns or mechanics (Jennings-Teats et al. 2010). Therefore, a taxonomy highlighting specific mechanics and design choices around in-game death and respawning could serve to better inform and aid the design of these techniques.

### *12.2.4 Grounded Theory*

Grounded theory methodology (GTM) is commonly used to explore new domains (Alharthi et al. 2018; Glaser and Strauss 2017). It is a data-driven and inductive research methodology where the analysis is conducted as data is collected (Hook 2015). The GTM process starts with data collection, gradually building up categories and forming a theory, before linking that theory to previous literature at the end (Hook 2015). It effectively enables a researcher to simultaneously analyse a body of artefacts (in this case platformer video games) and develop a theory about what elements of these artefacts are salient (Kreminski et al. 2019). This is usually done through the creation of a codebook which evolves over the course of the analysis and is used to note down the features of specific artefacts as they are analysed.

It is, however, important to note that GTM does not actually represent a single set of methods, as there are different philosophical schools of practice which fragment the ways it can be interpreted and deployed—often causing confusion (Glaser 1992). Notably, there are three major variants of GTM which can have major effects on the research outcome (Salisbury and Cole 2016), i.e., Strauss, Glaser, and Charmaz/Constructivist. For the creation of our taxonomy on in-game death and rebirth, we adopted the constructivist flavour of GTM (Charmaz 2006). This GTM variant frames the researcher as co-creating meaning within the domain they are studying (Charmaz 2000), focusing on providing lenses for analysis rather than a single objectively correct model of the domain (Salisbury and Cole 2016).

## 12.3 Methodology

We conducted a qualitative analysis of platformer games in order to identify the essential features and differing types of mechanics around death and respawning in platformer video games, as well as to highlight design choices that may be beneficial or detrimental to the player experience. We utilized a constructivist grounded theory approach (Charmaz 2006) (see related work) that started with an iterative process of finding and selecting platformer games. Games were analysed and coded by watching videos of gameplay as well as playing them when there was a lack of existing footage. Specifically, we employed open coding and conceptual memoing to identify the initial concepts around death and respawning. Axial coding—i.e., identifying relationships among the open codes and initial concepts (Alharthi et al. 2018)—was then employed to determine our initial set of categories. Finally, selective coding—i.e., integrating initial categories to form a core category that comprehensively describes the data (Alharthi et al. 2018)—was used to determine the final categories of our taxonomy.

| 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 |

**Fig. 12.1** The 62 platformer games in our corpus, categorized by corresponding critical reception: *Positively*, *Mixed*, and *Negatively Reviewed*. A ludography is included for our dataset

## *12.3.1 Search Strategy*

In order to obtain an accurate corpus of recent popular platformer games, we utilized the extremely popular digital games distribution platform, *Steam*, for our search. We searched for all video games that were explicitly tagged as a "Platformer". In an effort to observe trends in characteristics of recent platformers, we specifically restricted the search to video games that were released within the recent period of January 2018 to May 2019. Because we wanted to observe the most popular games in terms of rating count and *Steam* did not offer the ability to sort by number of reviews, we manually selected the top twenty or so games with the highest number of player reviews for the positively, mixed, and negatively reviewed categories below.

A total of 62 games were selected based on three categories of player ratings (see Fig. 12.1): (1) *positively reviewed*, 21 collected; (2) *mixed-reviewed*, 22 collected; and (3) *negatively reviewed*, 19 collected. We chose a fairly even spread of positively to negatively reviewed games to ensure that we were collecting the broadest range of death and respawning mechanics, both good and bad, to inform the creation of our taxonomy. Games were identified as positively reviewed if they had at least 85% or higher of their player audience positively recommend the game, mixed-reviewed if they were between 60% to 84%, and negatively reviewed if they had less than 60%. We adjusted for a high approval percentage of at least 85% for positively reviewed games, because we observed that even games with the poorest reputations had about half of their players recommend them while critically acclaimed games generally had overwhelmingly positive reviews of 90% or more.

## *12.3.2 Analysis Procedure*

### 12.3.2.1 Phase 1: Observations of Death and Rebirth Mechanics

We examined each game individually by watching a playthrough online or, if not available, obtaining the game and playing them ourselves. We recorded each game's approach to handling player death with information on what conditions result in death, where players were respawned, what was lost and gained, obstacle types, and visual and auditory representations of death. Other information we noted were its Steam game tags (in addition to "platformer"), game description, approval percentage, number of reviews, and basic game mechanics.

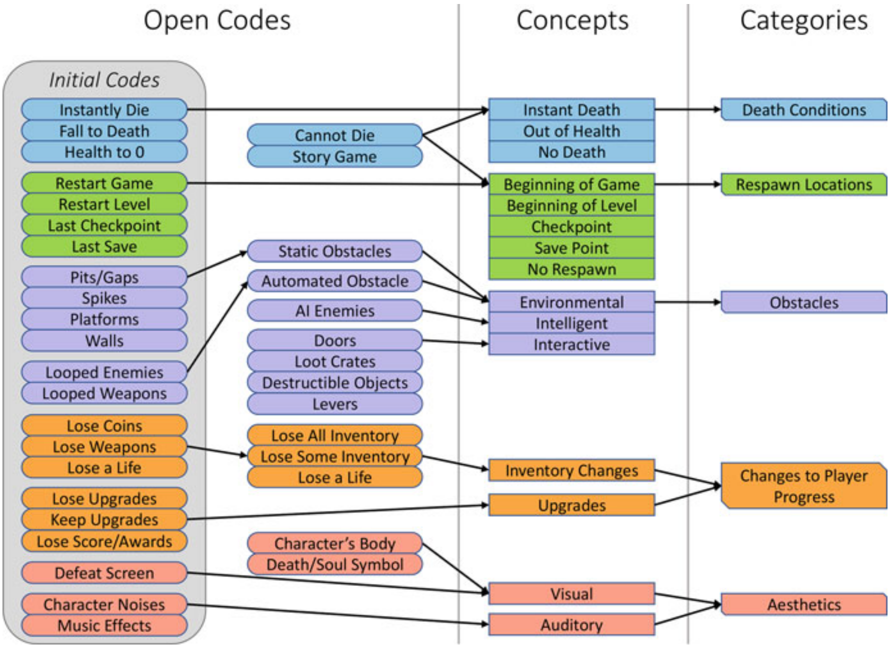


**Fig. 12.2** The coding process. Starting with open coding of observations. The open codes were then related into concepts using axial coding, and were later grouped and developed using selective coding to create our five main *Death and Rebirth Taxonomy Categories*

#### 12.3.2.2 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 death 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 5 key categories for our taxonomy of death and rebirth in platformer games. Throughout the coding process and construction of the categories, we re-observed a number of the games and reviewed related literature to refine the concepts. This coding process is further illustrated in Fig. 12.2.

