

# **Investigating Gamer Strategies: How Casual and Hardcore Players Overcome Breakdowns**

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*Tom Knoll, 8<sup>th</sup> October 2012*

# Abstract

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Digital games are rich learning environments that require a gamer to engage in challenging situations in order to progress. Recent research has suggested that the act of overcoming in-game problems provides opportunities for learning to occur. These incidents are known as 'breakdowns' and require the gamer to develop new skills. But little is known about how gamers develop these skills and learn to overcome breakdowns.

A study is presented which aimed to develop standardised categories of strategies that describe the approaches used by gamers to overcome breakdowns. Participants played two different games for 20 minutes each and the footage was analysed to identify the breakdowns encountered and to determine the approaches used to overcome them. The results showed that casual and hardcore gamers experienced different breakdowns depending on the nature of the game. In resolving these breakdowns, a set of five broad strategies were developed that could account for all of the approaches used. Casual and hardcore gamers tended to apply different strategies in response to the same types of breakdowns. It is suggested that developers could use this information to make games that maintain a gamers' involvement for longer and appeal to a broader audience by considering how different gamers respond to challenges within the game.

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# 1 Introduction

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Digital games have become a very popular pastime. According to McGonigal (2011), “Collectively, the planet is now spending more than 3 billion hours a week gaming” (p. 6). As stated by Malone (1981), games have a high level of intrinsic motivation where playing is satisfying enough without requiring any form of external reward. In addition, games are also rich learning environments where, according to Gee (2004), people learn to experience the world in new ways, join and collaborate with other people with shared interests (affinity groups) and develop resources for problem solving within the game.

This combination of intrinsic motivation and learning potential make games highly desirable in formal educational settings such as schools. Several studies have investigated the potential for using games in the classroom (Squire, 2005; Rowe, 2010) with mixed success. ‘Edutainment’ games often focus on providing declarative knowledge which is not necessarily the most effective way to use games in education. While games such as *SimCity* and the *Civilization* series might offer content that is relevant to a school’s curriculum, Gee (2004) argues that games have more to offer than mere ‘content’. They allow the gamer to learn in a more active way by immersing them in an environment where they can engage and explore the possibilities within a particular subject, rather than the passive ‘facts and figures’ approach favoured in traditional education. The acquisition of standardised blocks of information is not important to Gee (2004), more the unique role that games can play in encouraging the gamer to explore

a subject in new ways, test out hypotheses and see mistakes as learning opportunities. These are skills that are particularly valuable to an academic context. But it is not just formal educational settings that are starting to see the benefit of understanding the process of learning in games. Juul (2010) suggests that games are becoming more popular among people who were not previously gamers. This increase in gamer numbers has been attributed to developers creating games that are simpler to learn. Developers need to continue this trend if they are going to attract a broader audience without alienating experienced gamers<sup>1</sup>.

But while Gee (2004) and others acknowledge that learning is taking place within games; they don't provide a method for researching how this learning occurs. This methodological gap was first noticed by Squire (2002) who claimed: "there has been very little disciplined study of gaming" (p. 2). Oliver and Carr (2009) also acknowledged Squire's claim when researching the importance of social aspects in the learning process.

The following chapters will show that researchers are beginning to address this issue by investigating the moment-by-moment interactions of gamers in an attempt to identify when learning occurs. One promising area of this research to be reviewed in the next chapter is the use of 'breakdowns' (Pelletier & Oliver, 2006; Ryan & Siegal, 2009; Iacovides et al, 2011). Breakdowns provide a focus of analysis to help identify instances of learning. Using breakdowns to recognise when learning occurs provides the basis for the present study which seeks to

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<sup>1</sup> Depending on the authors, some research refers to people who play games as 'players', other studies refer to them as 'gamers'. For the sake of consistency, the term: 'gamers' will be used for the remainder of this dissertation, except where 'player' is used in a quote or as part of a concept.

build on existing research by investigating how this learning is taking place. Pelletier and Oliver (2006) attempted to understand how learning occurred by using breakdowns to develop a set of strategies used by gamers. This research was based on a case study approach that only that only focused on low-level strategies (such as 'click on unusual objects'), so generalisability is limited. Apart from this, there has been little research conducted into the use of strategies to overcome breakdowns. Further research is required to determine if gamer strategies are the missing link between encountering a problem (or breakdown) and successfully overcoming it.

The main purpose of the present study is to further our understanding of the gameplay experience by identifying specific points where gamers encounter problems, how these problems differ from gamer to gamer and what strategies they adopt to overcome these problems. This will provide a more complete picture of the nature of learning within games. It is hoped that this research will be valuable to game designers who want to create games that balance challenge with usability / learnability. This will enable games to become more accessible to gamers of all levels. This research aims to be broad enough that it can be applied across different genres of game and types of gamer. The next chapter will present an overview of previous research that has investigated gamer experience.

# 2 Literature Review

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This chapter reviews previous research in the field of gamer experience. To start with, a discussion of some of the methods commonly used to assess gamer experience is presented. This is followed by an introduction to the concept of breakdowns which is specifically aimed at understanding when and what gamers learn when they play games. After this, a section which explores meaningful ways to compare gamers with respect to the breakdowns that they experience is provided. Finally, a summary section outlining the directions and motivations for the current research is presented.

## 2.1 Methods for measuring gamer experience

This section will introduce some methods that have been previously used to assess gamer experience. This is not an exhaustive list, but gives an indication of commonly used approaches in this area of research.

### 2.1.1 Self-reporting

Questionnaires, interviews and think-aloud protocol are widely used methods of user testing which rely on data being provided by the participant. Questionnaires provide a way of standardising data collection between participants, but result in a reflective perspective that is not grounded in the context of the game as it happens. While there are questionnaires that measure gamer experience (Jennett et al, 2008); they are considered to be most

effective for evaluating functional properties or features of games (Fierley & Engl, 2010).

Interviews have been described as “a conversation with a purpose” (Kahn & Cannell, 1957) and would normally involve the participant playing through a section of a game alone and then being probed by the experimenter for feedback. In gaming research, a semi-structured interview would normally fit the exploratory nature of games (Schutter & Abeele, 2010). In general however, it can be difficult for researchers to remain impartial and avoid leading questions because even the tone of voice and the body language of the interviewer can influence the participant’s responses, even if this is unintentional (Preece, Rogers & Sharp, 2011).

Thinking aloud requires the participant to provide a commentary of their interaction with the game as they play it. This method can help determine what is going on in the participant’s head, which is something that is not possible with observation. One drawback with this method in gaming studies is that the act of thinking aloud can negatively affect a participant’s performance (Fierley & Engl, 2010). An alternative is retrospective thinking aloud (Hoonhout, 2008); where the commentary is provided afterwards while watching a video of the gameplay, as used in Khaled (2012). A drawback of retrospective think-alouds is that they require the testing session to be twice as long.

### **2.1.2 Observation**

Participants can sometimes find it difficult to accurately articulate how they completed a task through self-report methods such as interviews and questionnaires. Observation allows the researcher to gather detailed data while the participant has the opportunity to engage in uninterrupted interaction with a game. Participants can either be directly observed as they perform certain activities or observed indirectly through video or audio recordings of the session (Preece et al, 2011). Observation has been used in a number of gamer experience studies (Pelletier & Oliver, 2006; Ryan & Siegal, 2009), but the method does have its limitations. Firstly, just knowing that they are being observed might influence a participants' behaviour and secondly, observation on its own can only tell you what the participant did, but not why they did it.

### **2.1.3 Gameplay metrics**

Gameplay metrics allow gamer experience data to be collected remotely by logging participant's interactions with the game. Large amounts of data are gathered from gamers, which provide a completely accurate representation of a gameplay session. Over a large number of participants, this data can be used in visualisations such as heat maps to identify sections of the game that cause problems (such as excessive deaths due to high difficulty) so that they can be addressed (Drachen & Canossa, 2009). Some other key benefits of this method (as identified by Kim et al, 2008) are the reduction of experimenter bias, the potential for large sample sizes and no limitation on the length of testing sessions. However, with participants generally located remotely, it is difficult to determine for sure what gamers' intentions were when they performed particular

actions. For this reason, gameplay metrics are only really useful for identifying when and where a gamer encountered difficulty, but not why.

#### **2.1.4 Physiological measures**

Measuring the body's physiological activity in response to psychological manipulations has been used to investigate gamer experience in games. Commonly used measures are heart rate, galvanic skin response and electromyography (EMG) (Drachen et al, 2010; Mandryk & Inkpen, 2004). These methods have been used in response to concern that data collected through self-reporting alone may not correspond to what actually happened. Self-reporting relies on the participant to articulate their experiences accurately, often after the event. Physiological techniques have been used to identify affective states such as immersion, challenge and tension which have been corroborated with self reports (Gualeni, Janssen & Calvi, 2012). These are encouraging findings as physiological responses are difficult to fake. This approach does have its limitations such as the need for fairly intrusive sensors on the body, interference from non-game related events (such as talking or laughing disrupting EMG), and that these methods produce a large amount of data that is time consuming to analyse.

#### **2.1.5 Eye-tracking data**

The movement of participants' eyes can provide information about their experience of a game, helping to identify behaviours that are hard to articulate. Points of fixation have been linked to focus of attention (Rudmann, McConkie & Zheng, 2003), which has led to its use when evaluating educational games

(Muir & Conati, 2012) and establishing gamer strategies, such as the different approaches used by children and adults in a game (Pretorius, Gelderblom & Chimbo, 2010). While special equipment is required (which is fairly expensive), the method is unobtrusive and can be interpreted easily through visualisations of the data in gaze plots and heat maps. On the basis of this information, recommendations can be made such as minimising the salience of distracting stimuli or placing important elements where participants expect to find them. But fixations do not communicate meaning (Ross, 2009); they can only show you where a participant was looking but not why. Eye tracking still requires the participant to put the data into context.

The literature reviewed here indicates that a wide variety of methods are available, but few of them can be used reliably in isolation. The next section describes an approach that can be used to focus data gathering and analysis on moment-by-moment instances of learning.

## **2.2 Breakdowns**

None of the techniques examined in the previous section are robust enough to explore learning in games on their own. This section describes a focus for analysis that can be used in conjunction with these methods to recognise opportunities for learning in games and provide a starting point for identifying the strategies used by gamers.

## 2.2.1 What is a 'breakdown'?

*"Breakdowns are observable critical incidents where a learner is struggling with the technology, is asking for help, or appears to be labouring under a clear misunderstanding."* – Sharples (2009, p. 10)

This quote from Sharples (2009) initially seems to suggest that breakdowns are a hindrance to learning rather than a catalyst. Although Sharples was investigating mobile technology, other researchers have looked at breakdowns as a way to identify opportunities for learning in games. Pelletier and Oliver (2006) were looking for a way to study gameplay on a moment-by-moment basis as a way to investigate the potential for games in an educational setting. The methodology they developed was based on Activity Theory (Kuutti, 1996), which suggests that a subjects' intention to achieve an objective is mediated by a tool (the way a gamer interacts with the virtual world such as through an avatar) and the rules of the game. The relationship between these factors is known as an activity system. 'Contradictions' (or breakdowns) that occur within an activity system are considered to be motivational opportunities for learning.

*"...learning is an active, creative process motivated by problems rather than something that follows from the smooth operation of successful activity systems."* – Pelletier and Oliver (2006, p. 332)

This quote acknowledges that problems do not necessarily need to be eradicated from the gameplay experience but can actually be beneficial to the learning process. Through observation, breakdowns were used to identify strategies that gamers adopt to overcome problems encountered during gameplay. This directly addressed Squire's (2002) earlier concern that it was not possible to understand what people learn from games without evidence from particular instances of play. While Pelletier and Oliver's work does provide evidence that learning is occurring during gameplay, the strategies that they identified are very specific to particular games and low-level (such as 'click on unusual objects'). They also adopted a case-study approach, so it is difficult to generalise from such a small sample. For this reason, it is unlikely that they could be applied in a de-contextualised way. Pelletier and Oliver also treat all breakdowns as opportunities for learning. They do not consider the quality of the breakdowns encountered; whether they are due poor design or intentionally engineered by developers to facilitate learning.

