Open Research Online

The Open University's repository of research publications
and other research outputs

Making sense of game-play: how can we examine learning and involvement?

Conference or Workshop Item

oro.open.ac.uk

Making sense of game-play: How can we examine learning and involvement?

Ioanna Iacovides, James Aczel, Eileen Scanlon, Will Woods
The Open University
Milton Keynes
United Kingdom
+441908 655581
i.iacovides@open.ac.uk, j.c.aczel@open.ac.uk, e.scanlon@open.ac.uk,
w.i.s.woods@open.ac.uk

ABSTRACT

It has been argued that there is a need for more "rigorous research into what players do with games (particularly those that don't claim explicit status as educational), and a better understanding of the thinking that is involved in playing them." (Squire, 2008, p.167). This paper introduces a set of methods developed to explore these issues via a multiple case study approach, including; game-play observation, cued post-play interview, the collection of physiological data and the use of gaming diaries over a three week period. An examination of the strengths and limitations of the approach adopted is presented with reference to two particular methodological issues (i) how to identify breakdowns and breakthroughs that occur during game-play; (ii) how to identify learning occurring beyond game-play. The paper will conclude by emphasising the importance of taking both micro and macro level experiences into account when it comes to capturing learning and involvement within this context.

Keywords

Involvement, informal learning, play studies, methodology

INTRODUCTION

The gaming industry continues to expand, with different types of games appealing to wider audiences than ever before. For instance, when *Call of Duty: Black Ops* (Treyarch, 2010) was released, it made $360 million in the US and the UK within 24 hours (Stuart, 2010). Further, Facebook games such as *Farmville* (Zygna, 2009) and technological developments such as motion control (e.g. Nintendo's Wiimote, Microsoft's Kinect) seem to have opened up games to new audiences and helped to increase their cultural acceptance. At the same time, there continue to be claims made about the potential of games for learning (e.g. Gibson et al., 2010) not least because games often motivate people to devote hours to solve the challenges presented to them. However, there is still much that is yet to be understood about the game-play experience, with a need for more rigorous examination of how players interact with games and the sorts of thinking they engage in during play (Squire, 2008). It can be argued that the area would benefit from investigating both how and what people learn through their involvement with games.

In order to further explore these issues, this paper reports on research which developed a set of methods to explore how learning and involvement come together in and around instances of play. The following section introduces the relevant literature within the area before introducing the approach developed for the study carried out. While the analysis is currently in progress, this paper presents an examination of the strengths and limitations of the methods developed in terms of two particular methodological issues (i) identifying different types of breakdowns and breakthroughs that occurred during game-play; (ii) identifying learning which occurred beyond instances of game-play.

RELATED WORK

Player involvement and learning

One of the earliest models proposed to account for involvement in games comes from Malone and colleagues who proposed a theory of "intrinsic motivation". This was derived from experimental manipulations of drill and practice games which suggested that games are rewarding because of the ways in which they combine the elements of challenge, fantasy and curiosity (Malone, 1981). Later work (Malone & Lepper, 1987) also added the element of control, and further interpersonal motivators (recognition, competition and cooperation). However, it has been argued that, despite the later inclusion of interpersonal motivators, there is too narrow a focus on the structure of the game itself, without sufficient attention being paid to the social dynamics that occur around it and to the context within which the game itself is played (Egenfeldt-Nielsen et al., 2008).

Another general theory of motivation, which has recently been applied to games (Ryan, Rigby & Przybylski, 2006) is self-determination theory (SDT). Ryan et al., (2006) suggest that people play in order to satisfy our psychological need for: competence (need to experience challenge), autonomy (sense of volition) and relatedness (feeling connected to others). While relatedness does suggest a social reason for becoming involved in games, it could be argued that this theory still tells us little about the context in which this involvement occurs. Further, neither Ryan et al's or Malone and colleagues' work seem to tell us much about how involvement relates to any learning that results from game-play.

One model which does suggest how involvement and learning affect each other, is the Digital Game Experience Model (DGEM; Calleja, 2007). In particular, Calleja distinguishes between "macro involvement"; which refers to "motivational attractors to games that influence sustained engagement through the long-term" and "micro involvement"; which refers to "the moment by moment instance of the game-play instance" (p. 237). The macro level can be used to consider activities that occur around play, while the micro level refers to the experience of play itself. This distinction allows for a discussion of the learning and involvement experienced during play (e.g. Iacovides, 2009; who suggest that deeper levels of involvement actually depend on learning with respect to how the player internalises different aspects of the game). Further, the model can be used to consider how activities that occur outside of the moment of game play (e.g. using a walkthrough or discussing a game with friends) might affect longer term motivations.