## 12.4 A Taxonomy of Death and Rebirth in Platformer Games

Based on the concepts, common features, and mechanics that emerged from our analysis, we formed the **taxonomy of death and rebirth in platformer games** (see Fig. 12.3). Our taxonomy describes 5 major aspects of the cyclical process of death and rebirth in games: (1) *obstacles*, which are the cause of (2) *death conditions*

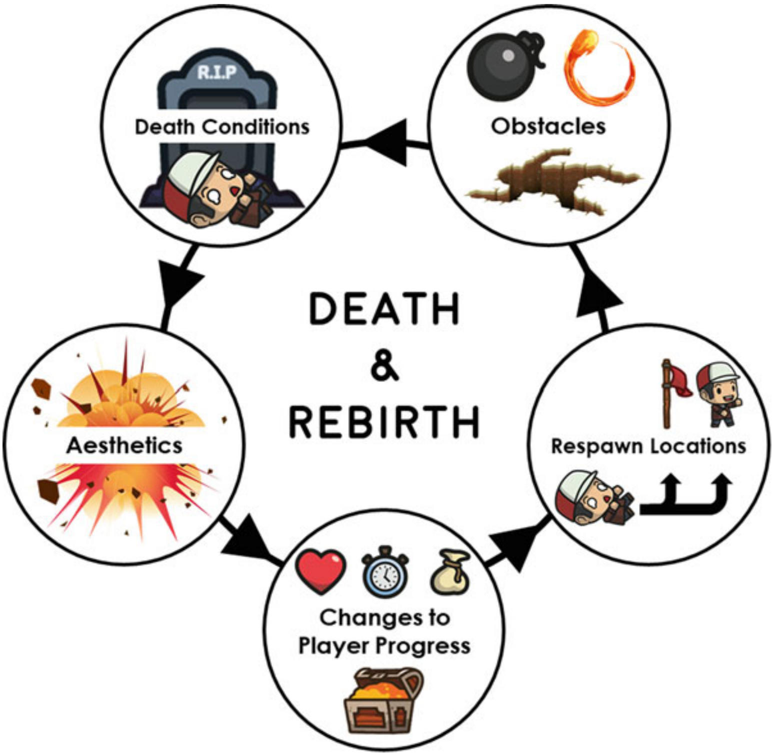


**Fig. 12.3** The death and rebirth taxonomy for platformers depicted in its cyclical nature. *obstacles* are the cause of *death conditions* being met, resulting in player death. Death is depicted through *aesthetics* and causes *changes to player progress*. Players are then reborn into *respawn locations* where they must attempt to overcome obstacles again as the cycle repeats

being met and resulting in player death depicted through (3) *aesthetics* as well as causing (4) *changes to player progress* before being reborn at (5) *respawn locations* to repeat the entire process. While not every game follows this process exactly (e.g., in some games the characters cannot die but have other forms of failure instead [G23, G26–27, G43–44]), this taxonomy provides the high-level structure necessary to understand, break down, and categorize the process of death and rebirth among a variety of platformer games. We also ran the 62 games/reviews from our corpus back through some of the taxonomy categories in order to highlight certain design decisions that may be positively or negatively impacting the player experience.

### *12.4.1 Obstacles*

Obstacles in platformers present challenges and difficulties for players to overcome (Smith et al. 2008; Sorenson et al. 2011; Wehbe et al. 2017). They are also critical elements of existing literature on analysing (Smith et al. 2008), dynamically adjusting (Hunicke 2005), and generating (Dahlskog and Togelius 2012) platformer levels. The resulting effects that obstacles have on player progress can either disrupt or encourage flow in gameplay (Isaksen et al. 2015; Lomas et al. 2013). And, ultimately, they are key factors that lead to player death (Wehbe et al. 2017). To analyse 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 death: (1) *intelligent*, (2) *environmental*, and (3) *interactive*.

#### 12.4.1.1 Intelligent

*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 of these obstacles include enemy characters that follow a player and deadly moving objects, such as homing weapons and other projectiles that aim towards the player's location. Of the 62 observed platformers, 19 predominately featured intelligent obstacles with relatively positive reviews from players (11 positive, 6 mixed, and 2 negative).

#### 12.4.1.2 Environmental

*Environmental* obstacles are components that are directly part of the game environment and can lead to player death. They can be either *static* obstacles that do not move or *automated* obstacles that move in rigid, fixed patterns. Of the 62 observed platformers, 34 of them predominately featured environmental obstacles with relatively negative player reviews (16 negative, 12 mixed, and 6 positive).

Static

*Static* environmental obstacles are immovable components of the level, such as spikes, pits, platforms, and walls. While platforms and walls do not necessarily directly result in death, their presence requires the player to make efforts to manoeuvre 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.

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. 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.

#### 12.4.1.3 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 manoeuvre 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]. Only 9 of the 62 observed platformers primarily featured interactive obstacles with fairly mixed player reviews (4 positive, 3 mixed, and 2 negative).

### *12.4.2 Death Conditions*

Platformer games heavily feature player death, to the extent that many such games have been colloquially referred to as "Nintendo hard" (Enger 2012). Player death has also been shown to evoke both positive (Bopp et al. 2016) and negative (Van Den Hoogen 2012) player experiences. As such, the primary death conditions and mechanics prevalent in these games are critical elements of the taxonomy. Specifically, we identified three distinct types of death conditions: (1) *instant death*, (2) *out of health*, and (3) *no death*. We also ran all 62 games and their review scores from the corpus back through this category of the taxonomy in order to explore if there were specific death conditions that might evoke a more positive or negative player experience (see Fig. 12.4). In Fig. 12.4, *no death* appears to be a rather neutral design choice, but using *instant death* as the primary vehicle for player death seems to create a fairly negative experience. Conversely, *out of health* appears to instill far more positive player experiences. We hypothesize that this is because *instant death* is likely to increase the frequency of player death—which has been found to subsequently decrease player enjoyment (Van Den Hoogen 2012)—over the more forgiving *out of health* death condition. However, this should be explored further in future work.