### **2.2.2 'Good' breakdowns and 'bad' breakdowns**

The concept of breakdowns was developed further by Ryan and Siegal (2009) as a way of creating a framework for heuristically evaluating games in terms of usability / learnability. Like Pelletier and Oliver (2006), this study acknowledges the importance of breakdowns within gameplay to provide the challenge that gamers' desire. But Ryan and Siegal differentiated between breakdowns that are required for learning purposes and those that are detrimental to the enjoyment of games. They came up with the following two categories of breakdown:

**Breakdowns of Interaction** – Considered a natural part of gameplay. Gamers develop new strategies in response to the changing conditions of the gameplay environment.

**Breakdowns of Illusion** – Where gamers become disconnected with the unfamiliar functioning of the virtual environment and lose their sense of engagement with the game.

It is suggested by Ryan and Siegal that developers are mainly concerned with minimising breakdowns of illusion but don't necessarily support breakdowns of interaction enough to prevent them from developing into breakdowns of illusion. The purpose of this research was to offer a set of guidelines that developers could use to support breakdowns of Interaction by providing opportunities for learning. At the same time, these guidelines help to maintain the element of challenge in games in a way that the level of difficulty does not exceed the gamers' ability.

This research affirms the potential of breakdowns as a way of studying learning as it occurs on a moment-by-moment basis. However, the problem with Ryan and Siegal (2009) and Pelletier and Oliver (2006) are that they based their assertions on observation alone, without follow-up discussion with their participants. Without some sort of self-reported input from participants, these studies can not determine for sure what a participant was trying to achieve with a particular action. Also, their methodology can not account for previous

knowledge that participants might have had and where this knowledge came from.

Iacovides et al (2011) addresses some of the limitations with Ryan and Siegal's (2009) breakdowns of interaction and illusion by further differentiating between breakdowns that are due to gamer actions, understanding and involvement. These categories were developed through the use of a multiple-case study design which involved more participants and also involved the use of post-play interviews, which could better account for gamer intentions and past experiences. The following categories of breakdown were developed:

**Player Actions** – When the gamer is unable to execute an action within a game successfully. For example, pressing the wrong button or mistiming a button press. Here the gamer will know what they want to achieve and just has trouble performing the required action.

**Player Understanding** – When a gamer is unable to proceed further through the game due to uncertainty about their objective or where they need to go next. This breakdown can also occur when a previously successful strategy no longer works.

**Player Involvement** – Where a gamer becomes bored or frustrated with the game. This category of breakdown is similar to Ryan and Siegal's (2009) definition for breakdowns of illusion, where the gamer starts to become disengaged from the game.

This further development of breakdown categories helps to determine the reason for the breakdown more effectively. For example, these categories can differentiate between whether it was a lack of comprehension of a game objective or an inability to successfully execute a certain action that was to blame. As with Ryan and Siegal (2009), breakdowns of gamer involvement should be avoided at all costs, while breakdowns of action and understanding offer potential for learning to occur.

### **2.2.3 Overcoming breakdowns: the difference between learning and progression**

Analysing breakdowns in gameplay allows a researcher to focus on points of interest where there is a potential for learning to occur. But does overcoming a breakdown always mean that learning has taken place?

Ryan and Siegal (2009) claimed that all breakdowns of interaction lead to learning, but Iacovides et al (2011) suggest that the resolution of a breakdown does not necessarily mean that learning has occurred. In Iacovides et al (2011), breakthroughs (adapted from Sharples, 2009) were applied, which generally indicate that a breakdown had been resolved. Sharples (2009) defines breakthroughs as “observable critical incidents which appear to be initiating productive new forms of learning or important conceptual change” (p. 10). In the case of breakdowns of understanding, the gamer also has to recognise how they achieved the breakthrough for learning to occur. Breakthroughs in action can be achieved without learning taking place but this is not necessarily going to be a satisfying experience. The additional concept of agency, also applied by

Iacovides, suggests that the gamer needs to feel responsible for the progression for it to be a satisfying experience because otherwise, they have not learned how to replicate the action again in the future. So if a gamer progresses accidentally through a breakdown or they don't really understand what they did, then they haven't actually learned anything.

#### **2.2.4 Analysing breakdowns as a focus for identifying gamer strategies**

Iacovides et al (2011) suggest that a breakthrough in understanding is the result of the gamer developing a new successful strategy. But for this reason, breakthroughs are of limited help because the present study seeks to further understanding of gamer strategies regardless of whether that strategy is applied with successful results. Pelletier and Oliver (2006) used breakdowns as a way to develop a set of low-level strategies in specific gameplay scenarios, but due to the small sample size, generalisation was not possible. Ryan and Siegal (2009) refer to their design guidelines as a way to "give players an opportunity to generalise from their experiences" (p. 8), in other words, helping them to develop strategies that they can use again in the future. The relationship of the successful application of strategies to breakdowns discussed in these studies is summarised in figure 1.



*Figure 1: The role of strategy in overcoming breakdowns*

The development of a set of high-level strategies that gamers use in response to breakdowns is something that hasn't been explored previously in great detail. The focus until now has been on defining breakdowns and categorising them. Understanding the approaches used when overcoming breakdowns would be useful to developers because they can make sure that the solutions to any in-game challenges are not beyond the capabilities of the gamer. In other words, purposefully engineered breakdowns could be implemented in a way that different gamers can overcome them, without the risk of compromising their involvement with the game.

It is unlikely that all gamers will experience breakdowns and develop strategies in the same way. The next section will explore individual differences between gamers.

## **2.3 Comparing different types of gamer**

The demographics of gamers are changing. Before game systems such as the Nintendo Wii were released, a large proportion of games had developed conventions that meant they were only really accessible to gamers with a high level of experience (Juul, 2010). While these games still exist, there are now more games that appeal to people who were previously non-gamers. With so many different types of gamer, it is necessary to consider whether they all experience breakdowns in the same way and if there are any differences in the types of strategies they develop and apply. In order to conduct a study comparing the breakdowns and strategies of different types of gamer, it is

essential to have a meaningful categorisation scheme. The following section looks at previous research that has compared different types of gamer.

### **2.3.1 Different ways to categorise gamers**

People play games for different reasons; they have different motivations, levels of experience and levels of expertise, which contribute to the types of games they play and how they play them (Yee, 2006). A number of studies have categorised gamers in different ways so that their performance can be compared against a range of variables. A few of these categorisation schemes will be reviewed here in order to determine their suitability in the present research.

Schuurman, Moor and Marez (2008) conducted a large-scale study with 3000 participants who completed a Likert scale questionnaire to determine their motivations for gaming. The purpose was to broaden characterisation of the gamer away from case studies with small sample sizes (e.g. Gee, 2004; Pelletier & Oliver, 2006; Ryan & Siegal, 2009). Schuurman et al deduced four types of gamer: 'overall convinced gamer', 'convinced competitive gamer', 'escapist gamer' and 'pass-time gamer'. However, a self-selecting sample from a popular online gaming forum was used to recruit participants. As this was made up of predominantly 'hardcore' (defined below) gamers, it was not necessarily representative of the wider gaming population.

Some research into the use of games in formal educational settings has used academic performance as a way to categorise gamers. Squire (2005) & Rowe

et al (2010) compared low and high achieving students on their performance with games in the classroom. Although Squire (2005) did use a commercially available game, categorising gamers solely by their scholarly achievements is not particularly generalisable outside of an academic setting. This is because the focus of this research tends to be on promoting declarative knowledge through games.

‘Expert’ and ‘Novice’ gamers are referred to in a number of studies (such as Vaida & Greenberg, 2009; Greenfield et al, 1994) where expertise is often defined by proficiency on a single game, number of games played or frequency of play. Defining expertise based on these criteria does not make the terms ‘novice’ and ‘expert’ universally applicable. For example, Zagal and Bruckman (2008) suggest that expertise is very specific to certain types of games and that it is unlikely that a gamer can be considered ‘expert’ across all genres. Similarly, Poels, De Kort and Ijsselsteijn (2008) noted that there is no uniform vocabulary for how frequency of play corresponds to expertise.

### **2.3.2 Categorising gamers for the present study**

As shown in the previous section, comparing different types of gamer has often resulted in categorising them in narrowly applicable or unrepresentative ways. While this may have been appropriate for those studies, the present study requires a way of defining gamer expertise that is applicable across all genres and not defined by proficiency.

Neys, Jansz and Tan, (2010) defined gamer types by the extent to which the participant themselves identifies as 'a gamer'. Based on the use of Self-Determination Theory by Ryan, Rigby and Przybylski (2006), participants categorised themselves as either a 'casual' or 'hardcore' gamer by determining the extent that gaming was a salient aspect of their social identity. Categorising gamers by whether they self-identify as 'casual' or 'hardcore' provides a universal measure of expertise that is not dependent on a particular genre of game. Juul (2010) provides simple criteria for 'casual' and 'hardcore' gamers:

### **Hardcore Gamers:**

- Have played a large number of games
- Will invest large amounts of time and resources towards playing games
- Enjoy difficult games

### **Casual Gamers:**

- Have played few games
- Will to commit little time and few resources towards playing games
- Dislike difficult games

While there is no defined boundary for when a casual gamer becomes a hardcore gamer (or vice versa), as long as these categories are applied in a consistent way, participants would be able to self-allocate themselves into one of these groups. This could then be corroborated by the researcher with a brief questionnaire about their gaming preferences. In addition, as hardcore and

casual gamers are effectively opposites of each other, there will be minimal overlap and confusion for participants.

## **2.4 Summary**

This chapter has reviewed existing literature on the approaches used to examine gamer experience, and also explored how this research can be used to compare the breakdowns and strategies of casual and hardcore gamers. In the following chapters, several of the elements discussed will be brought together and used in a study which attempts to explore the different breakdowns encountered and strategies used by casual and hardcore gamers. Section 2.5 will outline the rationale for the present study and why the development of a set of strategies that can be applied in a de-contextualised way is worthy of investigation.

## **2.5 Rationale and research questions**

The purpose of the present study is to understand how gamers overcome breakdowns during gameplay and whether there is a difference in the strategies used depending on whether you are a casual or hardcore gamer. Filling this gap in the existing literature would provide valuable insight into the ways that gamers approach in-game problems. It would enable game designers to create challenging scenarios that enable learning but do not negatively affect the gameplay experience by becoming frustrating and risking a reduction in gamer involvement. This will be established by identifying instances of breakdown and recording the approaches used to overcome those breakdowns. The use of breakdowns has been adopted because they highlight specific instances of

where problems arise that have the potential to hinder game progress. Previous literature also suggests that breakdowns lead to learning (Pelletier & Oliver, 2006; Ryan & Siegel, 2009). Encountering a breakdown during gameplay will require the formation or adjustment of a strategy to overcome it. The success of the strategy will determine whether the breakdown is overcome and progress is made in the game. Once all of the data has been coded, a consolidated list of strategies that can be used as a high-level description of how gamers tackle breakdowns will be presented.

The present study aims to address the following questions:

- 1. How far do casual and hardcore gamers differ in terms of the types of breakdown they experience?**
- 2. What strategies do gamers adopt to try and overcome different types of breakdown?**
- 3. To what extent do gamer strategies differ with respect to gamer type?**

# 3 Methods

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In this chapter, a study is presented that attempts to address the research questions posed in section 2.5. This is preceded by a brief consideration of the expected outcome from the results.

## 3.1 Conjectures

The research presented in the previous section suggests that breakdowns are a potential catalyst for learning and that they can be used to identify gamers' strategies. But, based on literature such as Juul (2010) and Squire (2005); different types of gamers experience games in different ways. In the present study it is expected that these differences between gamers will lead to different types of breakdowns being experienced by casual and hardcore gamers, a difference in the total number of breakdowns experienced between gamer types and also, casual and hardcore gamers adopting different strategies in response to breakdowns.