Gee (2004) addresses the issue of how people learn through their involvement with games, by providing an account based on his own observations and semiotic analysis. He argues that when people play games they are actively engaged in the process of learning a new literacy. This literacy includes multi-modal texts and graphical representations.

Through gaming, players learn to participate in "semiotic domains" made up of words, pictures, and/or anything else that is used to communicate meaning. These domains are associated with specific "affinity groups" of players whose knowledge, skills, tools and resources contribute to form complex systems of distributed parts. These groups might be considered a community of practice (Lave & Wenger, 1991) where learning occurs when players gain resources from fellow members to help them to solve problems within, and sometimes outside of, the specific domain. Gee (2004) uses the term "critical learning" to refer to the learning experienced when the player start to consider "the domain at a "meta" level as a complex system of interrelated parts" (p. 23). He also argues that critical learning involves not just a change in practice "but in *identity*" (p. 190). He goes on to discuss the learning that occurs from the adoption and experimentation of different identities, as well as from being able to reflect upon the relationship between old and new ones.

However, Pelletier and Oliver (2006) argue that while Gee provides a strong account of how learning through games can occur, he does not provide researchers with the tools for examining different games and contexts. Further, they point out that the literature in the area lacks "a method that looks at the process and outcomes of play, explaining how this relates to the design of the game as well as the social and cultural aspect of play." (p. 331). It could also be argued that the area would benefit from further empirical research to substantiate Gee's semiotic analysis. As such, it appears there is a need to develop methods which can be used to examine the different ways in which involvement and learning actually do come together *in* and *around* instances of game-play.

Considering wider activities

In order to explore in more detail the activity that occurs around game-play (through player involvement on a macro level) the concept of "gaming capital" may be a useful one. Consalvo (2007) developed this concept from Bourdieu's (1984) notion of "cultural capital" in order to:

" …capture how being a member of game culture is about more than playing games or even playing them well. It's being knowledgeable about game releases and secrets, and passing that information on to others. It's having opinions about which game magazines are better and the best sites for walkthroughs on the Internet." (p. 18).

Consalvo discusses the ways in which "paratexts" help players to acquire gaming capital. Paratexts are external resources that can "surround, shape, support, and provide context for texts" (p.182). So, in this context, games themselves constitute the primary texts; while examples of paratexts include walkthroughs, reviews, YouTube videos, blogs, and magazines that relate to games. Players can thus increase their knowledge about games and game-play practices by consulting these different resources. Both the concept of gaming capital and the idea of paratexts can be helpful for considering involvement and informal learning in relation to community membership. To use Gee's terminology, gaming capital might help explain why players choose to participate in different affinity groups and semiotic domains.

Evaluating game-play

There are numerous different ways in which researchers have tried to evaluate aspects of the game-play experience. For instance, Pelletier and Oliver (2006) used a small scale case-study approach to present a method for examining how people learn to play games. Using an approach based on Activity Theory (Kutti, 1996) they decided to decompose

activities into actions and operations and to take note of any "contradictions" (i.e. breakdowns, problems) that occurred. This allowed them to identify and discuss the strategies players adopted but focusing purely on the game-play meant they had to make certain inferences about what players were trying to do. As a result, it is difficult to gauge the extent to which the inferences the authors made actually governed players' behaviour within the game.

Ryan and Siegel (2009) also used the concept of breakdowns for examining game-play and drew upon the earlier work of Marsh et al., (2001) by making a distinction between a breakdown in interaction and a breakdown in illusion. Breakdowns are generally described as occurring "when actions we take to accomplish something no longer seems [sic] to work" (p.1). Breakdowns in interaction refer to what they call, "the natural breakdowns" that lead to learning within the game, and breakdowns in illusion refers to a loss of immersion (in terms of absorbed attention). Ryan and Siegel argue that the former are part of normal game-play, but unlike the latter, they do not disrupt the experience of flow. As a result of their analysis of game-play, they present four main categories of breakdown (which relate to: perceiving the environment, developing strategy, taking action, and meaning making) though they do not make a point of indicating which of them (and their associated sub-categories) are breakdowns of interaction or illusion. It seems implied that most stem from interaction issues but that some of these can also lead to further breakdowns in illusion. In recent work, Sharples (2009) takes a slightly different stance, using critical incident analysis to identify breakdowns and breakthroughs for gathering mobile technology design requirements within an educational context. In this instance, breakdowns are "observable critical incidents where a learner is struggling with the technology, asking for help, or appears to be labouring under a clear misunderstanding" while breakthroughs are "observable critical incidents which appear to be initiating productive, new forms of learning or important conceptual change" (p. 10).