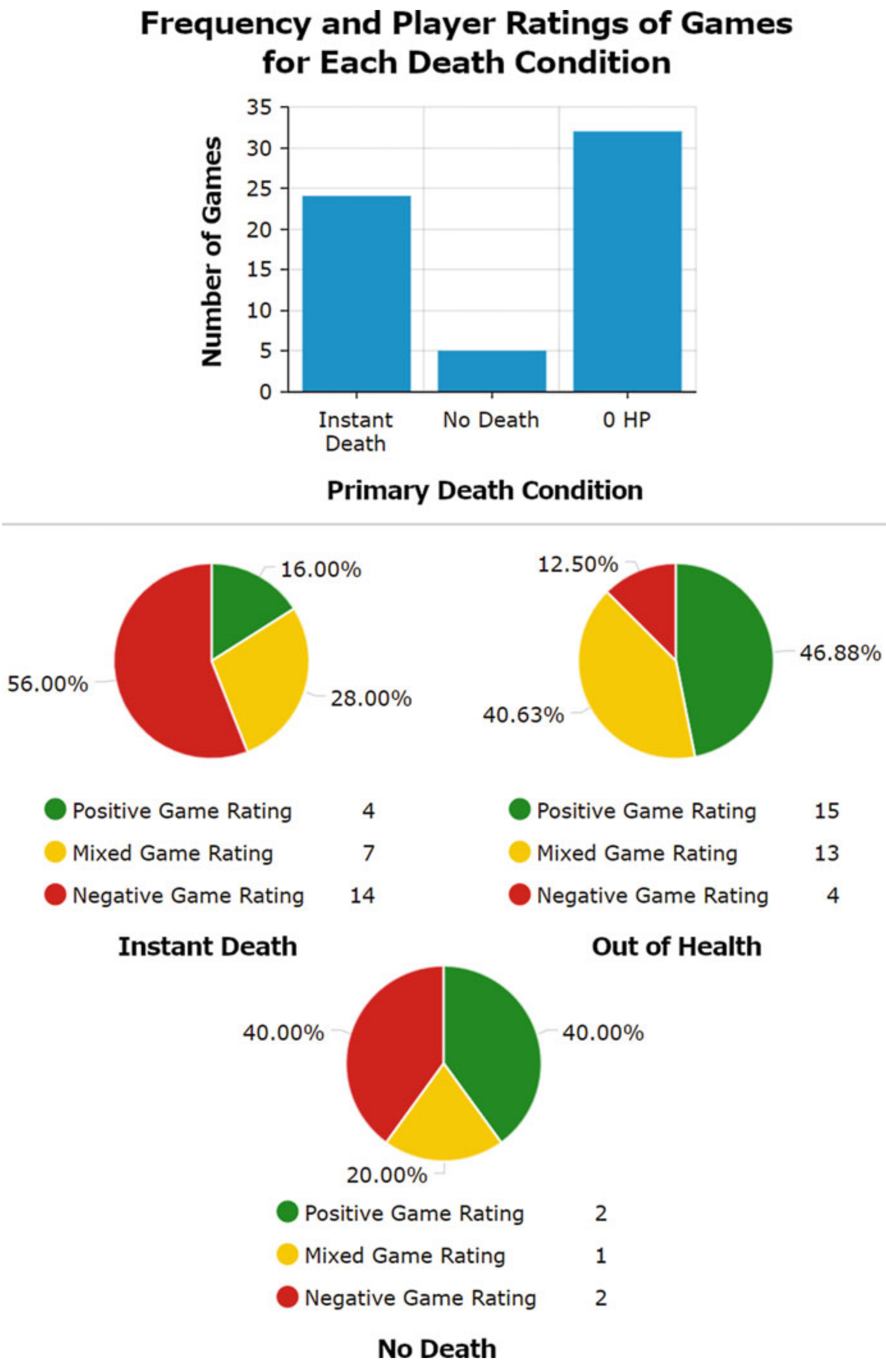


**Fig. 12.4** The frequency of games in each death condition from our 62 game corpus (top), and the distribution of player ratings for each death condition (bottom)

#### 12.4.2.1 Instant Death

*Instant death* describes games where the player's character dies immediately from a single injury, such as from hitting 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. However, as Fig. 12.4 illustrates, this positive reception is more of an exception than the rule, where the majority of games in our corpus that employed this approach received negative player feedback overall. While this death mechanic is slowly being phased out in more recent games (e.g., only featured in 15 of the 62 observed games), there is a nostalgia factor still driving interest, mirroring classic pixel perfect platformers such as Ninja Gaiden.

#### 12.4.2.2 Out of Health

*Out of health* 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. Notably, this death condition also contained significantly more positively reviewed games than the other two (15 games), and was utilized in the largest number of platformers from our corpus (32 games). This suggests it might be a highly beneficial approach to incorporate into the design of platformer games.

#### 12.4.2.3 No Death

*No death* describes games where death is not possible through the gameplay. It is also a fairly uncommon approach with only 7 of the 62 observed games falling in this category. However, no 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.

### 12.4.3 Aesthetics

Although there are a number of definitions and interpretations of game aesthetics, such as the emotional responses evoked in players (Hunicke et al. 2004), aesthetics in relation to this taxonomy refers purely to the sensory phenomena that players encounter in the game (Niedenthal 2009). Specifically, we focus on the different variations of *Visual* and *Auditory* aesthetics that occur during in-game death. However, as noted below, these aesthetic decisions can greatly impact player emotion and the overall gaming experience (Kao and Harrell 2016; Keehl and Melcer 2019; Nacke and Grimshaw 2011; Sanders and Cairns 2010), and therefore aesthetics is an important category to consider for the design of in-game death.

#### 12.4.3.1 Visual

Visuals are a critical aspect of the aesthetic experience, where even fundamental elements—such as shape and colour—can have a substantial impact on player emotions and overall experience (Kao and Harrell 2016; Melcer and Isbister 2016; Plass et al. 2014; Um et al. 2012). With respect to visual aesthetics around in-game death, we observed that the visual changes were primarily focused on the appearance of the character and/or the use of death screens. For instance, upon death, the body of the character could undergo a dissolve, explode into pieces, fall down, or disappear. Iconography such blood, skulls, and souls was also often used to indicate character death in-game, and could remain in the environment through multiple iterations of death and rebirth to indicate where the player had previously died. A number of the platformers observed would also utilize transition effects, e.g., cutting to black or tinting corners of the screen red. Death screens were also quite commonly utilized (20 of the 62 platformers) to halt gameplay and inform players of their failed attempt, as well as potentially show changes to their in-game progress—e.g., inventory items gained or lost, running death count total, number of lives left, or achievements.

#### 12.4.3.2 Auditory

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 (Kallinen 2004; Keehl and Melcer 2019; Nacke and Grimshaw 2011; Sanders and Cairns 2010). In our observed games, a number of different sound effects were employed during and immediately after death such as cries or grunts, squishing or wind noises, and short electronic sounds. Music would also often be modified such as by playing a unique melody or even abruptly stopping the background music upon death. Surprisingly, a fair number of platformers did not make any auditory changes at death (21 out of 62).

Consequently, this appears to be an often overlooked category of the taxonomy that could be better utilized to improve the emotional impact of platformer games.

### *12.4.4 Changes to Player Progress*

After a player's character dies, aspects of their progress are either retained or lost. Changes to the player's progress is an important aspect to include in our taxonomy as these types of changes have been shown to impact various aspects of the player experience (Lange-Nielsen 2011) and lead to strong emotional responses (Bopp et al. 2016). This is also a fairly prevalent category with 40 of the 62 games observed featuring some form of change to the player's progress (see Fig. 12.5). While these changes do take on a variety of forms, in an abstract sense they can be categorized as *upgrades* and *inventory changes*.

Similarly to the *death conditions* category, we ran our 62 game corpus through this category of the taxonomy in order to explore if there were specific changes to player progress that might evoke negative or positive experiences. As exemplified in Fig. 12.5, no changes to player progress appears to have a fairly even spread of game ratings while (1) changes to inventory only and (2) simultaneous upgrade and inventory changes appear to evoke increasingly positive player experiences, respectively. Surprisingly, only changing upgrades resulted in the majority of player experiences being negative and had the most negatively received games of any of the subcategories (8 games).

#### 12.4.4.1 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, custom character items, skill levels, and achievements. Prior work has shown that the use of such upgrades can have significant impact on enjoyment (Ketcheson et al. 2015; Melcer et al. 2017; Melcer and Isbister 2018) and challenge (Lange-Nielsen 2011), allowing players to customize their overall experience (Denisova and Cook 2019). Notably, Smith et al. (2008) combined the use of upgrades, specifically power-ups, and inventory into one category they referred to as *Collectible Items* in their framework. We chose to separate the two as they felt distinct and might have different impacts on the player experience, as illustrated in Fig. 12.5.

