Learning the Game: Breakdowns, Breakthroughs and Player Strategies

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Abstract
Digital games are rich learning environments that require players to engage with challenging situations in order to progress. Recent research indicates that game-play involves overcoming breakdowns and achieving breakthroughs in relation to player action, understanding and involvement. In particular, breakthroughs involve moments of insight where learning occurs which, in turn, can help increase involvement. However, little is known about how players actually achieve breakthroughs. We applied the breakdown/breakthrough "lens" to explore how players attempt to achieve breakthroughs in relation to two single player games. We identified a finite number of strategies that illustrate how players learn in games. These strategies are considered in relation to producing playable and engaging games.

Author Keywords
Games; learning; engagement; player strategies.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous. K.8.0. General: Games.

Introduction
Given the rising popularity of digital games, it is has become increasingly important to ensure that designers

are able to produce games that can be enjoyed by both dedicated "hardcore" gamers and more "casual" players [8]. Further, while it has been argued that learning is at the heart of all game-play [5], outside the realm of education, there has been little examination of how players learn during play. Through understanding the learning process – by focusing on the strategies players apply in response to the variety of challenges they face – developers will be able to produce engaging educational and commercial games that will appeal to a broad range of players.

Previous HCI research into games has mainly focused on what makes digital games so enjoyable e.g. [4], and on how to evaluate game-play experiences, e.g. [10]. Learnability has been considered in relation to design, e.g. [2], but rarely beyond the scope of grasping initial controls and mechanics. While cognitive challenge is considered a key component of game-play, e.g. [4], and there has been some consideration of how learning results from game-play breakdowns [6; 7; 11], little attention has been paid to the different strategies adult players employ to overcome the problems they encounter.

Building on the work of Ryan & Siegel [12] and Pelletier & Oliver [11], Iacovides et al [6; 7] examined breakdowns and breakthroughs in order to investigate the relationship between learning and involvement within game-play. Extending Sharples' definitions [14] (originally applied to a mobile educational context), Iacovides et al., argue that breakdowns and breakthroughs can occur in relation to player *action* (e.g. problems with the controller, performing a new attack); *understanding* (e.g. not knowing what to do next, figuring out a solution a puzzle); and *involvement* (e.g. getting frustrated, experiencing satisfaction) [6; 7]. However, their research did not consider the different player strategies players apply in an attempt to achieve breakthroughs.

In work that does consider how different players approach game-play, Blumberg et al. [3] conducted a study that examined how frequent and infrequent players negotiated impasses within a game. Similar to breakdowns, the authors describe an impasse as "a catalyst for the acquisition of new knowledge and problem-solving strategies" (p. 1531). Frequent players were found to make more references to insight and game strategies than infrequent players. However, while the findings indicate that there are differences in player approaches, the authors did not actually classify any of the game strategies used and so it is unclear how impasses were overcome in practice. Further, only one game was included in the study.

In similar work, Alkan & Cagiltay [1] investigated the strategies novices adopt when playing a new game. During the post-play interview participants suggested the main strategies they use are "trial and error" and using "friends as sources of information". The authors also noted that while a hint function was available that provided explicit instruction; it was never heeded by the participants. However, while the findings suggest that players do not always pay attention to information provided by the game, it is unclear exactly what the process of "trial and error" consisted of. In addition, the study also only examined a single game so it is unclear how general these strategies are.

While previous research has investigated the different types of breakdowns that occur during play there has

been little examination of how players actually overcome in-game challenges. This paper reports on an initial investigation that elicited a standardized set of strategy types to describe how players attempt to overcome breakdowns and achieve breakthroughs. By understanding the strategies applied, designers will be able to avoid situations where irreparable breakdowns occur, thus supporting more engaging game-play.

Method

Design:

This was an observational study of play that included a post-play interview (where a recording of the game-play session was reviewed).

Figure 1: Screenshot from Wonderputt (2012 finalist)

Participants:

20 participants (F=5; M=15; Mean age = 25.2) were recruited from the [institution anonymized] participant pool. Participants were paid £10, and consisted of an equal mix of hardcore and casual players so that the strategies would reflect a range of player ability.

Materials:

Two browser-based games were sourced from finalists of the Independent Games Festival. Two different genres (a puzzle game and an action-shooter) were selected to improve the generalizability. Wonderputt (WP) is a crazy golf game (Figure 1). The player completes 18 holes using the mouse to adjust the angle and the speed of the ball. The holes gradually get harder requiring more precision and creativity.

Figure 2: Screenshot from Rocketbirds: Revolution! (2010 finalist)

The second game, Rocketbirds: Revolution! (RR), is a 2D action game where the player has to negotiate their way through an enemy base (Figure 2). The game involves solving basic puzzles, killing enemies and managing health and ammunition.

Procedure:

The order of the games was counterbalanced over two sessions (split to minimize the effects of fatigue). Instruction sheets were provided and sessions lasted 20 minutes (unless the game was finished early). At the end of the session, the experimenter interviewed the

participant and played back a recording of the game-play session to stimulate their recall [as in 6]. The participant was asked to explain what they were doing and thinking with particular emphasis placed on how they dealt with the problems they encountered.