There has also been an interest in using physiological measures to examine players' emotional reactions to game-play. For instance, Mandryk and colleagues tested the efficacy of using physiological data to evaluate entertainment technologies. They found that galvanic skin response (GSR) was able to distinguish between conditions that involved playing a game with a friend and conditions that involved playing against a computer (Mandryk & Inkpen, 2004). They also suggested that this kind of data can be used to provide a continuous, objective measure of emotional experience (Mandryk & Atkins, 2007) though this is still a time-consuming and complex approach to adopt and it is not always clear what emotions are being modelled. Further, their findings were based on five minute episodes playing a sports game within a lab environment, and though that makes sense for the in-depth analysis appropriate to that particular study, such a setup does not seem very representative of typical game-play activity. A definitive model of emotion derived from these physiological signals has yet to be established, but Hazlett (2008) does suggest this kind of data can be used in real-time to indicate when significant instances have occurred, which the investigator can then ask the player about.

It appears then that there are a number of ways in which to examine different aspects of the game-play experience, but there is still a lack of studies that look at both micro and macro level involvement over longer periods of time, especially in relation to learning. It would seem that an exploratory, mixed method, case-study approach would be helpful in furthering our understanding of how involvement and learning come together in and around episodes of game-play (Iacovides et al., 2011).

METHODOLOGY

Research questions
The study reported in this paper is part of a larger project that aims to explore the relationship between motivation, engagement and informal learning that occurs through playing digital games. For the purposes of this research, Calleja's definition of involvement was adopted (Calleja, 2007) where *micro involvement* is used to refer to player engagement during episodes of game-play, and *macro involvement* is used to discuss player's general motivations and gaming-related activities that occurred outside the instance of play. In this case, *learning* refers to the informal learning that occurs as players progress through the game, whether they achieve this alone, or through collaboration with others (directly or indirectly through the use of paratexts). We are also interested in any other forms of learning that can be identified from player involvement with games. In Vavoula et al's (2005) terms, this sort of learning is informal in the sense that it takes place outside of a formal context (where a teacher would normally define learning goals and processes) and in most circumstances it is could also be called unintentional since learning is unlikely to be the main goal of play.

In order to gain a better understanding of how involvement and learning come together in practice, this study seeks to address the following questions:

1. How can we identify breakdowns that occur during play?
   a. How do players attempt to resolve these breakdowns?
   b. What role do breakthroughs play in this process?
2. What can examining breakdowns and breakthroughs tell us about how involvement and learning come together in practice?
3. What evidence is there that players are learning anything other than learning how to play?

The following sections describe how the study was carried out. While the analyses are currently ongoing, some examples from the case studies will subsequently be referred to in order to illustrate how the methods were able to capture breakdowns and breakthroughs, as well provide evidence for any learning that occurred beyond instances of play. The paper will then conclude with a reflection on strengths and weaknesses of the approach and an outline of future work.

Design and participants
In order to address the research questions, an exploratory case study approach was adopted, involving the use of multiple methods. The approach was adapted from previous work carried out by (Iacovides, 2009) who used cued retrospective reports to examine learning with respect to micro level involvement. Eight cases were completed, with nine participants in total (age 23-59; 5 male, 4 female). Each case consisted of a single participant who was asked to come into the lab on three occasions and to keep a gaming diary over a three week period; except for one case which consisted of two participants (a married couple). The couple were included as a case in order to test the efficacy of the method in dealing with more than one player and to consider some of the social influences that might affect involvement and learning. Players were recruited from a previous email interview study, and differed in terms of age and how they identified as gamers (where a mix of casual and more serious gamers was selected), with the aim of trying to maximise the differences between cases as far as possible (Stake, 2003). The lab was set up as a comfortable living room environment, with a couch, wide screen TV and game consoles for participants to play.

Procedure and methods

A variety of methods were used, including observation, post-play interview, the collection of physiological data and asking participants to keep gaming diaries over a three week period. The physiological measures were chosen on the basis of research that was carried out by Mandryk and colleagues, e.g. (Mandryk & Atkins, 2007). The data was collected using the ProComp Infiniti system and sensors, and BioGraph Software from Thought Technologies. Galvanic skin response (GSR) was collected using surface electrodes that snap onto Velcro straps worn around the index and ring fingers. For electrocardiography (EKG), three pre-gelled surface electrodes were attached in the standard configuration of two electrodes on the chest and one electrode on the abdomen. Heart rate is calculated from this EKG signal. For electromyography (EMG), surface electrodes were used on the jaw (indicative of tension), cheek (indicative of smiling) and on the forehead (indicative of frowning). Three electrodes preconfigured in a triangular arrangement were used on the jaw and cheek, while separate extender cables were used for the forehead. Facial and body hair can interfere with the EKG and EMG signals so participants were screened on the basis that this would not be an issue.