#### 12.4.4.2 Inventory Changes

Inventory systems in platformer games are another important feature to observe as they contain various explicit indicators of player progress, such as currency, lives,

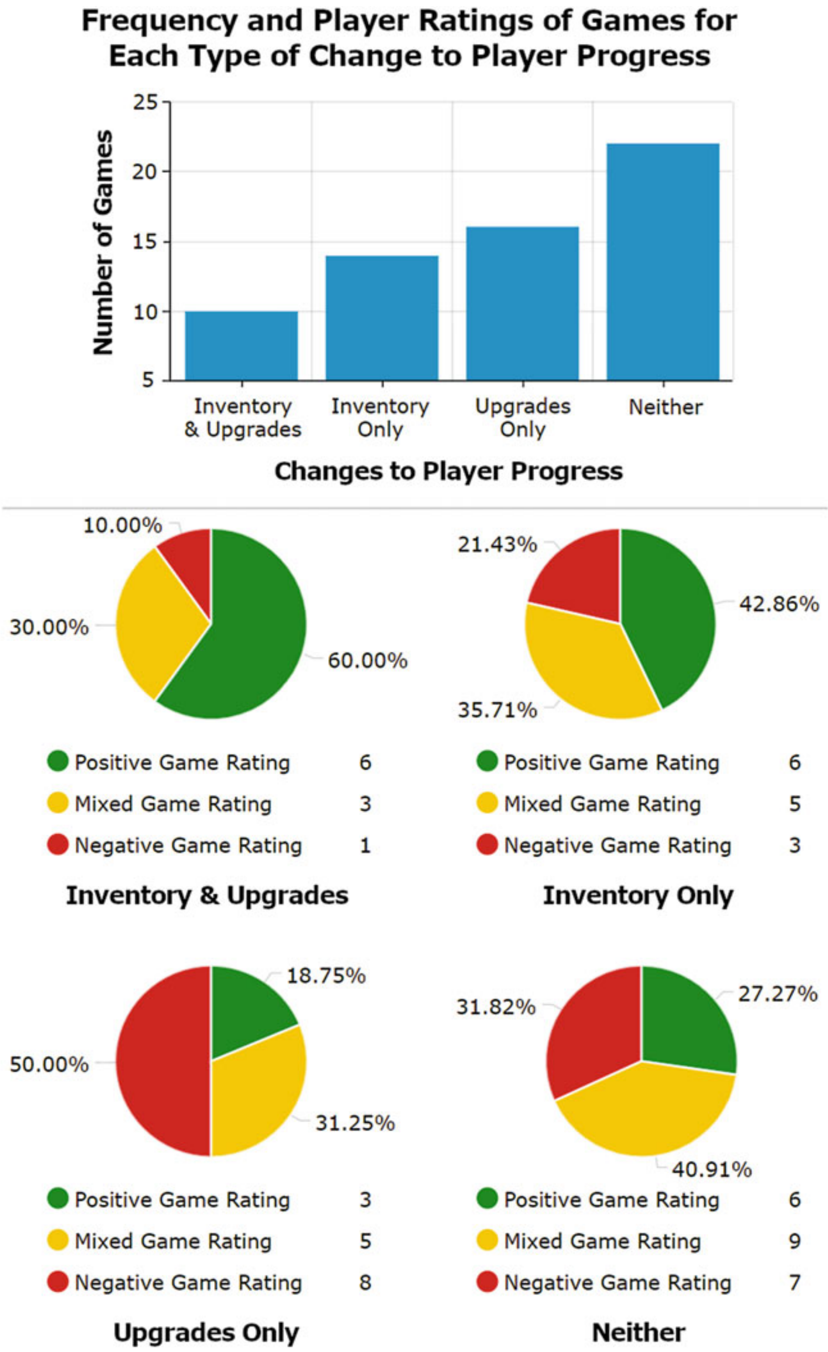


**Fig. 12.5** The frequency of games for each type of change to player progress from our 62 game corpus (left), and the distribution of player ratings for each type of change to player progress (right)

and items. We observed that the changes to inventory ranged from players' keeping all of their inventory after in-game death to losing some or all of it. Conversely, a number of games from the corpus also did not have an inventory (38 games), and did not utilize this subcategory as a result.

How much inventory is maintained or lost after in-game death alters the consequence of death for the player, and ultimately impacts the overall gameplay (Keogh 2013) and game experience (Carter et al. 2013). We observed this in our corpus as well, where games in which players lose all of their inventory after death featured far more frenetic gameplay than games where players only lost some or kept all of their inventory—which tended to be slower paced and more strategic.

### *12.4.5 Respawn Locations*

When there is death, there is also respawning in platformer games, i.e., when the player's character is brought back to life to continue gameplay. However, where the player can actually reappear varies wildly. Poor use of respawn locations (e.g., too far away or too directly into action) can lead to negative player experience (Clarke and Duimering 2006), and therefore the respawn location is another important focus of our taxonomy. For platformer games, we observed five distinct types of respawn locations: (1) *beginning of game*, (2) *beginning of level*, (3) *checkpoint*, (4) *save point*, and (5) *no respawning*.

In order to explore which respawn locations might evoke negative or positive player experiences, we ran our 62 game corpus through this category of the taxonomy (see Fig. 12.6). As illustrated in Fig. 12.6, both the use of check points and not allowing respawning at all led to fairly mixed player experiences, while respawning from the last player defined save point had quite positive player response. Surprisingly, while respawning at the beginning of a level was fairly negatively received, respawning even further back at the beginning of a game (e.g., starting over after death) had primarily positive player reviews. While there could be a number of factors contributing to this difference, we hypothesize that this may in part be due to the differences in how player progress is changed between the two subcategories (see Fig. 12.7). I.e., respawning at the beginning of the level primarily maintains upgrades only or nothing at all, while respawning at the beginning of the game primarily preserves both inventory and upgrades—giving players a stronger sense of progression.

#### 12.4.5.1 Respawn at Beginning of Game

When players are respawned at the beginning of the game, the player's current run ends and they are usually booted to the game's initial menu screen and given options to restart the game. Players must oftentimes replay all or some sections of the game as a result. Consequently, this respawn location usually means that it requires more