## 3.2 Method

The following sections describe the method that was followed and provides a brief description of how the resulting data was analysed.

### **3.2.1 Participants**

Twenty participants were recruited from the University College London (UCL) participant pool that was a mixture of UCL students and non-students. They were recruited on the basis that they were either a casual or a hardcore gamer. Recruitment into the relevant groups was achieved through a combination of self disclosed gamer type and a brief questionnaire during the first session (Appendix A). Ten hardcore and ten casual gamers were recruited. They were required to have familiarity, although not necessarily expertise with gaming in general. The only other restriction was on gamers who had previous experience with either of the two games being used in the study. It was important that gamers had never played the two games before so that their previous experience with the games did not influence the results.

### **3.2.2 Design**

A between-subjects design was used where participants were split into two groups based on their gaming experience (casual and hardcore). All procedures were the same for both groups. They were given the same instructions and played through the same two games in counterbalanced order over two sessions. The experiment was split into two sessions to minimise the effects of fatigue. These sessions were spread out across different days of the week and at different times of day. The data for each participant was analysed for the number of breakdowns experienced, the time spent in a state of breakdown and the different types of strategies used.

### 3.2.3 Materials

#### The games

Each participant played two games of completely different genre. This was done to improve the generalisability of the research. Both games were finalists for annual awards in the Independent Games Festival ([www.igf.com](http://www.igf.com)). They were sourced from this website to ensure both a reasonable level of quality and being independent games, it was unlikely that participants would have played them before.

Wonderputt (hereafter referred to as “WP”) is one of the games that participants played. This is a crazy golf game that takes place on a single screen (Figure 2). The gamer completes 18 holes using the mouse to adjust the angle and the speed of the ball. As the gamer progresses, the holes get harder requiring more precision and creative approaches.



Figure 2: Screenshot from Wonderputt

The other game presented to participants was Rocketbirds: Revolution! (hereafter referred to as “RR”). This is a 2D action / strategy game where the gamer has to negotiate their way through an enemy base (Figure 3). The gamer controls a single character that has to fight their way to the end of the level solving basic puzzles, killing enemies and managing their health and ammunition carefully.



*Figure 3: Screenshot from Rocketbirds: Revolution!*

RR and WP are web-based games. This type of game tends to be easily accessible and fairly short which means they do not require extended tutorial sessions to achieve basic proficiency. For this reason, they are ideal for the present study because gamers can become familiar with the gameplay mechanics within a short space of time. One potential limitation of using this type of game could be the lack of generalisability with more substantial PC or console games, but this would be an interesting direction for future research.

Both games are free from 'dynamic difficulty balancing' which is a feature of more modern PC and console games. An example of this is the 'rubber band effect' in games like Mario Kart where gamers who are further back get better weapons and improved speed (Youssef & Cossell, 2009). Such features would interfere with assessing participant's strategies as the game would compensate the for a gamers' lack of expertise.

## **Equipment**

A private testing room was used to allow the participant to have uninterrupted interaction with the game. They were sat in front of a computer screen with a keyboard and ambidextrous mouse. Audio output was delivered through the computers speakers. The specification of the PC was ample for playing web-based games without any lag. The gaming session was recorded on a high definition video camera positioned on a tripod behind the participant, which captured the participant's interaction with the game and the sound within the lab. A post interaction interview was recorded using the iPhone memo software and the monitor was used to play the gaming session back to the participant so that critical incidents could be discussed.

## **Questionnaire / Instructions**

At the start of the first session a standardised brief was given to participants outlining instructions to be followed as well as an overview of the game they were going to play. After this, participants were given a two page questionnaire about their gaming habits (Appendix A). The purpose of the questionnaire was to corroborate their self-allocation into either the casual or hardcore groups,

give an indication of the amount of time they spend playing games and provide a few examples of genres and specific titles that they enjoy.

Because participants were experiencing these games for the first time, a printed instruction sheet was provided by the experimenter to remind the participant of the controls for each game in case they got stuck (Appendix B for WP & Appendix C for RR).

### **3.2.4 Procedure**

#### **Pilot study**

Several minor changes were made to the experiment following the pilot test. As well as refining the brief, the location of the camera and deciding to provide participants with printed instructions, the researcher became aware that there is a wide subjective interpretation of what makes a casual or a hardcore gamer. Early participants believed that these terms referred to game genres and not to a gamers' relationship with games. For an academic interpretation of casual and hardcore gamers, the definitions by Juul (2010) were added to the advertisement for the study. In order to reduce confusion, two studies were advertised (one looking for casual gamers, the other for hardcore gamers) even though all participants took part in the same study. These advertisements can be found in Appendix D (hardcore) and Appendix E (casual).

## **Main study**

At the start of the first session, participants were welcomed into the lab, asked to sit down and make themselves comfortable. They were then provided with a copy of the brief (Appendix F). After agreeing to the terms of the study and signing a consent form (Appendix G), participants were asked to complete the questionnaire (Appendix A) about their gaming habits.

Upon completion of the questionnaire, participants were presented with one of the games in counterbalanced order. This was to ensure that the order in which games were played didn't affect the results. Once participants were comfortable and happy to begin the study, they were given a brief overview of the game to prevent them from having irresolvable problems during the testing period, when the experimenter would not be present. During this time the researcher answered any questions that the participant had about the game.

Once participants were happy to begin, the video camera started to record and they were left alone to play through to the end of the game or until 20 minutes had elapsed. The experimenter was not present during the testing session but they were available if the participant required any assistance or they wished to withdraw from the study at any point.

At the end of the gaming session, the experimenter returned to the testing room and the participant was offered a rest break. Following the break, the researcher sat with the participant and the video of the recording was played back on the monitor. This video data provided a frame of reference for the

participant and allowed the researcher to pick out critical incidents that they wished to discuss. The aim was for the researcher to understand as far as possible what strategies the participant adopted in response to breakdowns. Playback was paused where necessary to allow discussion. Once the video data had been reviewed, the participant was fully debriefed and any final questions were answered. At this stage, participants were asked to make an appointment for the second session. The procedure for the second session was identical to that of the first except, the participant was not required to fill in the questionnaire again and they played whichever game they didn't play during the first session. Once both sessions had been completed, they were paid £10 to thank them for their participation.

### **3.3 Conducting analysis of the data**

Video footage and interview data was coded for critical incidents. A critical incident was defined as a point in the gameplay where the researcher believed the participant was experiencing a breakdown of some kind. The time of the incident, description of the incident, the type of breakdown, the actions performed, the strategy(s) used, the resolution and the time taken to overcome the breakdown allowed the researcher to compile a list of key strategies used for the game.

Breakdowns were identified and categorised according to how well they matched the definitions of the different types of breakdowns mentioned in Iacovides et al (2011). An example of what this data looked like is shown in

table 1. Because this research is mostly exploratory, the analysis was mainly qualitative.

Time of incident	Description of Incident	Type of Breakdown	Action	Strategy / Goal	Resolution / Breakthrough	Time Taken to Overcome Breakdown
0:05 / 11:04	Participant (P) is unfamiliar with the controls.	<b>Breakdown of action (minor)</b> – P unfamiliar with the controls.	Tries several combinations of buttons until they feel confident enough to proceed.	<b>Probing</b> - Exploration of the controls to determine the correct buttons to be used.  <b>Practice</b> - with the controls within the safety of the opening screen (Gee's "Psychosocial Moratorium" principle).	<b>Breakthrough in Action</b> – P now knows how to shoot.	65 seconds
1:16	In order to reach the key, P needs to continue past it initially and go up in the lift.	<b>Breakdown in understanding (minor)</b> – P doesn't know what they have to do to collect the key.	Tries to jump through the small gap with no luck and tries to shoot at the object which doesn't work before progressing past.	<b>Trial and error</b> – P first tries to reach the card through the grate but when this doesn't work tries some other actions that the character can do. When they have tried everything they can think of they continue past the key.	<b>Breakthrough in Understanding</b> – P realises that it is not possible to collect the key at this stage so continues	5 seconds

Table 1: Example of qualitative analysis of gameplay footage and interview data.

Further, descriptive statistics are provided in order to indicate the incidence of breakdowns and different strategies across gamer type for each game. Statistical analysis was also used to examine the relationship between gamer type and time spent in a state of breakdown. Independent samples t-tests were used to determine whether there was a significant difference between casual and hardcore gamers. A full examination of this data is provided in the next chapter.

# 4 Results and Analysis

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This chapter presents the results of the study outlined in chapter 3. Firstly a discussion about how the data sources were coded and analysed is given. This is followed by a detailed description of how the breakdowns and strategies that were used to code the data were defined. A separate analysis of the data for both WP and RR is conducted which examines the differences between types of gamer, breakdowns experienced and strategies used within each game. Finally, a comparison of the results for both games is provided which examines the similarities and differences in the data for WP and RR.

## 4.1 Data analysis

The study produced a large amount of data including questionnaires, video of the gaming sessions and audio from post-session interviews. The following section details how this data was analysed.

### 4.1.1 Questionnaire analysis

Prior to playing the first game, participants were required to complete a short questionnaire about their gaming habits (Appendix A). The main purpose of the questionnaire was to corroborate participants' self-allocation into either the 'casual gamer' or 'hardcore gamer' groups. While there is no precise boundary between these two groups, the experimenter followed the broad definitions of casual and hardcore gamers provided by Juul (2010) as described in section

2.3.2 and applied them in a consistent way. For example, one participant identified themselves as a casual gamer when they signed up to the study, but the questionnaire revealed that they have been gaming for over 20 years, on a daily basis, for an average of 2 hours a day, on a variety of platforms and across a wide number of genres. This behaviour was more similar to others who identified as hardcore, and so this participant was added to the hardcore group instead. Two participants were changed from their initial categorisation on this basis.

#### **4.1.2 Video & audio analysis**

The data resulted from 40 gameplay sessions by 20 participants who each played two games. This amounted to nearly 12 hours of video data which was then coded to identify incidents of breakdowns, strategies and breakthroughs that occurred. The video data was combined with the audio gathered in the post-session interviews and manually synced by the experimenter.

The gameplay sessions of WP and RR are not directly comparable as they are games of different genre, pace and complexity. WP is a relatively short game that takes between 10-15 minutes to complete, whereas, RR takes significantly longer.

To make sessions comparable between gamers (but not games) in terms of breakdown and strategy counts, the window of analysis was capped at the time the game was completed by the fastest gamer. In the case of WP, this was at 617 seconds even though the mean gameplay session lasted 926 seconds.

Similarly, RR was capped at 664 seconds even though the average session lasted 1170 seconds. Unlike WP, the capping of RR was due to an early major breakdown of involvement by one participant and a few technical errors that occurred with other participants around the same time. Rather than lose these participants from the analysis, it was decided that the sessions would be capped at the time of the shortest session.

While capping the data in this way resulted in parts of it not being used in the analysis, it was still useful for helping to determine the strategies adopted by gamers as discussed in the next section. Gameplay sessions are labelled using the following shorthand method:

“**P13**” - Refers to the participant number (in this case; Participant 13).

“**WP**” or “**RR**” - Refers to Wonderputt (WP) or Rocketbirds: Revolution! (RR).

“**-H**” or “**-C**” - Whether the participant is a hardcore (H) or casual (C) gamer.

So for example, **P13RR-C** refers to participant 13, playing Rocketbirds: Revolution! It also indicates that they are a casual gamer.

## **4.2 Breakdowns and strategies**

Before any final coding of raw data could take place, the researcher first needed to have a well defined set of breakdowns and strategies that could be applied in a consistent way. These categories were developed iteratively during the preliminary analyses until they could account for all the instances which occurred.