Participants were asked to come into the lab to be observed playing on three separate occasions. The first session, was mainly introductory during which time a preliminary interview was carried out and the physiological equipment was explained. This session also involved filling in a short questionnaire about gaming habits and preferences and signing a consent form. Participants were asked to bring in a game of their choice to play in the lab for 15 minutes. The purpose of this was to familiarise them with the physiological equipment and the procedure they would follow during the next two sessions, during which they would be asked to play for up to an hour. A three minute baseline measure for the physiological recordings was taken before and after the game-play sessions, for comparative purposes. During game-play, the first author observed the session from a separate room which displayed camera feeds of the player and the game-play, as well as the player's physiological reactions. After the game-play, the investigator reviewed the video recording with the participant so they could discuss what the player was thinking and feeling during the session. Tea or coffee and biscuits were provided during the post-play interview, to make the experience more relaxed.

The second session took place the following week where again the participant was asked to bring in what they were currently playing. Care was taken to ensure that the player could continue their progress from the last time they played by either transferring a saved game file to the lab console, or asking them to bring in their own console to play on. The rationale for this was to try to tap into an experience in which the player was genuinely motivated to play a game. In the third session, the player was asked to play a game they had not played before and was also the sort of game they were unlikely to pick themselves (selected on the basis of the preliminary interview). The purpose of this was to examine what happened when they played something unfamiliar; though care was taken to make sure they had no objections to the investigators choice.

Finally, participants were required to keep a paper based diary of their game-playing and game-related activities over the period of the study. This diary included questions to prompt the participants; so in addition to asking them to take note of what they played every day and for how long, they were asked questions about what they did when they got stuck, who they talked to about games, whether they visited or contributed to forums, and whether they thought they learnt anything from their activities. The purpose of the diaries was to keep track of game-play which occurred outside the lab, and to get an idea

of their macro level involvement. The study concluded with a final ½-1 hour semi-structured interview, which was based on their diary entries. The diary-interview method is explained in further detail by Elliot (1997). Participants were also given a £15 Amazon voucher (approximately 17 Euros) to thank them for their participation in the study.

Analytic process

In order to examine the video recordings, transcriptions of the post-play interviews were completed and used to identify initial breakdowns and breakthroughs. INTERACT™ (Mangold International GmbH), a video analysis tool, was then used to code the multiple data streams (see Figure 1) in terms of the different breakdowns and breakthroughs that occurred.
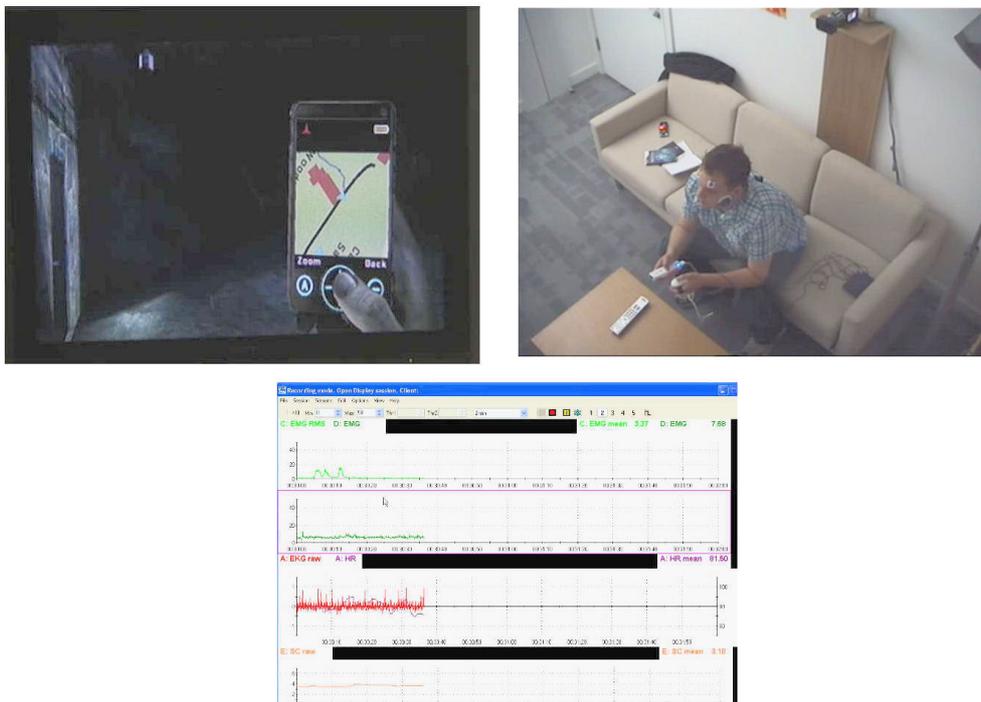

Figure 1: Video recordings of the game-play, the player and the physiological readings (Case 1: Matt playing *Silent Hill: Shattered Memories)*

In the first stage of the analysis the player's micro level involvement was considered. The physiological data was originally intended to signal significant instances to the investigator, which could then be followed up during the post-play interview; as suggested by Hazlett (2008). However, this turned out to be infeasible due to the difficulty of keeping track of the several physiological reactions whilst simultaneously watching the camera views of the player and the game-play. As such, the data will be used in conjunction with the camera recordings and post-play interview in order to identify when changes in emotional state occur.