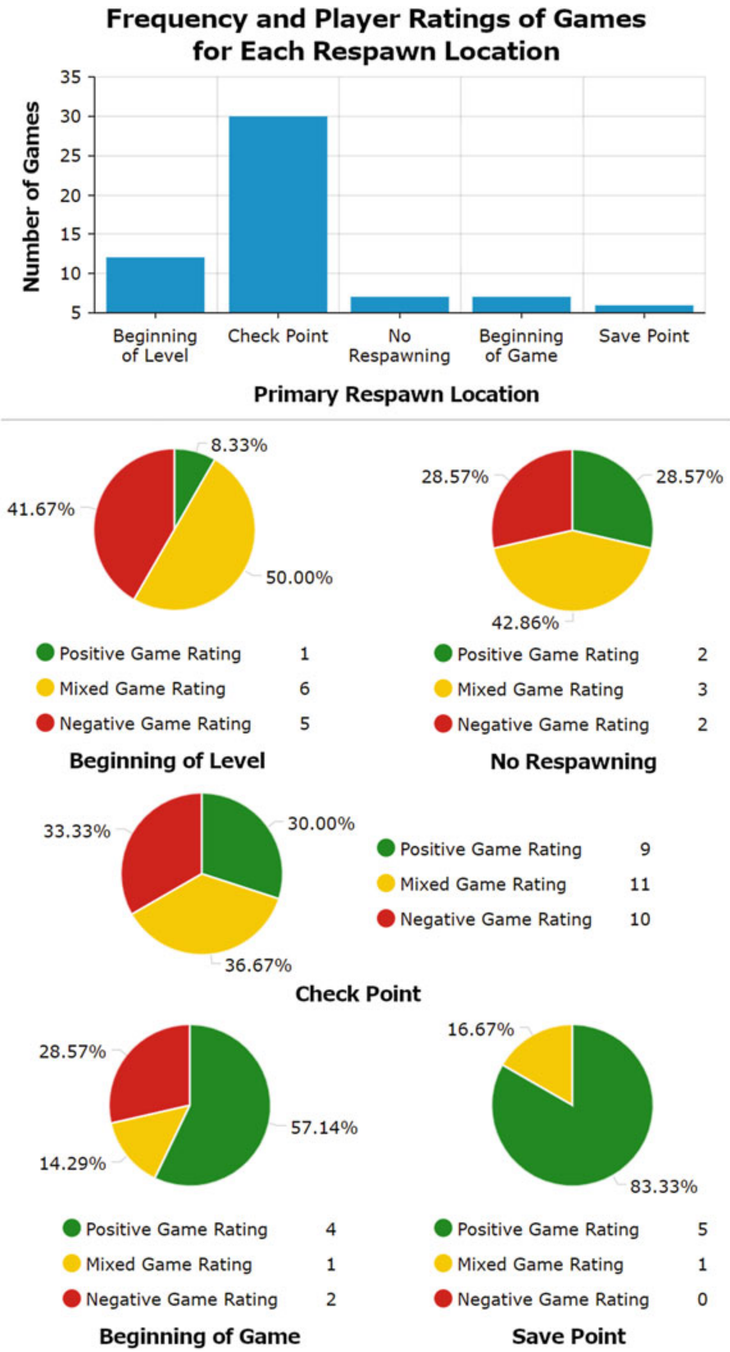


**Fig. 12.6** The frequency of games for each respawn location from our 62 game corpus (top), and the distribution of player ratings for each respawn location (bottom)

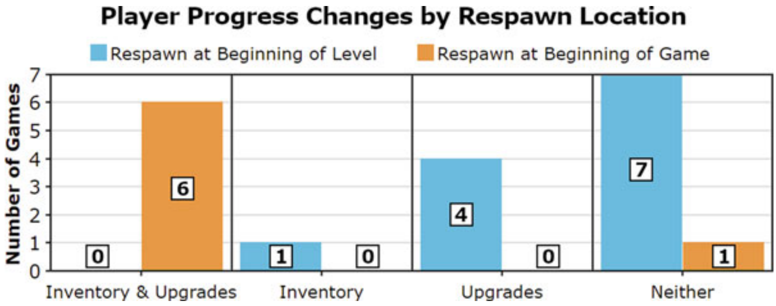


**Fig. 12.7** The differences between respawning at the beginning of a level and respawning at the beginning of the game in terms of *Changes to Player Progress*. Notably, respawning at the beginning of a game primarily maintains inventory and upgrades, while respawning at the beginning of a level primarily maintains upgrades only or nothing at all

of a player's time to attempt completing the game. However, depending on whether character and inventory progress are retained after death, restarting the game may not be a back-to-square-one situation. One well known and popular subgenre of games that focus entirely around this mechanic is permadeath (Copcic et al. 2013).

#### 12.4.5.2 Respawn at Beginning of Level

Respawning at the beginning of a 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, such as points and inventory, achieved in that failed level are lost upon death (see Fig. 12.7). The length of levels was generally dependent on subgenre, but the pixel perfect platforming style with relatively short levels in particular was common among these games. Notably, platformers from our corpus that featured this respawning location only had 1 positively reviewed game out of 12 and was fairly negatively received by players. Many of these games, such as *Freezeer* [G24] and *Cube the Jumper* [G15], also featured *instant death*—resulting in a high frequency of player deaths per level and offering another potential explanation for the highly negative player response (Van Den Hoogen 2012).

#### 12.4.5.3 Respawn at Checkpoint

Platformers in our corpus would most commonly respawn players at a checkpoint location not explicitly defined by the player (30 out of 62 games). Usually, this occurs when the character reaches a specific location in the game that automatically saves the progress, indicated by a brief saving animation or object that signifies the checkpoint location. Most platformers with checkpoints gradually increased their difficulty by expanding the distance between checkpoints as the game progressed; however, the distance was never so large that it forced the player to replay a lengthy portion of the level. I.e., checkpoints were used to break down levels into separate segments with smaller challenges for the player to overcome.

#### 12.4.5.4 Respawn at Save Point

Players are given a greater level of autonomy and control in games that have save points. 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. In the observed platformers, players activated save points by having their character interact with an object in the game environment that triggers a save in that location, or by manually saving the current progress of the game with a save function—usually through a pause menu or button press during gameplay. Notably, games that employed save points in the corpus received mainly positive reviews (5 out of 6 games). We hypothesize that this may be due to the greater autonomy that this approach affords players—which has been shown to increase enjoyment (Kim et al. 2015) and motivation (Deterding 2011)—with respect to in-game death.

#### 12.4.5.5 No Respawning

Games that had no respawning mechanics were essentially the same games that featured no death in their gameplay (see Section 4.2.3). The absence of death means that there is also no need for respawning in the game.

## 12.5 Discussion

We observed various components of platformer games to develop death and rebirth concepts for our taxonomy of death and rebirth in platformer games. We also ran our game corpus back through some of the taxonomy categories in order to highlight design decisions that may positively or negatively impact the player experience. Our taxonomy shows that there are a substantial number of mechanics, aesthetics, and design decisions that go into the death and respawning elements of games, despite the surprisingly limited amount of literature examining these categories directly.

### 12.5.1 Differentiating Roguelikes/Roguelites from Other Platformers

We observed that there were outliers of positive reception for platformers which featured high-risk gameplay. While the majority of games that employed a loss of inventory—i.e., no progress changes or maintaining only upgrades upon death—were negatively received in our corpus (see Fig. 12.5), there were two specific subsets of high-risk platformer games that still received positive reviews in this subcategory. Specifically, either pure survival games or games that applied roguelike or roguelite concepts. Although death mechanics featured in roguelikes have evolved over the years, the extremely popular mainstay features that have persisted are permadeath (Copcic et al. 2013) and procedurally generated levels (Shaker et al. 2016). Examples of these positively reviewed high-risk platformers include *Dead Cells* [G18], *Dungreed* [G22], and *Vagante* [G60].

What may seem counterintuitive makes sense when one remembers that it has been found that negative emotions triggered by in-game death can still lead to engaging positive player experiences (Bopp et al. 2016) and potential meaningful reflections of the human experience (Chittaro and Sioni 2018). The great amount of challenge is also particularly enticing to certain player types who value achievements, i.e., Advancement types (Yee 2006). Therefore, platformers with roguelike elements are high-risk, high-reward situations that certain (but not all) types of players can appreciate and actively seek out.