### 4.2.1 Defining and refining breakdowns

The categories of breakdown used in the present study were adopted from Iacovides et al (2011). They were breakdowns of action, understanding and involvement as described in chapter two. Although all of the breakdowns observed in the present study fell into one of these categories, the experimenter soon realised that the severity of the breakdowns needed to be taken into account. As an example, here are two breakdowns of understanding from the study:

- I. **P3WP-H** – *The participant starts course number 8 but doesn't know what they need to do in order to progress. They take an exploratory shot and immediately gauge, from the outcome, how to complete the course.*
  
- II. **P15WP-C** – *The participant starts course number 5 but doesn't know what to do in order to get the ball to the hole. They try a number of approaches but after several minutes they become so frustrated that they decided to terminate the session.*

While these breakdowns are both examples of understanding breakdowns, one was overcome within 10 seconds and the second led to several minutes of confusion before the participant became so frustrated, they decided not to continue with the session. In order to give a better indication of severity, the experimenter developed a way to differentiate between breakdowns that are resolved through the effective use of strategies, and those that lead to more serious consequences such as a reduction of involvement with the game. This was achieved by expanding the categories to include minor and major

instances. This resulted in a total of six categories which are described with examples below:

1. **Action Breakdown (minor)** – The gamer knows what they want to achieve but are unable to execute it effectively due to unfamiliarity with the controls or getting the timing of the action wrong. This breakdown is not serious enough that the gamer can't overcome it through practice and/or repeated attempts.

- **P1WP-H** – *The participant has to hit the ball into a waterfall which requires precision use of power. While the participant initially under or over hits the ball, through practice they eventually hit it with the correct amount of power into the hole.*
- **P13RR-C** – *The participant is not quick enough to shoot the guards before the guards shoot them. Through practice, they learn to draw and fire their gun more quickly and are able to defeat the guards.*

2. **Action Breakdown (major)** – The gamer knows what they need to do but executing the action is so challenging or the controls are so difficult to grasp, that they become frustrated after a prolonged period without success, risking a breakdown of involvement.

- **P3WP-H** – *The participant needed to skim the ball over the water to land on the island. The target area was so small that they needed to retry the shot for several minutes before they reached the island without the ball sinking. They eventually made it but were noticeably frustrated.*
- **P15RR-C** – *In the opening screen, the participant attempts to familiarise themselves with the controls. After trying for several minutes, they are still confused about the capabilities of their character and resort to asking the experimenter for assistance.*

3. **Understanding Breakdown (minor)** – The gamer is unsure what they are supposed to be doing or a previously used strategy no longer seems to work. This requires the gamer to develop a new strategy or work out how to solve the problem in order to proceed.

- **P2RR-C** – *The participant needs to open a door in RR but they don't have the necessary key. They explore the surrounding area until they find it, enabling them to proceed.*
- **P18WP-H** – *The participant has to hit the ball over an area of water. Initially they didn't know how the ball would react to the water, believing it would just sink. After taking an exploratory shot and noticing the ball skim across the surface, they now understood how to proceed.*

4. **Understanding Breakdown (major)** – The gamer finds that they are unable to proceed due to not comprehending what they are supposed to do, misinterpreting events in the game or finding that a previously used strategy no longer works. After significant effort in trying to overcome this breakdown, the gamer may become frustrated and begins to lose interest with the game.

- **P7RR-C** – *The participant thought they were interacting directly with doors, not realising that they were actually activating a keypad. When the participant needed to call a lift later in the game, they ignored the keypad, believing it to be part of the scenery. After trying several other strategies in an attempt to progress, they became frustrated, suffered a breakdown of involvement and needed the researcher's help in order to continue.*
- **P3WP-H** – *The participant is required to negotiate the ball around the course into the skull's mouth. However, they become confused by the layout of the course and aim for the hole from a previous course. After several minutes of trying to get the ball into the wrong hole, they become frustrated.*

5. **Involvement Breakdown (minor)** – The gamer either becomes bored with the game or starts to lose interest as a result of not understanding how to progress or finding the action involved to be too challenging for them. A resolution to the problems can overcome this reduction in involvement.

- **P2RR-C** – *The participant found a key but didn't know what door it opened. After looking around the immediate area they became frustrated. After several minutes they decided to backtrack through the level and eventually found the correct door which immediately resolved the situation.*
- **P11WP-H** – *To deactivate the force field, the participant needs to hit the blocks with the ball. The participant doesn't realise this and tries repeatedly to hit the ball under the force field. After more than 2 minutes they become frustrated until they accidentally discover the solution.*

6. **Involvement Breakdown (major)** – The gamer becomes so frustrated with their lack of progress that they resort to asking the researcher for help or even terminating the gaming session entirely. An alternative cause of this breakdown is the gamer becoming embarrassed with their perceived poor performance and not wishing to continue.

- **P15RR-C** – *The participant came to a point in RR where they didn't know how to progress. They tried several different strategies and spent several minutes trying to work it out but without success. After several minutes they decided that they didn't want to continue and terminated the session.*
- **P19RR-C** – *The participant comes across a crate on the surface. After more than 8 minutes of trying to work out what it is for, they become frustrated with the game and lose interest. Eventually they ask the researcher how much of the session is left, indicating that they are keen for it to end.*

## **4.2.2 Defining and categorising strategies**

Individual breakdowns were identified during the initial coding of the data. The researcher recorded the methods that the participant used to overcome it either from the commentary provided by the participant in the post-play interviews and/or from the video data. Once all of the video data had been coded, the researcher had a long list of the different approaches used by participants to overcome breakdowns. These approaches were then consolidated, linking similar themes together until the researcher was left with a short list of diverse and general categories of strategies that could then be properly defined as shown in the next section.

To assist with the development of a consolidated list of strategies, the learning principles proposed by Gee (2004) were a valuable source of reference. While Gee's original collection of 36 principles were designed to encourage optimal facilitation of learning within games, they also reflect some of the approaches gamers use while attempting to overcome problems during gameplay. Once the categories had been properly developed, the researcher revisited the original video data to enable them to place the approaches used into one of the newly defined categories.

### **Categories of strategies**

The following strategies were developed using the method described in 4.2.2. As well as a general definition of the strategy, examples from both WP and RR have been included to show typical circumstances of where each strategy was applied. All strategies used across the 20 participants and both games fell into one of the following categories:

1. **Trial and Error / Probing** – The gamer tries several different approaches in a systematic way until they find one that works. Alternatively, they take exploratory action and base their subsequent approach on the feedback from this action. This strategy is based on Gee's (2004) "Probing Principle" which states that learning is a cycle of probing the world, reflecting on this action, forming a hypothesis and testing it through re-probing and then accepting or rethinking the hypothesis.

- **P18RR-H** – *The participant comes across a crate up against a wall. They initially try to use the crate to jump over the wall. When this doesn't work, they try to open the crate. Finally, they take the crate down in the lift and successfully use it to climb over another wall.*
- **P2WP-C** – *The ball lands in an area surrounded by a force field. The participant is not sure how to proceed so hits the ball into the force field to see what happens, this leads them to the solution that they can now act on.*

2. **Transfer of Knowledge (Real World, Other Games, Within the Game)**

– The gamer uses their knowledge of the real world, their experiences with other games or earlier experience within the same game and applies this knowledge to the current situation. Gee's (2004) "Transfer Principle" was the basis for this strategy.

- **P11WP-H** – *From their understanding of how they believe the ball will interact with water in real life, the participant hits the ball much harder in an attempt to skim across the surface. This approach works.*
- **P16RR-C** – *After being shot several times by an enemy, the participant stands still in the hope that their health will regenerate like in the X-Box game Halo.*

- **P2RR-C** – *The participant comes across a ledge that they cannot reach. From their earlier experiences within the game they know that they can stand on a crate to gain extra height so return to the surface to get one.*

3. **Practice / Repetition** – When the gamer is gaining proficiency with the controls or trying a new approach, they rehearse / refine the technique on the obstacle itself or in a safe area of the game before attempting to overcome the obstacle for real. This strategy is based on Gee’s (2004) “Psychosocial Moratorium” principle which states that learners can afford to take risks in certain parts of the game where the consequences of failure are minimal.

- **P16RR-C** – *The participant comes face to face with an enemy but has forgotten how to fire their gun. They quickly return to the previous screen and practice firing for a few moments before returning to face the enemy.*
- **P14RR-C** – *Because the participant has never played the game before, they practice within the safety of the first screen. They gain basic proficiency in moving, jumping and firing the gun before proceeding.*
- **P3WP-H** – *The participant knows that the only way to proceed is to hit the ball up the hill, so they attempt it several times, adjusting the power of their shot based on the feedback of the previous attempt until they succeed.*

4. **Reflection** – Play is either suspended briefly while the gamer considers how best to proceed or they give careful thought to their approach while the game is in progress. This strategy can be applied in response to an immediate breakdown or used to consider the bigger picture of how the gamers’ actions affect the entire gaming session (such as trying to make sense of the scoring system).

- **P12RR-H** – *The participant has accidentally unequipped their gun so when they face an enemy they are unable to return fire. They retreat to the previous screen to consider why they are unable to fire and work out what they have done.*
- **P4WP-H** – *Up to course number 5, the participant had been collecting all of the rainbows. However, as the difficulty of the game increased, they decided to only collect easy ones, otherwise they would need to take a large amount of shots which would adversely affect their score.*

5. **Accidental** – An event occurs in the game that overcomes the breakdown that is unrelated to gamer intentions.

- **P6WP-H** – *While trying to hit the ball through the force field, the participant accidentally hits one of the blocks which deactivates the force field and allows them to proceed.*
- **P9RR-C** – *The participant comes face to face with enemies that look exactly like them. This causes confusion as they do not know which character they are controlling. This situation is resolved when the participant gets shot; sending their character into the previous screen, which immediately makes it obvious which character they are controlling.*

### 4.2.3 Extracts of coded data

In this section some extracts from the method used by the researcher to code video and interview data are presented to illustrate how the analysis was conducted. Critical incidents were recorded in a table comprising of seven sections. An incident was defined as a point in the game where the participant found themselves in a situation where they were unable to progress through lack of proficiency with the controls (action breakdowns), a lack of understanding for their current objective (understanding breakdowns) or a

reduction of their level of interest / involvement in the game (involvement breakdowns). In addition, any significant changes in a participant's strategies were also recorded even when this change in behaviour was not accompanied by a breakdown. For reasons of space, only the first 120 seconds of incidents have been reproduced. Table 1 shows incidents from a participant who played RR.

### Extract from P1RR-H

Time of incident	Description of Incident	Type of Breakdown	Action Taken	Strategy / Goal	Resolution / Breakthrough	Time Taken to Overcome Breakdown
0:05 / 11:04	Participant (P) is unfamiliar with the controls.	<b>Breakdown of action (minor)</b> – P unfamiliar with the controls.	Tries several combinations of buttons until they feel confident enough to proceed.	<b>Probing</b> - Exploration of the controls to determine the correct buttons to be used. <b>Practice</b> - with the controls within the safety of the opening screen.	<b>Breakthrough in action</b> – P now knows how to shoot.	65 seconds
1:16	In order to reach the key in the second screen, P needs to continue past it initially and go up in the lift.	<b>Breakdown in understanding (minor)</b> – P doesn't know what they have to do to collect the key.	Tries to jump through the small gap with no luck and tries to shoot at the object which doesn't work before progressing past.	<b>Trial and Error</b> – P first tries to reach the card through the grate but when this doesn't work tries some other actions. When they have tried everything they can think of, they continue past the key.	<b>Breakthrough in understanding</b> – P realises that it is not possible to collect the key at this stage so continues	5 secs
1:40	In order to open the door, P just needs to press the action button.	<b>Breakdown in understanding (minor) and breakdown in action (minor)</b> – P doesn't know if they can open the door, also doesn't know how to open it.	P presses several buttons and notices that the character interacts with the control panel.	<b>Trial and Error</b> - leads to P understanding how to interact with control panels.	<b>Breakthrough in understanding and Action</b> - P now knows what control panels are for.	10 secs
1:56	P presses the space bar instead of 'up' which leads to discovery of the inventory screen.	<b>Breakdown in Understanding (minor) &amp; Action (minor)</b> – P doesn't know how to jump believing the controls to be the same as other games they've played.	P presses space a few times until they realise that it doesn't jump but accesses the inventory. They spend a few minutes familiarising themselves with the inventory.	<b>Transfer (Games)</b> – P is used to the space bar being the jump button. <b>Trial and Error</b> - P discovers functions and controls that they were previously unsure about.	<b>Breakthrough in understanding / action</b> - P now knows how to operate the inventory screen and also how to jump	15 secs

Table 1: Extract of coded data from P1RR-H.