The next stage of analysis involves the examination of the gaming diaries. The entries were typed up, with particular attention paid to identifying breakdowns and breakthroughs that occurred during game-play sessions outside of the lab. The final part

of this analysis entails the use of Nvivo 8 to analyse the diary interview transcripts. The emphasis here is on identifying macro level interactions (e.g. looking at gaming websites or guides) and any evidence that suggests learning occurring beyond learning how to play the game. This analysis also includes the application of prior themes, developed in an earlier study which relate to the concept of gaming capital (Iacovides et al, 2011) and categories which relate to learning (Iacovides et al, in press).

METHODOLOGICAL ISSUES
Since the analysis is in progress, this section offers a reflection on the method developed. Some examples from the case studies will be presented below in order to illustrate how effectively the adopted methods were able to capture the following methodological issues.

(i) Identifying breakdowns and breakthroughs that occurred during game-play
The main focus of the video analysis was on coding for the different types of breakdowns that occurred during play, the attempts made to overcome these breakdowns, and to any breakthroughs that occurred during these attempts. The breakdowns and breakthroughs were subsequently classified as major or minor, and then discussed by the authors in order to establish which could be regarded as involving important episodes and underlying issues. While this was a time consuming process, using the video recordings in conjunction with the post-play interview transcripts was very useful for capturing large amounts of rich evidence concerning the different types of breakdowns and breakthroughs that occurred.

For instance, when Matt (M, 24) was playing *Silent Hill: Shattered Memories* (Climax Group, 2009), he entered a part of the game which he referred to as the nightmare realm and soon found himself being chased by monsters. There are no weapons within the game, so he had to come up with different methods of avoiding these monsters. Soon after entering this realm, it became apparent Matt was having trouble doing so and with navigating through the environment. This soon led to his character's death and his having to start again from the last save point, which was identified as an important episode. It seemed clear that this failure frustrated Matt, not so much because his character died but because he did not think he had done anything wrong; "I just got trapped, I went under the bed but he found me, twice and then I'm trying to run away which is a dead end anyway and as soon as one found me, all three found me, which was quite annoying. I was like, that's not fair at all". This suggests that Matt was experiencing breakdowns on numerous levels; as his attempts to avoid the monsters were unsuccessful, he didn't understand why his actions were unsuccessful and he subsequently experienced a loss of agency, where he saw the game as being at fault rather than himself. However, after this episode, Matt started to develop more effective ways of dealing with the monsters, and also experienced a breakthrough in understanding when he realised that the GPS function on his character's phone (see Figure 1) also indicated the location of the monsters. However, it is worth pointing out Matt still had some difficulties with navigating through the environment, in the form of minor breakdowns. Due to the pressure of being chased through parts of the nightmare realm which looked very similar, he often felt unsure about where he was going. After a while, he found himself in a new area; "I was quite happy to see outside because I wasn't just running round in circles through doors". This new area arguably resulted in a breakthrough in terms of involvement since it was seen as confirmation of progress, despite Matt being unsure about how he got there. Interestingly, this suggests was able to progress within the game but without experiencing a

breakthrough in understanding; something which will require further consideration during the main analysis.

While the analysis of the physiological data is ongoing, it is worth noting that there seems to be increased activity across all measures whilst Matt is in the nightmare realm, especially when he is running away from the monsters. In this particular session, the data is generally quite messy and suffers from movement artefacts when Matt has to jerk the Wii controls to shake off the monsters. These artefacts mean the data is difficult to interpret though it is interesting to note that when Matt leaves the nightmare realm, there is a noticeable drop in forehead EMG and HR measures. His GSR also starts to slowly decrease the longer he spends outside of the nightmare realm, indicating a reduction of arousal as he becomes calmer. The camera recording also shows Matt visibly relax, since he shifts in his seat upon entering the new area. As he reports: "I was quite relieved to sort of have the world change, because then I knew, nothing was going to attack me again".

Finally, the diary entries allow us to track Matt's experience with *Silent Hill* over time; illustrating how little he played the game, especially in comparison to how often he played *Metro 2033* (4A games, 2010) in the same time period. The diary interview also gives us further insight into why he gradually lost interest *Silent Hill*. Despite initially being intrigued by the narrative, he grew frustrated with the game-play. In short, he felt the game-play in the nightmare realm was "a bit, arbitrary" because "when you got chased, you couldn't really do much about it" and so it ended up at "the bottom of the list" of what he wanted to play. The lack of agency he expresses suggests that Matt experienced a fundamental breakdown in involvement, and so he lost interest in the game.