### 12.5.2 Examining Common Combinations of Design Choices

One fundamental feature of any taxonomy is its capability to categorize and describe existing designs (Melcer and Isbister 2016). In addition to running the 62 game corpus through the taxonomy to examine player experience for individual categories, we also examined common combinations of design choices for platformers (see Fig. 12.8)—further highlighting its descriptive power. Specifically, Fig. 12.8 shows the six most frequent combinations (5+ games for each) of *death conditions*, *changes to player progress*, and *respawn locations*. The most common combination (10 games) was the use of *checkpoints* with players dying once they run *out of health* and encountering changes to *upgrades* before respawning. Surprisingly, although this was the most frequent combination of design choices, the majority of games utilizing this combination were negatively reviewed (3 positive, 1 neutral, 6 negative). This illustrates how even popular platformer designs may not necessarily evoke the best player experience, and our taxonomy may be a useful tool to aid in identifying and improving these potentially problematic designs.

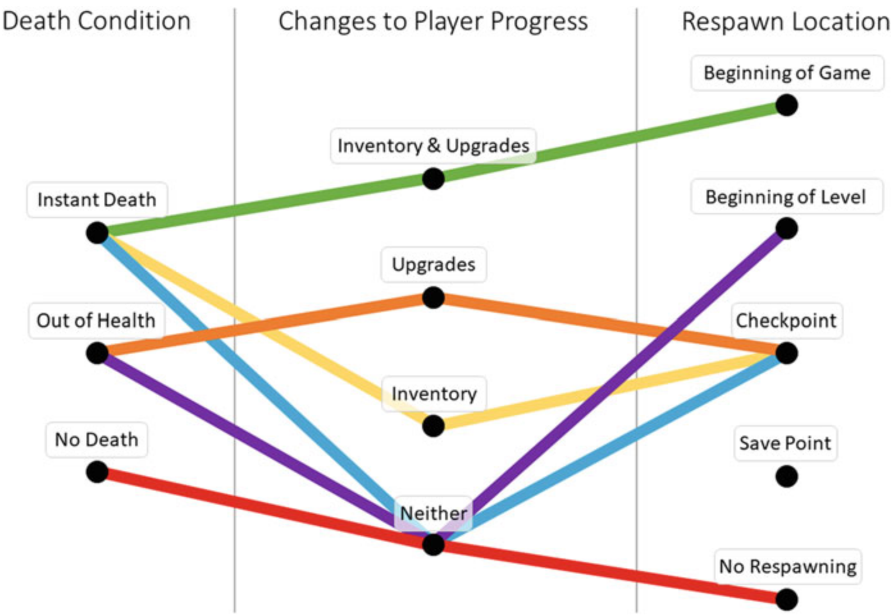


**Fig. 12.8** The top 6 combinations of design choices for *death conditions*, *changes to player progress*, and *respawn locations*

### 12.5.3 *Guiding Dynamic Difficulty Adjustment and Related Techniques*

Game designers must focus on the balance between inspiring confidence in players and providing sufficient challenge (Juul 2013). As mentioned earlier, techniques such as DDA attempt to effectively strike this balance for players of varying skill levels (Jennings-Teats et al. 2010; Smeddinck et al. 2016; Zohaib 2018), keeping the player in a constant state of flow (Denisova and Cairns 2015). However, current DDA techniques have been criticized for being based primarily on designer intuition rather than actual play patterns. While existing approaches addressing this issue have utilized machine learning (Jennings-Teats et al. 2010), our taxonomy presents a different opportunity since in-game death—and the categories of our taxonomy as a result—is inherently linked to challenge. Specifically, our taxonomy presents a structured tool grounded in the design of commercial platformers to categorize the different design possibilities around death and rebirth in games. As a result, it highlights novel and broadly applicable elements of a game's design that can be dynamically adjusted to improve the player experience. For instance, adjusting how far backwards a player respawns, how much of their progress is maintained, and the overall conditions for death are all approaches that have not been explored deeply in current DDA literature, but are highlighted in our taxonomy. Furthermore, future research could be done to examine how specific death and rebirth mechanics relate to various aspects of player experience to further inform DDA technique design. E.g., death and rebirth mechanics that enable a higher level of control could satisfy a player's need for autonomy (Ryan et al. 2006), or mechanics that better enable continuous successful progression in a game could satisfy a player's need for competence (Ijsselsteijn et al. 2008; Johnson et al. 2018; Ryan et al. 2006).

## 12.6 Limitations

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. Additionally, there are various player styles and preferences that are not accounted for in anonymous Steam user reviews. Positive and negative reviews may also not be related to aspects of death and rebirth, and could partially be from other aspects of the games (e.g., overall aesthetics, critical bugs, and so forth). As such, using overall Steam scores for a game to judge the efficacy of specific taxonomy categories is fairly limited. However, it does serve to illustrate how the taxonomic breakdown could be utilized to examine the impact of specific design decisions around the handling of death and rebirth on player experience. Finally, it is also important to note that the game experience is composed of many layers beyond what the five dimensions of our taxonomy covers, and has been represented by a number of factors in various game experience questionnaires. While the taxonomy is a helpful tool to guide some aspects of design for researchers and designers, further research is needed to clarify and nuance the relationship between death and rebirth design decisions and the many layers of player experience.

## 12.7 Conclusion

We utilized grounded theory to develop a taxonomy of death and rebirth concepts in platformer games. The goal of our taxonomy was to provide a means for game designers and researchers to better analyse and design how platformers handle in-game death. We identified 5 key categories as the basis of our **taxonomy of death and rebirth in platformer games**: (1) *obstacles*, (2) *death conditions*, (3) *aesthetics*, (4) *changes to player progress*, and (5) *respawn locations*. We also ran our 62 game corpus back through some of the taxonomy categories in order to highlight certain design decisions that may be positively or negatively impacting player experience. Further studies should be conducted to more deeply understand how categories and concepts in our taxonomy impact crucial player experience aspects such as game flow, engagement, challenge, autonomy, and self-efficacy.

## 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 and 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. (Oct 10, 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 and 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 and Concept*.
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 and 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*.

## References

Alharthi, S.A., Alsaedi, O., Toups, Z.O., Tanenbaum, J., Hammer, J. (2018). Playing to wait: A taxonomy of idle games. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (p. 621). ACM.

Antle, A.N. & Wise, A.F. (2013). Getting down to details: Using theories of cognition and learning to inform tangible user interface design. Interacting with Computers, 25(1), pp.1–20.

Aarseth, E., Smedstad, S.M., SunnanÃě, L. (2003). A multidimensional typology of games. In Proceedings of the Digital Games Research Association (DiGRA) Conference.

Bopp, J. A., Mekler, E., Opwis, K. (2016). Negative Emotion, Positive Experience? Emotionally Moving Moments in Digital Games. In Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (pp. 2996–3006). ACM.

Brandse, M. (2017). The Shape of Challenge. In International Conference of Design, User Experience, and Usability (pp. 362–376). Springer, Cham, Switzerland.

Carter, M., Gibbs, M., Wadley, G. (2013). Death and dying in DayZ. In Proceedings of The 9th Australasian Conference on Interactive Entertainment: Matters of Life and Death (p. 22). ACM.