Table 2 provides extracts of the incidents encountered by a participant who played WP. Once again, this table represents the first 120 seconds worth of incidents.

### Extract from P15WP-C

Time of incident	Description of Incident	Type of Breakdown	Action Taken	Strategy / Goal	Resolution / Breakthrough	Time Taken to Overcome Breakdown
0:15 / 21:13	P doesn't know how powerful the shots will be so takes a few practice shots to get a feel for the controls.	<b>Action (minor)</b> – P understands what the controls do, but don't know how they will translate into the speed of the ball.	P takes a few practice hits to get a feel for how the power meter translates into the speed of the ball.	<b>Probing and Practice</b> - Exploration of the controls.	<b>Action</b> – After a few shots, P understands how far the ball will travel when they hit it.	95 secs

Table 2: Extract of coded data from P15WP-C.

## 4.3 Results

The following sections present and analyse the results for participants playing WP and RR using the finalised definitions for breakdowns and strategies introduced in sections 4.2.1 and 4.2.2.

### 4.3.1 Results for the game: 'Wonderputt'

As mentioned previously, participant's gameplay sessions with WP were capped at 617 seconds. The following table provides a summary of the breakdowns encountered and the strategies used:

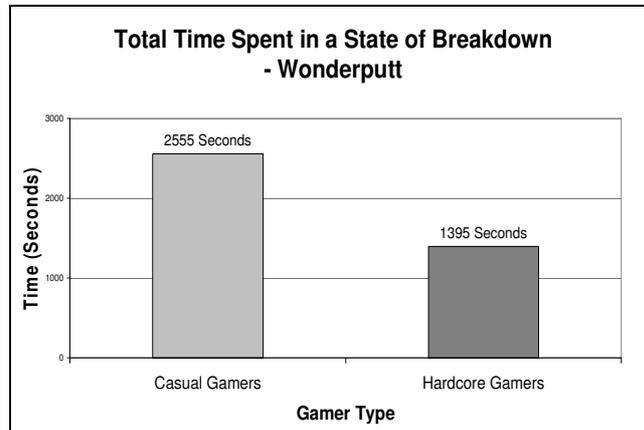
<b>Breakdowns</b>	<b>Casual Gamers</b>	<b>Hardcore Gamers</b>
<b>Total Breakdowns</b>	62	79
Total Action Breakdowns	26	36
Total Understanding Breakdowns	28	39
Total Involvement Breakdowns	8	4
<b>Total Minor</b>	57	75
Minor Action	21	33
Minor Understanding	28	38
Minor Involvement	8	4
<b>Total Major</b>	5	4
Major Action	5	3
Major Understanding	0	1
Major Involvement	0	0
<b>Total Time in a State of Breakdown</b>	2555 seconds	1395 seconds
<b>Strategy Used</b>	-	-
<b>Total Strategies</b>	81	105
Trial and Error / Probing	38	40
Transfer of Knowledge	12	15
Practice / Repetition	19	30
Reflection	7	15
Accidental	5	5

Table 3: Wonderputt Breakdown and Strategy Totals

### Time spent in a state of breakdown

An initial observation from table 3 is that overall; hardcore gamers experienced 21 more breakdowns compared to casual gamers. However despite having fewer breakdowns to overcome, casual gamers spent a far greater amount of time in a state of breakdown. An independent samples t-test was conducted to compare the total time spent in a state of breakdown in WP for participants in the 'casual gamers' condition and participants in the 'hardcore gamers' condition. There was a significant difference for the total time spent in a state of breakdown for the casual gamer ( $M = 255.5$ ,  $SD = 121.6$ ) and hardcore gamer ( $M = 139.5$ ,  $SD = 71.3$ ) conditions;  $t(18) = 2.6$ ,  $p = 0.018$ . These results suggest that gamer type does relate to total time spent in a state of breakdown

for WP. Specifically, these results suggest that casual gamers are likely to spend more time overcoming breakdowns when compared to hardcore gamers. This effect is shown in graph 1.



Graph 1: Total Time Spent in a State of Breakdown for Wonderputt

The finding that casual gamers take longer to overcome breakdowns might partially explain why they experienced fewer overall for WP. As a result of taking longer on each breakdown, they were unable to encounter a new breakdown until the previous one had been resolved.

### **Types of breakdowns experienced**

Table 4 shows the breakdowns experienced by casual and hardcore gamers expressed as percentages. Displaying breakdowns in this way makes comparison easier because it shows the ratio of breakdowns experienced independently of the totals, which were different for each type of gamer. The table shows that across both types of gamer, breakdowns of action and understanding were the most common. Breakdowns of involvement comprised a relatively small proportion of overall breakdowns but the difference between casual and hardcore gamers was much greater (8%). Casual gamers also

experienced a higher proportion of major breakdowns. These differences are highlighted in table 4.

	Casual Gamers	Difference	Hardcore Gamers
<b>Breakdowns of Action</b>	42%	4% →	46%
<b>Breakdowns of Understanding</b>	45%	4% →	49%
<b>Breakdowns of Involvement</b>	13%	8% ←	5%
<b>Minor Breakdowns</b>	92%	3% →	95%
<b>Major Breakdowns</b>	8%	3% ←	5%

Table 4: Allocation of Breakdowns for Wonderputt

The data in table 4 suggests that casual gamers may be more susceptible to breakdowns of involvement and major breakdowns compared to hardcore gamers. One possible reason in this case might be because of parts of the game that require skill or precision in order to successfully progress. These sections would be less challenging for hardcore gamers but have the potential to cause problems for casual gamers. As noted by Juul (2010), casual gamers tend to prefer games which are easy to pick up and play and they are less willing to commit time and resources to playing games. A typical example is shown here:

**P13WP-C** – *The participant needs to get the ball to the top of a hill. They know exactly where they want the ball to end up but after numerous attempts, they are unable to hit the ball with the precision required to stop it rolling back to the bottom. This leads to frustration and the participant begins to lose interest in the game.*

In the example above, the skill requirements of the game are greater than the level of proficiency that the participant currently possesses. A major breakdown in action or understanding is usually the result of an extended period of time in a

state where the participant is unable to progress. As shown in the above example, this also tends to be a precursor to a breakdown of involvement, where the participant is notably frustrated or losing interest in the game quickly. Such states go beyond the element of challenge purposefully engineered into a game like WP. This is because they induce a state where the participant is losing a sense of engagement with the game which may lead to them giving up.

### Types of strategies used

Table 5 shows the proportional use of strategies for casual and hardcore gamers in WP. ‘Trial and Error / Probing’ was the most commonly used strategy for both groups.

	Casual Gamers	Difference	Hardcore Gamers
<b>Trial and Error / Probing</b>	47%	9% ←	38%
<b>Transfer of Knowledge</b>	15%	1% ←	14%
<b>Practice / Repetition</b>	23%	6% →	29%
<b>Reflection</b>	9%	5% →	14%
<b>Accidental</b>	6%	1% ←	5%

Table 5: Proportional differences in strategies used for WP.

‘Trial and Error / Probing’ was used by almost all participants as a way to gauge how much power to use when they were learning the controls early in the game. But casual gamers tended to use this strategy more often later in the game as shown in the following example:

**P8WP-C** – *The participant continuously looks for shortcuts throughout the session even though there isn't any. Before attempting to follow the set path of the course, they first used the ‘Probing’ strategy to see if it was possible to break through fences, hit the ball*

*through grass, flick the ball over obstacles etc. This leads to the participant taking an excessive amount of shots and taking longer to complete the course.*

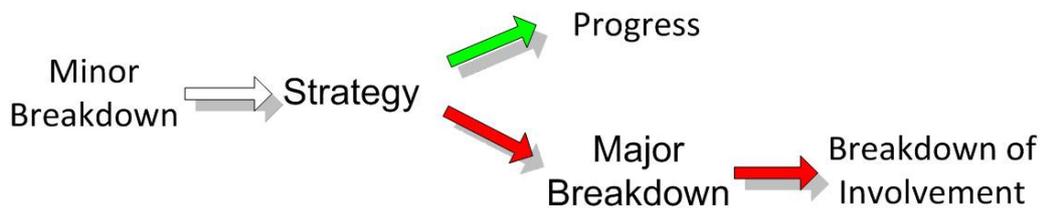
By comparison, hardcore gamers tended to recognise the conventions of the game early on and if they are unable to find shortcuts in the first few courses, they didn't spend extended periods of time looking later on. Another trend in table 5 is that hardcore gamers utilised the 'Practice / Repetition' strategy more often. This was particularly true after experiencing action breakdowns. Where a casual gamer would be more likely to look for an alternative approach in response to a few failed attempts, hardcore gamers would persevere if they were confident that they were using the correct approach.

**P10WP-H** – *Hitting the ball up the waterfall requires precision use of power. Even after a few failed attempts, the participant is sure that they are using the correct approach. They use the feedback from previous shots to refine the level of power they are using until they reach the hole successfully.*

In these examples, casual (P8WP-C) and hardcore (P10WP-H) gamers are adopting different strategies in response to the same types of breakdowns. By utilising 'Practice / Repetition', hardcore gamers are developing proficiency which allows them to overcome breakdowns relatively quickly. On the other hand, casual gamers are switching from one approach to another which takes more time and is likely to be a contributing factor to the significant difference observed between gamer types and time spent in a state of breakdown.

## Summary for Wonderputt

The results of this part of the study suggest that the types of breakdown encountered and the strategies used within WP are closely linked with each other. A gamer must adopt a strategy of some kind in order to overcome a breakdown. Similarly, if a gamer selects an inefficient strategy in response to a breakdown, they risk a more serious major breakdown or a breakdown of involvement as shown in Figure 4.



*Figure 4: The Process of Overcoming Breakdowns with Strategies*

Casual gamers spent significantly longer in a state of breakdown compared to hardcore gamers. This was partially due to the use of less efficient strategies. Casual gamers tended to use 'Trial and Error / Probing' more often, which would usually involve trying to pull off 'trick shots' or finding shortcuts. This would ultimately require a larger time investment than just following the set path of the course. On the other hand, hardcore gamers tended to use strategies like 'Practice / Repetition' where they would refine an approach that they were confident of until they were successful. This would simultaneously overcome the initial breakdown and remove the risk of development into a more serious type of breakdown.