It seems the diaries are another source of evidence concerning breakdowns and breakthroughs, though due to their retrospective nature the evidence they provide is far less detailed that that provided by the video and post-play interview data. On the plus side, they can capture more naturalistic events since they refer to activity outside of the lab. For instance, Natasha (F, 31) notes an episode when she was playing *Doctor Who: The Adventure Games* (Sumo Digital, 2010) where she experienced a breakdown in the form of not being able to get past the Dalek enemies without getting shot. She "tried 2 or 3 times before giving up and handing the game over to William" (her husband) as she found the controls "very fiddly" and though she watched him play for another half hour, she soon grew "bored" of it. It is interesting to note that, during the three week study period, she does not report playing this game again. In another case, Linda (F, 59) reports breakdowns beyond her control when experiencing server problems whilst trying to play *Farmville* (Zynga, 2009). She also discusses getting stuck on a couple of occasions when trying to solve the murder mystery puzzles in *Broken Sword: The Shadow of the Templars* (Revolution Software, 2009). In the latter case, she used the in-game hint system as a "prompt" in cases where she felt the "brain gets into a stuck groove and lateral thinking [is] usually needed". This can be seen as an example of how the game itself can facilitate breakthroughs that are necessary for continued progress.

(ii) Identifying learning beyond instances of game-play
The diary entries were also able to capture player interactions with paratexts, such as Matt looking up a forum post about the different weapons he could buy in *Metro 2033*; in order to try and find out which ones he should save up for within the game. These interactions also included instances such as Matt regularly checking Reddit games (a site

aggregator) to keep up to date on the latest gaming news. This can be seen as Matt accessing the wider gaming community for knowledge about new releases and developments within the industry. Further, Matt's use of paratexts relates to the concept of gaming capital, in the sense that he seems to already know how to access the information he wants and as a gamer, he likes to keep up to date about different gaming developments. In Justin's (M, 32) case, he ended up looking up some general knowledge after playing *God of War III* (Santa Monica Studio, 2010) in order to find out more about Greek mythology and "some of the more obscure characters in the game". This is an example of not just learning beyond the instance of play but also of learning something other than learning how to play the game. The diaries were also able to capture the development of collaborative skills such as Linda playing drums on *Guitar Hero 5* (Neversoft, 2009) with her daughter who played guitar, as a reward after doing housework. In addition, the interviews were used as an opportunity for participants to talk about their general gaming activities over time, so while Alex (M, 41) frequently mentioned playing with his son in the diary entries, it became clear from the interview that they would frequently bond over game-play and use the episodes to discuss other issues; such as how using walkthroughs can be helpful but it can be more rewarding when you put more effort into activities and succeed on your own.

It is worth noting that while the diaries were useful for capturing activities outside of the lab, and the final diary interviews for yielding richer descriptions of these activities, some of the evidence for learning that occurred beyond learning how to play was found during the observation and post-play interview phases of the study. For instance, it became clear from Katy's (F, 23) interview about her session playing *Zelda: Twilight Princess* (Nintendo EAD, 2007), that she had developed a strong empathy for the character. She used the phrase "Poor Link" several occasions; usually a response to the character Link dying within the game, but she also talked about aspects of the narrative being "really sad" when you considered them from his point of view. Further, she seemed to reflect on how there were times when she acted within the game in specific ways as "that's the way Link would do it" but sometimes she did things "just out of curiosity". For instance, at one point she talked to all the characters within an area, because even though "Link would probably run straight through the door" she wanted to see what they had to say. This sort of thinking is a good example of what Gee (2004) seems to be referring to when he talks about the critical learning that occurs when players consider the relationships between their individual and virtual identities.

DISCUSSION
In order to explore how player involvement and learning come together in and around instances of game-play a multi-method case study approach was developed. This paper sought to address two specific methodological issues (i) how to identify different types of breakdowns and breakthroughs which occur during game-play; (ii) how to identify learning which occurs beyond game-play.