Charmaz, K. (2000). Grounded Theory Methodology: Objectivist and Constructivist Qualitative Methods in N. K. Denzin and Y. Lincoln (eds.), Handbook of Qualitative Research (pp. 509–535).

Charmaz, K. (2006). Constructing grounded theory: A practical guide through qualitative analysis. Sage.

Chittaro, L. and Sioni, R. (2018). Existential video games: Proposal and evaluation of an interactive reflection about death. Entertainment Computing, 26, (pp. 59–77).

Clarke, D. & Duimering, P.R. (2006). How computer gamers experience the game situation: a behavioral study. Computers in Entertainment (CIE), 4(3), p.6.

Constant, T. and Levieux, G. (2019). Dynamic Difficulty Adjustment Impact on Players' Confidence. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems. ACM.

Copcic, A., McKenzie, S., Hobbs, M. (2013). Permadeath: A review of literature. In 2013 IEEE International Games Innovation Conference (IGIC) (pp. 40–47). IEEE.

Dahlskog, S. & Togelius, J. (2012). Patterns and procedural content generation: revisiting Mario in world 1 level 1. In Proceedings of the First Workshop on Design Patterns in Games (p. 1). ACM.

De Lope, R.P. & Medina-Medina, N. (2017). A comprehensive taxonomy for serious games. Journal of Educational Computing Research, 55(5), pp.629–672.

Deterding, S. (2011). Situated motivational affordances of game elements: A conceptual model. In Gamification: Using game design elements in non-gaming contexts, a workshop at CHI.

Denisova, A. & Cairns, P. (2015). 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 (pp. 97–101). ACM.

Denisova, A. & Cook, E. (2019). Power-Ups in Digital Games: The Rewarding Effect of Phantom Game Elements on Player Experience. In Proceedings of the 2019 Annual Symposium on Computer-Human Interaction in Play. ACM.

Dormann, C. (2016). Toward Ludic Gerontechnology: a Review of Games for Dementia Care. Proceedings of the 1st International Joint Conference of DiGRA and FDG.

Elverdam, C. & Aarseth, E. (2007). Game classification and game design: Construction through critical analysis. Games and Culture, 2(1), pp.3–22.

Enger, M. (2012). What is "Nintendo hard"?. http://bnbgaming.com/2011/02/08/what-is-nintendo-hard/. Accessed 8 Aug 2019.

Ens, B., Hincapié-Ramos, J.D., Irani, P. (2014). Ethereal planes: a design framework for 2D information space in 3D mixed reality environments. In Proceedings of the 2nd ACM symposium on Spatial user interaction (pp. 2–12). ACM.

Frasca, G. (2007). Ephemeral games: Is it barbaric to design videogames after Auschwitz?. Cybertext yearbook, 2, pp.172–180.

Gilleade, K. and Dix, A. (2004). Using frustration in the design of adaptive videogames. In Proceedings of the 2004 ACM SIGCHI International Conference on Advances in computer entertainment technology (pp. 228–232). ACM.

Glaser, B.G. (1992). Basics of grounded theory analysis: Emergence vs forcing. Sociology press.

Glaser, B.G. & Strauss, A.L. (2017). Discovery of grounded theory: Strategies for qualitative research. Routledge.

Harrer, S. (2013). From Losing to Loss: Exploring the Expressive Capacities of Videogames Beyond Death as Failure. Culture Unbound. Journal of Current Cultural Research (pp. 607–620).

Hook, N. (2015). Grounded theory. In Game Research Methods (pp. 309–320). ETC Press.
Hunicke, R., LeBlanc, M., Zubek, R. (2004). MDA: A formal approach to game design and game research. In Proceedings of the AAAI Workshop on Challenges in Game AI (Vol. 4, No. 1, p. 1722).
Hunicke, R. (2005). The case for dynamic difficulty adjustment in games. In Proceedings of the 2005 ACM SIGCHI International Conference on Advances in computer entertainment technology (pp. 429–433). ACM.
Ijsselsteijn, W., van den Hoogen, W., Klimmt, C., de Kort, Y., Lindley, C., Mathiak, K., Poels, K., Ravaja, N., Turpeinen, M, Vorderer, P. (2008). Measuring the Experience of Digital Game Enjoyment. In Proceedings of Measuring Behavior.
Isaksen, A., Gopstein, D., Nealen, A. (2015). Exploring Game Space Using Survival Analysis. In Proceedings of the 10th International Conference on the Foundations of Digital Games.
Jennings-Teats, M., Smith, G., Wardrip-Fruin, N. (2010). Polymorph: Dynamic Difficulty Adjustment Through Level Generation. In Proceedings of the 2010 Workshop on Procedural Content Generation in Games.
Johnson, D., Gardner, M.J., Perry, R. (2018). Validation of two game experience scales: The Player Experience of Need Satisfaction (PENS) and Game Experience Questionnaire (GEQ). International Journal of Human-Computer Studies (pp. 38–46). 118.
Juul, J. (2009). Fear of failing? the many meanings of difficulty in video games. The video game theory reader, 2(237–252).
Juul, J. (2013). The art of failure: An essay on the pain of playing video games. MIT press.
Kallinen, K. (2004). The effects of background music on using a pocket computer in a cafeteria: Immersion, emotional responses, and social richness of medium. In CHI'04 Extended Abstracts on Human Factors in Computing Systems (pp. 1227–1230). ACM.
Kao, D. & Harrell, D.F. (2016). Exploring the impact of avatar color on game experience in educational games. In Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems (pp. 1896–1905). ACM.
Keehl, O. & Melcer, E. (2019). Radical tunes: exploring the impact of music on memorization of stroke order in logographic writing systems. In Proceedings of the 14th International Conference on the Foundations of Digital Games. ACM.
Keogh, B. (2013). When game over means game over: using permanent death to craft living stories in minecraft. In Proceedings of The 9th Australasian Conference on Interactive Entertainment: Matters of Life and Death (p. 20). ACM.
Ketcheson, M., Ye, Z., Graham, T.C. (2015). Designing for exertion: how heart-rate power-ups increase physical activity in exergames. In Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play (pp. 79–89). ACM.
Kim, K., Schmierbach, M.G., Chung, M.Y., Fraustino, J.D., Dardis, F., Ahern, L. (2015). Is it a sense of autonomy, control, or attachment? Exploring the effects of in-game customization on game enjoyment. Computers in Human Behavior, 48, pp.695–705.
Klastrup, L. (2006). Why death matters: understanding gameworld experiences. In Proceedings of the 2006 ACM SIGCHI international conference on Advances in computer entertainment technology (p. 29). ACM.
Klabbers, J.H. (2003). The gaming landscape: a taxonomy for classifying games and simulations. In Proceedings of the Digital Games Research Association (DiGRA) Conference.
Klimmt, C., Blake, C., Hefner, D., Vorderer, P., Roth, C. (2009). Player performance, satisfaction, and video game enjoyment. In International Conference on Entertainment Computing (pp. 1–12). Springer, Berlin, Heidelberg.
Kreminski, M., Samuel, B., Melcer, E., Wardrip-Fruin, N. (2019). Evaluating AI-Based Games Through Retellings. In Proceedings of the Fifteenth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE-19). AAAI.
Lange-Nielsen, F. (2011). The Power-up Experience: A study of Power-ups in Games and their Effect on Player Experience. In Proceedings of the Digital Games Research Association (DiGRA) Conference.