### 4.3.2 Results for the game: ‘Rocketbirds: Revolution!’

Gameplay sessions for RR were capped at 664 seconds as this reflected the longest length of session that was completed by all participants. Table 6 provides a summary of the breakdowns encountered and the strategies used:

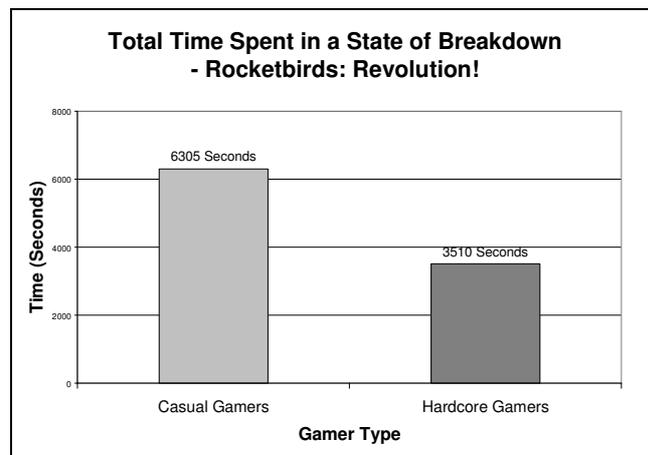
<b>Breakdowns</b>	<b>Casual Gamers</b>	<b>Hardcore Gamers</b>
<b>Total Breakdowns</b>	80	76
Total Action Breakdowns	27	29
Total Understanding Breakdowns	44	44
Total Involvement Breakdowns	9	3
<b>Total Minor</b>	69	74
Minor Action	25	27
Minor Understanding	38	44
Minor Involvement	6	2
<b>Total Major</b>	11	2
Major Action	2	2
Major Understanding	6	0
Major Involvement	3	0
<b>Total Time in a State of Breakdown</b>	6305 seconds	3510 seconds
<b>Strategy Used</b>	-	-
<b>Total Strategies</b>	96	86
Trial and Error / Probing	50	37
Transfer of Knowledge	11	17
Practice / Repetition	23	19
Reflection	12	9
Accidental	0	4

Table 6: Rocketbirds: Revolution! Breakdown and Strategy Totals

#### Time spent in a state of breakdown

Unlike WP, the total number of breakdowns experienced for casual gamers was very similar to the number experienced by hardcore gamers. But similarly to WP, casual gamers spent a far greater amount of time in a state of breakdown. An independent samples t-test was conducted to compare the total time spent in a state of breakdown in RR for participants in the ‘casual gamers’ condition and participants in the ‘hardcore gamers’ condition. There was a significant

difference for the total time spent in a state of breakdown for the casual gamer ( $M = 630.5$ ,  $SD = 334.2$ ) and hardcore gamer ( $M = 351$ ,  $SD = 201$ ) conditions;  $t(18) = 2.27$ ,  $p = 0.036$ . These results suggest that gamer type does have an effect on total time spent in a state of breakdown for RR. Specifically, these results suggest that casual gamers are likely to take longer to overcome breakdowns compared to hardcore gamers. This effect is shown in graph 2.



Graph 2: Total Time Spend in a State of Breakdown for Rocketbirds: Revolution!

### Types of breakdowns experienced

Table 7 shows the proportion of breakdowns experienced by casual and hardcore gamers in RR. Breakdowns of understanding and action were the most common for both groups. Breakdowns of involvement were experienced less often, but occurred much more frequently for casual gamers. For both types of gamer, the majority of breakdowns were minor, but the table reveals that casual gamers experienced substantially more major breakdowns. These trends are highlighted.

	Casual Gamers	Difference	Hardcore Gamers
<b>Breakdowns of Action</b>	34%	4% →	38%
<b>Breakdowns of Understanding</b>	55%	3% →	58%
<b>Breakdowns of Involvement</b>	11%	7% ←	4%
<b>Minor Breakdowns</b>	86%	11% →	97%
<b>Major Breakdowns</b>	14%	11% ←	3%

Table 7: Allocation of Breakdowns for Rocketbirds: Revolution!

The data in Table 7 suggests that casual gamers are more susceptible to breakdowns of involvement and major breakdowns compared to hardcore gamers. This trend is similar to that recorded for WP. In contrast, RR has a higher difficulty level, a more substantial control system and requires a larger investment of time in order to progress. According to Juul (2010), these are characteristics that are more synonymous with hardcore gamers. In addition, hardcore gamers have generally played a large number of games and are more likely to have come across similar in-game scenarios before. These factors might explain why casual gamers experienced more problems that escalated into major breakdowns and breakdowns of involvement.

**P7RR-C** - *The participant encounters a crate and assumes that they need to use it to jump over the wall. The wall is still too high. In response to this failure they try a number of different approaches to get over the wall for the next 10 minutes which all fail. The participant becomes very frustrated and terminates the session.*

**P20RR-H** - *The participant encounters a crate and assumes that they need to use it to jump over the wall. This approach fails so the participant considers the purpose of the crate and quickly realises that they could use it more effectively in another area of the game.*

In the first example, P7 experiences a major breakdown of understanding which leads to a major breakdown of involvement, where they are not prepared to finish the session. Two casual gamers experienced this at the same point in the game. The casual gamers in these situations were unable to work out what the purpose of the crate was and as time went on, they lost interest. On the other hand, P20 encounters the same problem but is able to work out what to do with the crate which prevents the minor breakdown of understanding that they experienced from developing in a major breakdown or a breakdown of involvement. The reason P20 was able to successfully overcome the breakdown is because they used a more effective strategy. This will be discussed further in the next section.

### Types of strategies used

Table 8 shows the proportional use of strategies for casual and hardcore gamers in RR. 'Trial and Error / Probing' was the most commonly used strategy for both groups.

	Casual Gamers	Difference	Hardcore Gamers
<b>Trial and Error / Probing</b>	52%	9% ←	43%
<b>Transfer of Knowledge</b>	11%	9% →	20%
<b>Practice / Repetition</b>	24%	2% ←	22%
<b>Reflection</b>	13%	3% ←	10%
<b>Accidental</b>	0%	5% →	5%

*Table 8: Proportional differences of Strategies used for RR*

Hardcore gamers had built up experience from playing similar games in the past. As reflected in Table 8, they were able to recognise problems in RR from similar situations in other games (using 'Transfer of Knowledge') and apply

these conventions in order to overcome breakdowns. On the other hand, casual gamers did not have much experience with games similar to RR so 'Transfer of Knowledge' was not as useful to them. The most viable alternative for casual gamers when encountering a novel problem was to use 'Trial and Error / Probing' which was used more often compared to hardcore gamers. This trend is also shown in the following examples:

**P1RR-H** – *The participant needs to progress through a section of jungle. They spot an area up ahead that is glowing and immediately head towards it. They were confident that this was the correct route because they remember a similar element from the game 'Abe's Odyssey' which indicated to the participant where they should go next.*

**P8RR-C** – *The key for a door up ahead is visible through a gap but it's not possible to pick it up until later on. The participant doesn't realise this and tries a number of different approaches in an attempt to reach the key. They spend several minutes trying before moving on.*

P1 instantly recognised a familiar situation from another game and used 'Transfer of Knowledge' to apply their previous experience to the current obstacle. P8 did not have such experience with other games so when they came across a key in an early portion of the game, they didn't realise that they needed to fulfil other objectives first. P8 tried a variety of approaches such as shooting at the key, jumping towards it and trying to roll through the gap. They were using 'Trial and Error / Probing' here. In contrast, P1 immediately realised that acquiring the key was not possible at such an early stage in the game. This was because they had encountered similar situations before.

## **Summary for Rocketbirds: Revolution!**

As with WP, breakdowns and strategies seem to be closely linked in RR, following the same process as shown earlier in Figure 4. Regarding the strategies used, hardcore gamers had an advantage because they had generally played similar games in the past as indicated in the initial questionnaires (Appendix A). This meant that they were able to effectively utilise 'Transfer of Knowledge' to apply their previous experience. Breakdowns tackled with 'Transfer of Knowledge' were usually overcome quite quickly. On the other hand, casual gamers did not have relevant past experience to guide them. They relied more on 'Trial and Error / Probing' which was more time consuming. This is important because the longer a participant spent in a state of breakdown; the more likely it was that their minor breakdown would develop into a major breakdown or a breakdown of involvement.

### **4.3.3 Comparing the results across different games**

The purpose of testing participants on two games was to determine if the types of breakdowns encountered are consistent across genres, whether gamers use similar strategies for different types of game and whether different genres affect casual and hardcore gamers in a similar way. The following section will look for similarities and differences in breakdowns and strategies between WP and RR and consider how game genre influenced the incidences of breakdowns and the strategies used.

## **Breakdowns**

For both WP and RR, casual gamers spent a significantly longer amount of time in a state of breakdown. This consistent finding suggests that casual gamers take longer to overcome breakdowns and that this effect is not necessarily limited to a single genre of game.

In both WP and RR, major breakdowns and breakdowns of involvement were more common for casual gamers. These types of breakdowns were often the result of spending an extended period of time in a state of breakdown. A minor breakdown developing into a major breakdown was generally observed to be caused by the ineffective use of strategies.

It was expected that there would be an influence of genre on the types of breakdowns experienced for casual and hardcore gamers. For example, as WP is a puzzle game, it is reasonable to expect that participants would experience more understanding breakdowns. Also, because RR is an action game, more action breakdowns were expected. In fact the opposite was true. This could be due to the difference in the difficulty level between the games with RR being the harder game (as shown by the greater number of involvement breakdowns that were experienced), but also because of the way the games have been categorised. WP is considered a puzzle game but contains elements where precise execution is required (such as hitting the ball towards a small target or timing a shot to coincide with a moving bridge). Similarly, although RR is considered an action / strategy game, it involves a large amount of puzzle

solving (such as how to use the crate to jump over the wall). This highlights the fallacy of trying to categorise games into discreet groups.

## **Strategies**

For both games and for both types of gamer 'Trial and Error / Probing' was the most commonly used strategy. This is to be expected because none of the participants in the present study had ever played the games before. The data shows that the initial few minutes of gameplay were usually taken up by participants experimenting with the controls. With the exception of this strategy, there were few trends carried over between games.

However, both the genre of game and the type of gamer are important factors in the choice of strategies. The best example of this is 'Transfer of Knowledge'. In RR there was a substantial difference between the numbers of hardcore gamers using this strategy compared to casual gamers. A potential reason for this is that RR is a style of game that most hardcore gamers were familiar with. This meant they had a wealth of past experience that they could apply in a way that casual gamers were not able to do. But with WP, this was a game that neither type of gamer had much experience with. Even though 'Transfer of Knowledge' was used to overcome breakdowns within this game, the knowledge that gamers were using often came from the real world rather than from previous gaming experience. Because of this, neither type of gamer had an advantage over the other when using this strategy. This is shown in the following examples:

**P7WP-C** – *The participant realises that they need to hit the ball over a section of water. Through their understanding of real world physics, they presume that they will need to hit the ball harder than normal so that it will skim over the water. This approach proves to be successful.*

**P12WP-H** – *Ice on the course forms a curved groove. The participant uses their knowledge of how the ball would react to the course in real-world golf and successfully uses the groove to guide the ball towards the hole.*

The influence of type of gamer and genre of game on breakdowns and subsequent strategy use are shown in Figure 5. This figure builds on the process of strategy use shown earlier in Figure 4.

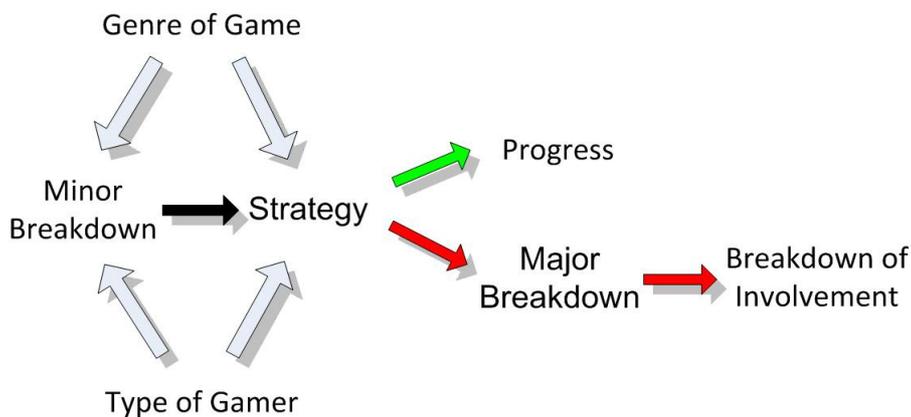


Figure 5: The Influence of Genre and Gamer Type on Breakdowns and Strategy Use

#### 4.4 Discussion of the conjectures made in 3.1

The results show that there was little difference between the number of breakdowns experienced by casual and hardcore gamers. However, there was a significant difference between the amount of time spent in a state of breakdown for casual and hardcore gamers. As noted in 4.3.1, it was not really

possible for participants to experience another breakdown until the previous one had been resolved. Therefore the results suggest that casual gamers take a relatively long time to overcome breakdowns and encounter new ones soon after overcoming the previous one. But on the other hand, hardcore gamers tend to overcome breakdowns quickly and experience a longer period between breakdowns.