In terms of issue (i), the video recordings of the game-play and player could have been relied on to identify various breakdowns and breakthroughs that occur on a micro level, but without the post-play interview certain inferences would have to have been made about the nature of these. For instance, when Matt died in *Silent Hill*, it would have been reasonable to assume this annoyed him; especially in conjunction with the footage of him shaking his head afterwards and saying "I don't know" just after the event. However, the underlying issue here would have been missed. Matt wasn't annoyed because he died, he was annoyed because he didn't understand why he died. This breakdown in

understanding was compounded by his general confusion about where he was supposed to go, despite experiencing some minor breakthroughs by developing new strategies. The diary entries also allow insight into player's involvement over time, such as Matt's giving up on *Silent Hill*. Further, while the lab was set-up for console game-play, the diaries were able to capture game-play on other devices including computers, handheld consoles and mobile phones, which could then be discussed in the final interview. It can be argued that collecting data from multiple sources helps in terms of triangulating the data when identifying breakdowns and breakthroughs, and also allows for a more in depth understanding of how these breakdowns and breakthroughs occur over time.

In terms of issue (ii), the methods were able to gain further insight into learning that occurred beyond instances of play, in terms of players' macro level involvement with games. The diaries enabled us to take into account player involvement with external resources such as game paratexts; which were consulted for game advice and to keep up to date with general gaming developments. The diaries also captured instances of players further exploring information they had encountered within a game e.g. Justin looking up aspects of Greek mythology. Keeping up to date with gaming news and looking up further information can also been seen as examples of learning beyond the experience of learning how to play. The final interview based on the diary entries also allowed for participants to elaborate instances of game-play and was especially useful for considering participant involvement in wider gaming activities. By asking participants to bring in a game of their choice, and to further discuss this choice during the interviews, we were able to gain a deeper understanding of their involvement and learning than would have been possible from just observing a session of game-play. For instance, Katy chose to bring in *Zelda: Twilight Princess* as she had decided to replay it, much like "re-reading a favourite book". Both the post-play and diary interviews revealed she had a long running involvement with the Zelda series, suggesting that the empathy she displayed for the characters was something that had occurred as a result of years of playing Zelda games and engaging in game-related activities such as role play and writing fan fiction. Again, the method not only allowed for triangulation of data, but for a consideration of a player's history and the different kinds of learning and involvement that occur over time.

That is not to say there are no limitations to the adopted approach. The most obvious disadvantage is the amount of time required to conduct the study and analyse the data. Further, when it comes to the physiological data there is the issue of movement artefacts; which suggests that this sort of data is less appropriate for evaluating games that depend on motion control and for situations when players talk to themselves out loud or to each other during game-play. Though Hazlett (2008) suggests using the data in real-time, this proved to be a struggle for a single observer. Therefore, the data will be used post-play in order to identify when changes in emotion have occurred during important episodes. In addition, it should be noted that while the introductory session and the length of the main game-play sessions helped participants feel at ease within the lab, some did report feeling aware of the fact that they were being observed. Finally, as this is a case-study approach, care needs to be taken when making statistical generalisations and comparisons between sessions, though Yin (2008) suggests generalisations to theory are appropriate.

While the analysis is ongoing, it is hoped that by looking for general patterns across the rich and informative data set, we can gain a deeper understanding of how involvement and learning come together in and around instances of game-play. It is only through taking both macro and micro level experiences into account that we can really understand just "what players do with games" and "the thinking that is involved in

playing them" (Squire, 2008; p.167). Furthermore, a questionnaire is also planned in order to assess gaming habits and attitudes of different players (e.g. casual and hardcore gamers) on a larger scale (especially in terms of certain activities that might support learning). This will help contribute to a broader developing account of how involvement and learning relate to each other within the context of digital games.

ACKNOWLEDGMENTS

BIBLIOGRAPHY

4A Games (2010) Metro 2033 [Xbox 360], THQ, European version, played April 2010.

Bourdieu, P. (1984). Distinction: A Social Critique of the Judgment of Taste. Cambridge MA: Harvard University Press.

Calleja, G. (2007). Digital Game Involvement: A Conceptual Model. Games and Culture, 2, 236–260.

Climax Group (2009) Silent Hill: Shattered Memories [Wii], Konami Digital Entertainment, European version, played April-May 2010.

Consalvo, M. (2007). Cheating: Gaining Advantage in Videogames. Cambridge, MA: MIT Press.

Egenfeldt-Nielsen, S., Smith, J. H., & Tosca, S. P. (2008). Understanding Video Games: The Essential Introduction New York and London, Routledge.

Elliott, H. (1997). 'The Use of Diaries in Sociological Research on Health Experience. Sociol. Res. Online. vol. 2, no. 2, http://www.socresonline.org.uk/2/2/7.html

Gee, J. P. (2004). What Video Games Have to Teach Us About Learning and Literacy. New York: Palgrave Macmillan.

Gibson, D., Aldrich, C., & Prensky, M. (Eds.) (2007). Games and simulations in online learning: Research and development frameworks. Hershey, PA: Information Science Publishing.

Hazlett, R.L. (2008). Using biometric measurement to create emotionally compelling games. In Isbister, K., & Schaffer, N. (Eds) Game Usability: Advice from the Experts for Advancing the Player Experience. Burlington, USA: Morgan Kauffman Publishers, pp. 187-206.