Developing the strategies

The data was coded for critical incidents where players were unable to progress through a lack of proficiency with the controls (action breakdowns), a lack of understanding about their current objective (understanding breakdowns) and when they experienced a reduction in their level of interest in the game (involvement breakdowns). The incidents often involved combinations of breakdowns (e.g. action and understanding), and were examined to uncover player strategies that were used to try and achieve breakthroughs. Similar to thematic analysis, the categories were developed through an iterative process until a definitive set was able to account for the different approaches observed. The strategies are defined below with illustrative examples. Participants are referred to by number e.g. Participant 1 is P1.

1. *Trial & Error*

This approach consists of exploring what the game allows, how to carry out actions and finding out which actions lead to progress. Essentially, the player is trying to find out what will happen if they try out different things. For instance, P10 (Hardcore) in RR is having trouble picking up a key, resorting to pressing different buttons on the keyboard in case one might work. Trial & Error sometimes results in accidental discoveries such as P8 (Casual) in WP, who didn't know how to complete the course but through repeatedly aiming at the hole, mistakenly hit one of the blocks which deactivates a force field blocking their progress.

2. *Experiment*

On the basis of previous knowledge and/or what is learnt from Trial & Error, the player forms an informal hypothesis, takes a subsequent action and, depending on the outcome, either proceeds in the game or reforms the hypothesis. For instance, after taking an exploratory shot (Trial & Error) to see how the crane works in WP, P19 (Casual) uses this information to direct his next shot and is able to use the crane to progress. This strategy can also involve transferring knowledge from the real world, from experiences with other games or from earlier experience within the same game. However, inappropriate transfer can lead to further breakdowns. For example, in RR, P6 (Hardcore) misses several jumps by assuming the character will grab onto a ledge automatically as in the case of Mario and Zelda games.

3. *Stop & think*

Play is suspended briefly (either by pausing or not acting within the game) while the player considers how best to proceed. While reflection may occur "in action" as part of the Experiment strategy, this category is reserved for reflection "on action" [13]. For instance, in RR, P12 (Hardcore) accidently unequipped their gun so when they came across an enemy they were unable to return fire. They retreat to the previous screen and pause to consider what has gone wrong. A variant of this strategy involves checking external resources or looking for in-game help. For instance, in WP, P4 (Hardcore) P looks at the information sheet provided to find out more about the controls work.

4. *Practice*

This strategy was coded when the player's aim was to gain proficiency with the controls and so rehearsed or refined a technique on the obstacle or in a safe area of the game. For instance, in RR, P14 (Casual) decides to practice within the safety of the first screen, where there were no enemies. They gain basic proficiency in moving, jumping and firing the gun before proceeding. Similarly, in WW, after trying out the controls, P20 (Hardcore) takes a few deliberate practice hits to improve their ability control the power meter and subsequent speed of the ball.

5. *Take the hint*

Games often provide explicit hints and tips at various points in the game – this strategy involves the player understanding what the game is trying to tell them and carrying out the suggested action. In WP, this could was only observed at the intro screen when players would attempt to interpret the arrows provided to them on screen and translate them to the mouse controls. In RR, hints are provided at various points but further breakdowns can occur if the player misses these or does not understand them. For instance, P15 (Casual) does not see the hint about using the action button to access the lift and ends up exploring other parts of the game for clues instead.

DISCUSSION AND FUTURE WORK

By considering these 5 strategies in relation to how people learn to play, designers will be able to produce games that appeal to a broad audience (as the categories can account for how different players respond to a variety of challenges). Further, the findings highlight certain issues that need to be considered in order to avoid the occurrence of breakdowns that will severely reduce player involvement.

The first design issue to consider relates to the difference between Trial & Error and Experimentation. Trial & Error has been referred to in other research e.g. [1] but it is not always clear what the label is used for. In Gee's analysis of games [5], he describes how players are continually probing the game-world, reflecting on actions, forming a hypothesis, testing through re-probing and then accepting or rethinking. However, the findings indicate that there are times when players try certain things just to see what, if anything, will happen. Unlike Gee's "Probing principle" suggests, an explicit hypothesis is not always formed. However, in Experimentation, the player needs to already have an initial understanding about the game-world in order to be able to test it.

This distinction is particularly important to consider in relation to educational games where it is key to ensure that players are able to develop the required knowledge and skills to effectively implement the strategy. While Trial & Error may lead to progress, subsequent understanding is not guaranteed, and progress in itself is not an indication of learning [7; 9].

A further consideration relates to the need to ensure that players are given an opportunity to Practice either in a "safe" part of the game, or in terms of supporting gradual improvement of skills throughout the game. In addition, Stop & Think should be supported and encouraged as Reflection is an integral component of the learning process [13] and can help to increase player satisfaction [7].

Finally, the Take the Hint strategy, was not always adopted as sometimes the player was unable to interpret what the game was suggesting or did not see the suggestion in the first place. As such, any hints need to be made very clear and easy to understand. However, in games such as The Path or The Stanley Parable, the opposite behavior is supported – by giving the player clear instructions (e.g. stay on the path) but encouraging them not to (e.g. little happens if you do just stay on the path). It would be interesting to explore the games and situations where players choose to ignore the hint.

In addition, while the study covered more than one type of genre, further research is required to establish the extent to which the strategies apply to genres not included, e.g. role playing games. The strategies could also act as a starting point for multiplayer game-play. Finally, a more in-depth investigation could consider the influence of expertise in relation to the choice and execution of strategies.

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