In both games, casual gamers experienced more major breakdowns and breakdowns of involvement. By comparison, hardcore gamers experienced more minor breakdowns of action and understanding but tended to overcome these quickly which meant they didn't develop into more serious breakdowns.

Casual and hardcore gamers utilised different strategies in response to similar breakdowns. But the difference in strategy use between these two gamer types depended on the game. For example, in RR, a game that was more synonymous with hardcore gamers, the hardcore gamers were more likely to adopt 'Transfer of Knowledge' because they had experienced similar situations in the past. By comparison, in WP, in a game that was more synonymous with casual gamers, this trend disappeared because hardcore gamers didn't have previous experience to fall back on.

# 5 Discussion

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## 5.1 Summary of findings

The aim of this study was to explore the relationships between casual and hardcore gamers in respect to the types of breakdowns they experience, the types of strategies that they use and the influence of genre on their gameplay habits.

One of the key outcomes from the present study was the development of a set of strategies that could account for all approaches used by casual and hardcore gamers to overcome breakdowns. This is something that has not previously been explored in such detail within the literature. Previous research has mainly been concerned with identifying when individual instances of learning happen and what is learned in those situations. The strategies developed in the present study help to explain how this learning occurs. This study builds on the previous research on learning in games by developing high-level strategies that are used to overcome breakdowns and can be applied across multiple genres. This directly builds on Pelletier and Oliver's (2006) work which developed low-level strategies based on specific games and used a case-study approach which meant the sample size was very small. The work of Iacovides et al (2011) provided the foundation for the present study by providing a way to categorise breakdowns and to consider whether or not progression always led to learning. This study takes the next step from Iacovides et al (2011) by using these

breakdown categories as a focus of analysis to explore how learning occurs in games. Breakthroughs were recorded during the data collection stage but this data was not used because it didn't help in the development of strategies, which was the primary focus of the present study.

Once a list of strategies was developed, a comparison was made between casual and hardcore gamers concerning the types of breakdowns that they experienced and the strategies they adopted in order to overcome them. It was found that a comparable number of breakdowns are experienced by both hardcore and casual gamers but casual gamers spend significantly longer in a state of breakdown.

It was suggested that this outcome occurred for a number of reasons. Firstly, casual gamers seemed to adopt less effective strategies compared to hardcore gamers, which made the process of overcoming breakdowns take longer. Secondly, the breakdowns experienced by casual gamers were more likely to develop into more serious types of breakdown, such as major breakdowns or breakdowns of involvement.

## **5.2 Addressing the original research questions**

This section will examine the extent that the research presented in this study answers the original research questions.

### **1. How far do casual and hardcore gamers differ in terms of the types of breakdown they experience?**

Casual gamers tended to experience more major breakdowns and breakdowns of involvement. The results of the present study suggest that this difference, observed in both games occurred where the difficulty level was beyond the abilities of most casual gamers. In addition, major breakdowns and breakdowns of involvement were seen to follow from the ineffective use of strategies.

### **2. What strategies do gamers adopt to try and overcome different types of breakdown?**

Through analysis of the way casual and hardcore gamers attempted to overcome breakdowns in WP and RR, a set of strategies was developed that could account for all the methods that gamers used in the present study. These strategies together with examples can be seen in section 4.2.2.

### **3. To what extent do gamer strategies differ with respect to gamer type?**

The type of strategy used depended on gamer type but also the type of game being played. In RR for example, hardcore gamers were able to apply previous gaming experience using 'Transfer of Knowledge'. Casual gamers did not have such extensive previous experience that they could apply, so used 'Trial and Error / Probing' instead.

## **5.3 Evaluation of the present study**

### **5.3.1 Was the experiment representative of a typical gaming session?**

Participants were given a maximum of 20 minutes to play RR and as long as it took to complete WP (approximately 10–15 minutes). This limit was imposed because of the need to play back the whole session during the interview. This length of gameplay session is not representative of the self reported data provided in the questionnaire. For casual gamers this was around two hours (M=1.85 hours) and for hardcore gamers it was around three hours (M=2.9 hours). This may not have been enough time for participants to familiarise themselves with the game properly. Literature for user testing in game studies suggests longer sessions such as Pagulayan et al (2007), who suggest at least one hour. Although there is incentive to play WP multiple times due to unlockable content, the independent nature of the games selected for this study are much shorter than the types of big budget games that participants reported playing (Appendix H). A potential opportunity for future research could be to extend the present study by using more mainstream titles and allowing gamers to play for longer.

Gameplay sessions took place in a small cubicle in a psychology laboratory. This provided consistency between participants, but was unlikely to be representative of a typical gaming environment (such a living room or bedroom). Fierley and Engl (2010) suggest that it is important to make the testing environment as much like the average living room as possible to make the

session more natural. But modern gaming devices allow gameplay to take place almost anywhere, so there might not be such a thing as a 'typical gaming environment' after all.

Even though the experimenter tried to make participants as comfortable as possible and were not present during gameplay, a number of participants reported feeling embarrassed by their performance. Participants were very aware that they were being filmed and became self-conscious. In a few cases, the effect was so strong that it caused participants to terminate the session due to embarrassment. The researcher took these cases into consideration during the analysis stage and noted that this effect was due to being observed rather than a result of frustration due to gameplay.

### **5.3.2 Generalisability of the findings**

A set of strategies were proposed that aimed to be applicable across games, genres and types of gamer to explain how breakdowns are overcome. These strategies accounted for approaches used by participants within the present study, but there are some factors that might limit their applicability outside of this study.

First of all, the present study consisted of only 20 participants arranged into two groups (10 casual and 10 hardcore gamers). While this was a larger and more diverse range of participants compared to some earlier case studies (Pelletier & Oliver, 2006; Ryan & Siegal, 2009), as highlighted in section 2.3.1, there are many different types of gamers. Casual and hardcore gamers were chosen in

this study because they were considered to be polar opposites. But there are many other meaningful ways to categorise gamers that may have led to different results. What about age, gender, cultural background or IQ score? These differences offer opportunities for further research.

Secondly, only two games were used to compile the list of strategies in 4.2.2. These games represent only two genres (Action / Shooter and Puzzle). Further research will be required to determine if these breakdowns / strategies are true for a wider variety of games and if there are any other strategies that gamers use for different genres. Also, the present study only considers single player games, investigating if gamer strategies are different in multiplayer games provides scope for future research.

Finally, part of the first gaming session required participants to complete a short gaming questionnaire asking them to provide examples of the types of games they play (a full list can be found in Appendix H). One potential issue that this list identifies is that WP and RR are both web-based games and every game mentioned by participants is a premium title for the PC or a console game. The games used in this study may not be representative of the types of games the participants would play in real life.<sup>2</sup> Although, participants might have assumed that the researcher was only interested in more mainstream titles, especially as the questionnaire was completed before participants knew they would be playing independent, web-based games in the present study.

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<sup>2</sup> Although it should be noted that since this study was conducted, Wonderputt was made available on iTunes and subsequently became a 'number one bestseller' on the iPad. There are also plans for Rocketbirds: Revolution! to be released on the PlayStation Network.

### **5.3.3 The scope of the strategies identified**

The restrictions imposed by the lab setting, the length of the gameplay session and the influence of observation may have affected the strategies that gamers used to overcome breakdowns. For example, Walsh and Apperley (2009) commented that gamers often refer to strategy guides or the internet when they encounter problems during a game. In the present study, despite some participants encountering some serious breakdowns, none of them attempted to seek external assistance during the sessions. Participants may have believed that seeking external assistance was beyond the requirements of the study, or maybe the sessions were not long enough to require external assistance.

Similarly, during the interviews, a number of participants reported that they might take a break from a game if they encountered a breakdown, or leave that part of the game and come back to it later. The linear nature of the games in the present study meant that gamers were not able to bypass breakdown situations, but none of the participants took a break either. This might have been because of the short gameplay sessions, or because participants felt that they needed to conform to the requirements of the study despite their personal preference.

### **5.3.4 Addressing these limitations in future studies**

From the perspective of ecological validity, future studies could be improved by making the sessions less intimidating through making the testing environment look less like a laboratory. This might also reduce the observation effect experienced in the present study where embarrassment caused participants to withdraw.

An ethnographic approach could improve the methodology in several ways. Firstly, the suggestion of Fierley and Engl (2010) that the testing environment should resemble the average living room would be addressed because participants would be tested in their actual gaming environments. This would also enable gaming sessions to be longer, in line with the recommendations of Pagulayan et al (2007) and the data from the present study which suggests that the average gaming session lasts between two and three hours. A second potential benefit of an ethnographic approach is that participants may behave more naturally and a more representative range of strategies might be displayed such as seeking external assistance or taking a break from a challenging breakdown. Due to the exploratory nature of the present research, an ethnographic approach was not appropriate. A lab based study provided more control over confounding variables so that a valid set of strategies could be developed. Now that these strategies have been established, future research could test their applicability outside of the lab.

## **5.4 Implications for practitioners**

The present research has not only shown the range of strategies that gamers use in response to particular breakdowns but also how these strategies differ between casual and hardcore gamers. Games designers in the future need to consider the motivations and needs of these different types of gamer if they want to appeal to a different audience. Understanding the range of strategies that different gamers adopt in response to problem situations would enable designers to create games that are accessible to casual gamers, while not negatively impacting on gameplay experience for hardcore gamers.

Designers are beginning to realise that they need to cater for gamers of different levels of proficiency, and one example of its implementation is Nintendo's 'Super Guide' feature (Iwata, 2009). This feature allows games such as *New Super Mario Bros Wii* and *Donkey Kong Country Returns* to maintain a high level of challenge which is desired by hardcore gamers, but also provides support for casual gamers if the game recognises that they are stuck at a particular point. This is similar to the concept of 'dynamic difficulty balancing' described by Youssef and Cossell (2009). This system doesn't really take different strategies into account but it does allow more nuanced balancing than would be available from just selecting 'easy', 'normal' or 'hard' as a difficulty setting. It intervenes and helps the gamer only when they need it.

The strategies developed as part of the current study could be used to provide more tailored support to gamers of all levels when they experience breakdowns. For example, consider a breakdown that has been engineered into a game and requires a gamer to follow established gaming conventions to resolve it. A hardcore gamer would be expected to utilise 'Transfer of Knowledge' to overcome this breakdown, but a casual gamer would lack the required previous experience. By enabling the breakdown to be solved relatively easily by 'Trial and Error' as well, both hardcore and casual gamers will feel the satisfaction associated with overcoming the breakdown on their own.

## **5.5 Future research**

Future research needs to consider whether breakdowns are the best way to investigate gamer strategy. Pelletier and Oliver (2006) raise the point that

breakdowns only look at learning from a limited perspective, when a gamer encounters a problem in the game. Breakdowns do not consider learning that occurs as a result of successful behaviours that are not motivated by breakdowns. An example might be a gamer that learns to find their way around a virtual environment like in the *Grand Theft Auto* series. There are also many other genres of games such as racing, role playing games (RPG), and first person shooters (FPS) that could be used as the basis of research into gamer strategies. In addition, the present research only looks at single player games that were played in isolation. Further research could be done to investigate how multiplayer games and social interaction affect strategy use. The research presented in this study provides a good starting point for this future work by offering refined categories of breakdowns to help focus analysis and providing a basic set of strategies that can be further developed.