Iacovides, I. (2009). Exploring the link between player involvement and learning within digital games. In Proceedings of the 23rd Conference on Human Computer Interaction, pp.29-34, Cambridge, UK.

Iacovides I., Aczel J.C., Scanlon, E., Taylor, J. & Woods, W.I.S. (2011). Motivation, engagement and learning through digital games. Journal of Virtual and Personal Learning Environments, 2(2), 1-1

Iacovides, I., Aczel J.C., Scanlon, E., & Woods, W.I.S. (in press). What do players have to say about informal learning through games? Paper accepted for the 14th Biennial Conference of European Association for Research on Learning and Instruction, University of Exeter, UK.

Kutti, K. (1996). Activity theory as a potential framework for human computer interaction research, in: B. A. Nardi (Ed.) Context and consciousness: activity theory and human–computer interaction, pp 17-44. Cambridge, MA, MIT Press.

Lave, J., & Wegner, E. (1991). Situated Learning: Legitimate Peripheral Participation. Cambridge University Press, UK.

Malone, T. W. (1981) Toward a theory of intrinsically motivating instruction. Cognitive Science: A Multidisciplinary Journal, 5, 333-369.

Malone, T. W., Lepper, M. R. (1987) Making learning fun: A taxonomy of intrinsic motivations for learning. Aptitude, Learning, and Instruction, 3, 223-253.

Mandryk, R. L, Inkpen, K.M.. (2004). Physiological Indicators for the Evaluation of Co-located Collaborative Play. In: Proceedings of the ACM Conference on Computer Supported Cooperative Work, 102-111. Chicago, USA.

Mandryk, R. L., Atkins, M.S. (2007). A Fuzzy Physiological Approach for Continuously Modeling Emotion During Interaction with Play Environments. International Journal of Human-Computer Studies, 6(4), 329-347.

Marsh, T., Wright, P., & Smith, S. (2001). Evaluation for the Design of Experience in Virtual Environments: Modeling Breakdown of Interaction and Illusion. C*yberPsychology & Behavior*, 4(2), 225-238.

Neversoft (2009) Guitar Hero 5 [Xbox 360], Activision, European Version, played May 2010.

Nintendo EAD (2006) Zelda: Twilight Princess [Wii], Nintendo, European version, played May 2010.

Pelletier, C. & Oliver, M. (2006). Learning to play in digital games. Learning, media and technology, 31, 329-342.

Revolution Software (2009) Broken Sword: The Shadow of the Templars (Director's Cut) [DS], played June 2010.

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). Motivation pull of video games: A Self-determination theory approach. Motivation and Emotion, 30, 347-365.

Ryan, W., & Siegel, M. A. (2009). Evaluating interactive entertainment using breakdown: Understanding embodied learning in video games. In Proceedings of DiGRA. London, England.

Santa Monica Studio (2010) God of War III [Playstation 3], Sony Computer Entertainment

Treyarch (2010) Call of Duty: Black Ops [Multiple platforms], Activision.

Sharples, M. (2009) Methods for Evaluating Mobile Learning. In G.N. Vavoula, N. Pachler, and A. Kukulska-Hulme (eds), Researching Mobile Learning: Frameworks, Tools and Research Designs. Oxford: Peter Lang Publishing Group, pp. 17-39. http://www.lsri.nottingham.ac.uk/msh/Papers/Methods%20Evaluating%20Mobile%20 Learning.pdf (accessed Apr. 2011).

Stake, R.E (2003). Case studies. In Denzin and Lincoln (Eds), Strategies of Qualitative Inquiry, 2nd ed. Sage Publications, 2003, pp. 134–164.

Stuart, K. (2010). Guardian gamesblog, http://www.guardian.co.uk/technology/gamesblog/2010/nov/11/games-pc (accessed Apr. 2011).

Squire, K. (2008). Open-Ended Video Games: A Model for Developing Learning for the Interactive Age. In The Ecology of Games: Connecting Youth, Games, and Learning, Salen, K. (Eds). Cambridge, MA: The MIT Press, pp. 167–198.

Sumo Digtial (2010) Dr. Who: The Adventure Games [PC download], BBC Wales, Free UK version, played July 2010.

Vavoula G., Scanlon E., Lonsdale P., Sharples M. & Jones A. (2005) Report on empirical work with mobile learning and literature on mobile learning in science. Jointly Executed Integrated Research Projects (JEIRP), D33.2.2

Yin, R.K. (2008). Case Study Research: Design and Methods. SAGE Publications, California, USA. (2008).

Zygna (2009) Farmville [Social network browser game], Facebook, played May-June 2010.