Lara-Cabrera, R. & Camacho, D., (2019). A taxonomy and state of the art revision on affective games. Future Generation Computer Systems, 92, pp.516–525.

Lessel, A. (2013). Nintendo Hard, or Hardly Working?. https://venturebeat.com/community/2013/09/27/nintendo-hard-or-hardly-working/. Accessed 10 Sep 2019.

Lewis, C., Whitehead, J., Wardrip-Fruin, N. (2010). What went wrong: a taxonomy of video game bugs. In Proceedings of the fifth international conference on the foundations of digital games (pp. 108–115). ACM.

Lomas, D., Patel, K., Forlizzi, J., Koedinger, K. (2013). Optimizing Challenge in an Educational Game Using Large-Scale Design Experiments. In Proceedings of the 2013 SIGCHI Conference on Human Factors in Computing Systems (pp. 89–98).

Mäkelä, V., Sharma, S., Hakulinen, J., Heimonen, T., Turunen, M. (2017). Challenges in public display deployments: A taxonomy of external factors. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (pp. 3426–3475). ACM.

McCallum, S. & Boletsis, C. (2013). A taxonomy of serious games for dementia. In Games for Health (pp. 219–232). Springer Vieweg, Wiesbaden.

Melcer, E.F. & Isbister, K. (2016). 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 (pp. 2225–2233). ACM.

Melcer, E. & Isbister, K. (2016). Motion, Emotion, and Form: Exploring Affective Dimensions of Shape. In Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems (pp. 1430–1437). ACM.

Melcer, E.F., Hollis, V., Isbister, K. (2017). Tangibles vs. Mouse in Educational Programming Games: Influences on Enjoyment and Self-Beliefs. In Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems (pp. 1901–1908). ACM.

Melcer, E.F. & Isbister, K. (2018). Bots & (Main) Frames: exploring the impact of tangible blocks and collaborative play in an educational programming game. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (p. 266). ACM.

Melnic, D. & Melnic, V. (2018). Saved games and respawn timers: The dilemma of representing death in video games. In University of Bucharest Review: Literary and Cultural Studies Series (pp. 29–37). VII.

Mueller, F.F., Gibbs, M.R., Vetere, F. (2008). Taxonomy of exertion games. In Proceedings of the 20th Australasian Conference on Computer-Human Interaction: Designing for Habitus and Habitat (pp. 263–266). ACM.

Mukherjee, S. (2009). 'Remembering How You Died': Memory, Death and Temporality in Videogames. In Proceedings of the Digital Games Research Association (DiGRA) Conference.

Nacke, L.E. & Grimshaw, M. (2011). Player-game interaction through affective sound. In Game sound technology and player interaction: Concepts and developments (pp. 264–285). IGI global.

Niedenthal, S. (2009). What we talk about when we talk about game aesthetics. In Proceedings of the Digital Games Research Association (DiGRA) Conference.

Plass, J.L., Heidig, S., Hayward, E.O., Homer, B.D., Um, E. (2014). Emotional design in multimedia learning: Effects of shape and color on affect and learning. Learning and Instruction, 29, pp.128–140.

Rego, P., Moreira, P.M., Reis, L.P. (2010). Serious games for rehabilitation: A survey and a classification towards a taxonomy. In 5th Iberian conference on information systems and technologies (pp. 1–6). IEEE.

Robinett, W. (1992). Synthetic experience: A proposed taxonomy. Presence: Teleoperators & Virtual Environments, 1(2), pp.229–247.

Rusch, D. (2009). Mechanisms of the Soul-Tackling the Human Condition in Videogames. In Proceedings of the Digital Games Research Association (DiGRA) Conference.

Ryan, R., Rigby, C.S., Przybylski, A. (2006). The Motivational Pull of Video Games: A Self-Determination Theory Approach. Motivation and Emotion, pp. 344–360, 30(4).

Salisbury, J.H. and Cole, T., 2016. Grounded Theory in Games Research: Making the Case and Exploring the Options. In Proceedings of the 1st International Joint Conference of DiGRA and FDG.

Sanders, T. & Cairns, P. (2010). Time perception, immersion and music in videogames. In Proceedings of the 24th BCS interaction specialist group conference (pp. 160–167). British Computer Society.

Sarkar, A. and Cooper, S. (2019). Transforming Game Difficulty Curves using Function Composition. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems. ACM.

Schneider, E., Lang, A., Shin, M., Bradley, S., 2004. Death with a Story: How Story Impacts Emotional, Motivational, and Physiological Responses to First-Person Shooter Video Games. In Human Communication Research (pp. 361–375), 30(3).

Sedig, K., Parsons, P., Haworth, R. (2017). PlayerâĂŞgame interaction and cognitive gameplay: A taxonomic framework for the core mechanic of videogames. In Informatics (Vol. 4, No. 1, p. 4). Multidisciplinary Digital Publishing Institute.

Smeddinck, J.D., Mandryk, R.L., Birk, M.V., Gerling, K.M., Barsilowski, D., Malaka, R. (2016). How to present game difficulty choices?: Exploring the impact on player experience. In Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (pp. 5595–5607). ACM.

Smith, G., Cha, M. and Whitehead, J. (2008). A framework for analysis of 2D platformer levels. In Proceedings of the 2008 ACM SIGGRAPH symposium on Video games (pp. 75–80). ACM.

Smith, A.M., Lewis, C., Hullett, K., Smith, G., Sullivan, A. (2011). An inclusive taxonomy of player modeling. University of California, Santa Cruz, Tech. Rep. UCSC-SOE-11-13.

Sorenson, N., Pasquier, P., DiPaola, S. (2011). A generic approach to challenge modeling for the procedural creation of video game levels. IEEE Transactions on Computational Intelligence and AI in Games, 3(3), pp.229–244.

Shaker, N., Togelius, J., Nelson, M.J. (2016). Procedural content generation in games. Switzerland: Springer International Publishing.

Um, E., Plass, J.L., Hayward, E.O., Homer, B.D. (2012). Emotional design in multimedia learning. Journal of educational psychology, 104(2), p.485.

Van Den Hoogen, W., Poels, K., Ijsselstein, W., De Kort, Y. (2012). Between Challenge and Defeat: Repeated Player-Death and Game Enjoyment. Media Psychology, 15(4).

Vossen, D.P. (2004) The nature and classification of games. Avante, 10(1).

Wehbe, R.R., Mekler, E.D., Schaekermann, M., Lank, E., Nacke, L.E. (2017). Testing Incremental Difficulty Design in Platformer Games. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (pp. 5109–5113). ACM.

Xue, S., Wu, M., Kolen, J., Aghdaie, N., Zaman, K. (2017). Dynamic Difficulty Adjustment for Maximized Engagement in Digital Games. In Proceedings of the 26th International Conference on World Wide Web Companion (pp. 465–471). ACM.

Yee, N. (2006). Motivations for play in online games. CyberPsychology & behavior, 9(6), pp.772–775.

Zohaib, M. (2018). Dynamic Difficulty Adjustment (DDA) in Computer Games: A Review. Advances in Human-Computer Interaction.