## **5.6 Conclusion**

The work presented in this study offers a new perspective in the research on learning and games. Built on literature that sought to identify where learning was taking place and what was being learned, this study explored how learning occurs by focusing on the strategies used by gamers to overcome breakdowns. The key output from this research was a set of gamer strategies that can be applied across different game genres and gamer types. Through the course of the study, it was discovered that casual and hardcore gamers approach in-game problems in quite different ways. Supporting these different approaches is vital for gamers of all levels to maintain interest and involvement with the games they play.

An improved understanding of how learning occurs in games is highly sought-after information for a number of key groups. The findings reported in this dissertation serve as an important starting point for further work in the area which will allow developers to create more fulfilling and enjoyable games, publishers to sell more copies by appealing to a broader audience and educators to engage their students in new and exciting ways.

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# Appendices

## Appendix A – Gaming Questionnaire

### Gaming questionnaire

The questionnaire focuses on your experiences of playing computer and video games. All responses will be anonymised and kept confidential. We ask for your name, only so that we can match the questionnaire to other data collected.

1. Name		
2. Age		
3. Sex	Male	Female

Circle your response for each question below and please do not leave any blank.

4. What age did you start playing video games?

Under 5	5-7	8-10	11-13	14-16	16-18	18 or above
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5. In an average month, how often do you play video games?

Less than once a month	Once a month	Several times a month	Weekly	Several times a week	Daily
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6. On average, approximately how long does a typical gaming session last?

0 hour	½ hour	1 hour	2 hours	3 hours	4 hours	5 hours	5 hours+
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8. Do you regularly use any of the following gaming platforms?

		Yes	No
a	PC/laptop		
b	Nintendo Wii		
c	Nintendo DS/3DS		
d	Sony Playstation 3		
e	Sony Playstation 2		
f	Sony PSP		
g	Microsoft Xbox 360		
h	Mobile phone		
j	Other – please state		

8. Which of the following types of video games do you play?

		Often	Some times	Never
a	Action & Shooter e.g. Call of Duty, Grand Theft Auto			
b	Adventure e.g. Lego Indiana Jones, Mystery Case Files			
c	Arcade & Platform e.g. Mario Party, Little Big Planet			
d	Board, Card and Casino e.g. Scrabble, Poker			
e	Children's e.g. Peppa Pig, Pokémon			
f	Education & Reference e.g. French Coach, Cooking Guide			
g	Fighting e.g. Street Fighter, Super Smash Bros Brawl			
h	Music & Dancing e.g. Just Dance, Guitar Hero			
i	Puzzle e.g. Brain Training, Bejewelled			
j	Quiz & Trivia e.g. Buzz, Who Wants to be a Millionaire?			
k	Racing e.g. Gran Turismo, Mario Kart			
l	Role Playing e.g. World of Warcraft, Mass Effect			
m	Simulation e.g. Sims, Tom Clancy's H.A.W.X.			
n	Sports e.g. Fifa 10, Wii Fit			
o	Strategy e.g. Total War, Civilization			
p	Other – please state			

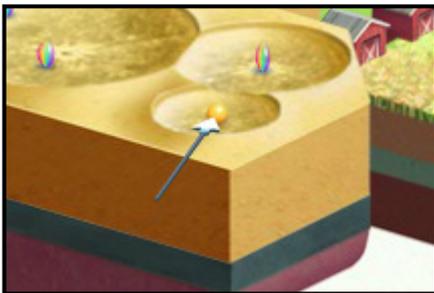
9. In the space provided below could you please provide an example of each type of game you play? You can also list any games you are unsure about how to categorise here.

## Appendix B – Control Sheet (Wonderputt)

### Wonderputt – Controls



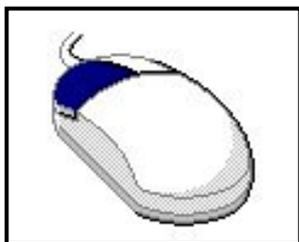
This game uses only the mouse to control the ball



Use the mouse to adjust the direction that the ball will travel



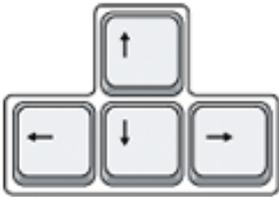
Use the mouse to also adjust the power of the shot



When you are ready, use the left mouse button to hit the ball

## Appendix C – Control Sheet (Rocketbirds: Revolution!)

### Rocketbirds: Revolution! - Controls



#### **Movement Keys**

← → Move left and right  
↑ Jump  
↓ Crouch



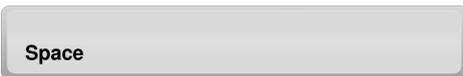
#### **Aim Weapon**

Press and hold to draw weapon



#### **Action Key**

Fire weapon, pick up items and operate doors/lifts



#### **Inventory**

Press and hold to view inventory/switch weapon

## **Appendix D – Study Advertisement (Hardcore Gamers)**

### **Study Name**

Calling Hardcore Gamers! Earn £10 for playing computer games (over two sessions).

### **Brief Abstract**

Hardcore gamers wanted to play a web-based game for twenty minutes and then discuss their experience with a researcher. Participant will need to be available for two sessions, where they will play a different PC game in each session.

### **Detailed Description**

This study is designed to determine the strategies used by video game players and if there is any connection between strategies used and how a participant identifies themselves as a gamer. You will be introduced to a short web-based game on a PC. Once you are comfortable with the controls you will be left for up to 20 minutes to play the game on your own without interruption. During this time, your interaction with the game will be recorded via a video camera. After 20 minutes, the researcher will enter the room and ask you to stop playing. At this point, the researcher will replay your gameplay session on the monitor and will invite you to discuss your experiences of the game. The audio of this session will be recorded. Participants will be required to return for a second session at a later date, where they will play through a different game using the same procedure as above. Participants will be paid £10 once they have completed the second session.

**A ‘hardcore gamer’ for the purposes of this study does not necessarily just refer to the types of games you play but your relationship with games in general. Hardcore gamers will usually have played a large number of video games, will invest large amounts of time and resources toward playing games and enjoy games that are hard to master. If this description does not match your gaming experience, please see the advertisement for ‘casual gamers’.**

Because of the wide subjective interpretation of the term ‘hardcore gamer’, the researcher will ask you to complete a brief questionnaire asking you to think about your reasons for playing games, the types of games you play, what game you played most recently, how frequently you play and for how long.

Please be advised that we are not testing your abilities as a gamer, we are only interested in the strategies you use.

### **Duration**

60 Minutes per session (two sessions in total)

### **Payment**

£10 (after the second session)

## Appendix E – Study Advertisement (Casual Gamers)

### Study Name

Calling Casual Gamers! Earn £10 for playing computer games (over two sessions).

### Brief Abstract

Casual gamers wanted to play a web-based game for twenty minutes and then discuss their experience with a researcher. Participant will need to be available for two sessions, where they will play a different PC game in each session.

### Detailed Description

This study is designed to determine the strategies used by video game players and if there is any connection between strategies used and how a participant identifies themselves as a gamer. You will be introduced to a short web-based game on a PC. Once you are comfortable with the controls you will be left for up to 20 minutes to play the game on your own without interruption. During this time, your interaction with the game will be recorded via a video camera. After 20 minutes, the researcher will enter the room and ask you to stop playing. At this point, the researcher will replay your gameplay session on the monitor and will invite you to discuss your experiences of the game. The audio of this session will be recorded. Participants will be required to return for a second session at a later date, where they will play through a different game using the same procedure as above. Participants will be paid £10 once they have completed the second session.

**A ‘casual gamer’ for the purposes of this study does not necessarily just refer to the types of games you play but your relationship with games in general. Casual gamers are less willing to commit time and resources toward playing video games, and tend to prefer games with positive and pleasant fictions, which are also easy to pick up and play. If this description does not match your gaming experience, please see the advertisement for ‘hardcore gamers’.**

Because of the wide subjective interpretation of the term ‘casual gamer’, the researcher will ask you to complete a brief questionnaire asking you to think about your reasons for playing games, the types of games you play, what game you played most recently, how frequently you play and for how long.

Please be advised that we are not testing your abilities as a gamer, we are only interested in the strategies you use.

### Duration

60 Minutes per session (two sessions in total)

### Payment

£10 (after the second session)

## Appendix F – Participant Brief

### Information Sheet for Participants in Research Studies

*You will be given a copy of this information sheet.*

Title of Project: Understanding Player Strategies for Overcoming Breakdowns during Gameplay

This study has been approved by the UCL Research Ethics Committee as Project ID Number: MSc/1112/002

Name, Address and Contact Details of Investigators: **Thomas Knoll**  
**UCL Interaction Centre**  
**t.knoll.11@ucl.ac.uk**

We would like to invite you to participate in this research project. Please read the following information carefully and discuss it with others if you wish. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Please ask the investigators if there is anything that is not clear or you would like more information.

#### **Details of Study**

This study is designed to determine the strategies used by video game players and if there is any influence from the genre of the game and the extent to which the participant identifies themselves as a gamer. In each session you will be shown one of two PC games selected in random order. Once you are comfortable with the controls you will be left for up to 20 minutes to play the game on your own without interruption. During this time, your interaction with the game will be recorded via a video camera. After 20 minutes, the researcher will enter the room and ask you to stop playing. At this point, the researcher will replay your gameplay session on the monitor and will invite you to discuss your experiences of the game. The audio of this session will be recorded. The whole session will last no longer than an hour. At the end of the first session the researcher will arrange a suitable time to conduct the second session. **Please be advised that we are not testing your abilities as a gamer, we are only interested in the strategies you use.**

At the end of the session we will answer any questions that you might have about this research and you will be paid £10 for your time after you have completed the second session. If you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form. Even after agreeing to take part, you can still withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

## Appendix G – Informed Consent Form

Title of Project: Understanding Player Strategies for Overcoming Breakdowns during Gameplay

This study has been approved by the UCL Research Ethics Committee as Project ID Number:

MSc/1112/002

### Participant's Statement

I .....

agree that I have

- Read the information sheet and/or the project has been explained to me orally;
- I understand that my participation will be taped/video recorded, and I am aware of, and consent to, any use you intend to make of the recordings after the end of the project.
- I understand that I am being paid for my assistance in this research and that some of my personal details will be passed to UCL Finance for administration purposes.
- Had the opportunity to ask questions and discuss the study; and
- Received satisfactory answers to all my questions or have been advised of an individual to contact for answers to pertinent questions about the research and my rights as a participant and whom to contact in the event of a research-related injury.

I understand that I am free to withdraw from the study without penalty if I so wish and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

Signed:

Date:

### Investigator's Statement

I .....

confirm that I have carefully explained the purpose of the study to the participant and outlined any reasonably foreseeable risks or benefits (where applicable).

Signed:

Date:

## Appendix H – List of Games (from the Questionnaire)

Casual Gamers	Hardcore Gamers
Call of Duty Medal of Honor FIFA NFS Most Wanted Cricket Battlefield Age of Empires Who wants to be a Millionaire? Grand Theft Auto Pro Evolution Soccer Street Fighter Tekken Football Manager Civilization III – IV Sudoku Angry Birds Pac man Green House Chess Pong	FIFA Call of Duty Grand Theft Auto Gran Turismo Tom Clancy Taken UFC3 Raw Mass Effect Football Manager Cricket Total War Need for Speed Street Fighter Counter Strike Gothic Mario Party Pokémon Super Smash Bros Soul Calibur Guitar Hero Another Code Mario Kart Mario Galaxy League of Legends Saboteur Battlefield Indiana Jones NBA Pro Evolution Soccer Tiny Tower Paladog Tetris Scrabble Utopia Final Fantasy Starcraft II Counter-Strike Little Big Planet O2 Jam Hearts of Iron 3 Star Wars Battlegrounds Medieval Total War 2 Star Wars Battlefront Skyrim Poker Age of Mythology Tomb Raider