Investigating the Effect of Scaffolding in Modern Game Design

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Abstract. Nowadays, game developers are much more focused on providing players with short-term rewards for overcoming challenges than they have been previously. This has resulted in a lot of games having more scaffolding to teach the players what to do, so they don't quit the games in frustration of not knowing what to do.

This paper investigates the effects that scaffolding in games has on players' experience of a game. To this end, a custom game was designed and implemented that contained a number of different scenarios with different types of scaffolding. This was used to conduct an experiment on 18 participants, measuring their experience with the scenarios they were tasked with completing. It turned out that participants overall found the scenarios with subtler scaffolding more interesting than the ones with text based scaffolding or no scaffolding at all. Additionally, they felt better about completing the scenarios that did not make use of scaffolding.

Keywords: Video games · Game design · Player experience · Player motivation · Scaffolding

1 Introduction

Early on in video game history, games were very hard on purpose because they were meant to be played in arcades, and players would have to pay to continue playing. It was common for games to just show a few hints and leave it up to the player to figure out what to do. Nowadays, a lot more games have repeated text prompts and tutorials teaching the players what to do. It is much more important for game developers now that they can retain their players because of how the business models of these games have changed. Today, downloadable content provides a lot of additional revenue for developers, and they want to make sure the players stick around longer such that they spend their money on it [9].

The prevalence of grinding [7] based challenges in games makes it possible to reach a wider audience, which could be why a lot of casual games prefer this approach versus grip based challenges. Grinding-based challenges make sure that if a player puts in a certain amount of time, they will be provided with some reward. This keeps more people playing than allowing for the possibility of getting stuck on hard challenges.

In recent years, more attention is being paid to the design of various challenges in games, because allowing players to repeatedly overcome challenges makes them more

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likely to keep playing [8], but it seems like the more attention developers are paying, the more they feel the need to very explicitly tell the players what they need to do throughout. This approach is referred to as scaffolding [5] (and references therein).

Scaffolding is defined as help given to a learner that is tailored to the learner's specific goals at any given time, while also helping them actually learn what they have to learn. Directly telling the learner what to do might make them complete the task, but then they might just be stuck on the next one since they never actually learned how to complete the task. Instead, good scaffolding provides the learners with hints and prompts that help them figure out what they have to do [6].

This paper investigates to which degree the quality of the scaffolding [5] impacts the player experience in modern games. Are players less interested when the scaffolding is bad and directly tells them what to do, as opposed to when they figure out the solution for themselves because of good scaffolding?

This is investigated through a custom game, made for this specific purpose, which ensures that the game is able to single out the factors that this paper will try to investigate, and making the test perfectly uniform. This was possible by designing the test so that different participants played the same selection of control, indirect and text based challenges.

2 Background

2.1 Game Mechanics

In an interview, Super Mario 3D Land Director Koichi Hayashida [1] described the way they implemented new challenges in the levels. It followed a simple four-step structure: The new element is first introduced in a safe environment (Fig. 1.1). Then there is a similar challenge, but without the safety net of the first (Fig. 1.2). It is then applied in a different way than the first two times, to show that the mechanic is not just one-dimensional (Fig. 1.3). Finally, the big payoff moment combines the various ways the mechanic can work, and is harder, and thus also more interesting than the previous challenges.

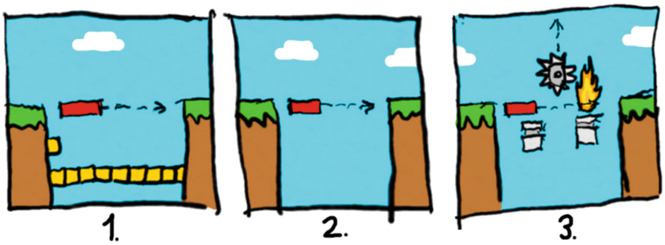

Fig. 1. Example from a hypothetical Super Mario level. If the player falls down in Scenario 1, they land on a platform and can go back up and try again (safe environment). Scenario 2 provides the same challenge, but without the safety net. Scenario 3 uses the same concept but adds variety and new threats that the player has to deal with at the same time.

The last step here is not needed to teach the mechanic, but is included in the description since the Mario games often have levels based on specific mechanics. The newly taught mechanic is thus often abandoned in favor of a new mechanic in the very next level, which is why the players need some sort of payoff after being taught a mechanic.

2.2 Player Motivation

Nicole Lazzaro elaborated on players' motivation while playing games and tied it to four key factors: Hard Fun, Easy Fun, Altered States, and The People Factor [2]. Different people find different factors in a game fun, and one could argue that by changing how the challenge is presented, one changes which players the challenge appeals to. The main two factors that we focus on in this paper are Hard Fun and Easy Fun.

Hard Fun focuses on personal triumph, and is about players playing to see how good they are at the game. This means that the main objectives are, for example, completing the game, earning the highest score, or beating the enemy team. Because of this, skill-based games (as opposed to chance-based games) are often more enjoyable for players who prefer Hard Fun. Some games that are Hard Fun could be fast-paced platformers; e.g., Super Meat Boy, or competitive games; e.g., Dota or Counter Strike.

Easy Fun relates to the whole game experience, rather than just the objective. The main objectives of players who seek out Easy Fun are to explore the world and trying to come up with their own solutions to problems they are presented with, immersing themselves in the story of the game, or even just doing things that feel satisfying because they are presented with juicy visual effects. Games in this category could be story-based games, e.g., Mass Effect, or sandbox games e.g., Minecraft.

If a game has a section with a lot of scaffolding, a player who prefers Easy Fun might be just as satisfied when completing the tasks as players who enjoy Hard Fun would be when they complete a much harder challenge. This should not discredit one type of fun or the other, but ideally a compromise between the two could be found that allows both types of players to have a good experience with a challenge.

A possible solution to the problem of players not enjoying the same kind of challenges in games is found in the twenty-nine-year-old The Legend of Zelda. In an investigation of the dungeon designs, Mike Stout [3] notes how the dungeons are designed with optional rooms that the players do not have to enter. While a more experienced player might rush ahead without a problem, less experienced players have the option of familiarizing themselves with new enemy types and equipment in less dangerous settings than the road straight ahead often presents. This additional training might provide them with the experience they need to push on, without needing to hold their hand.

Another way to teach players something is to block them from moving further unless they solve a problem they are presented with. This will force players to figure out the solution to the problem, or they will simply be unable to proceed. This method is used throughout many games, including Valve's Half Life 2 [4] (Fig. 2).

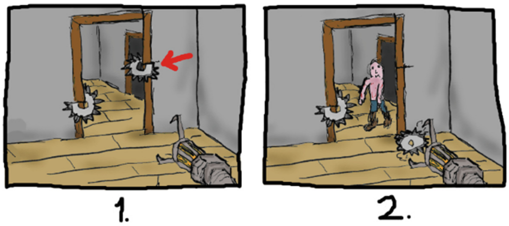

Fig. 2. Example from Half Life 2. Players are blocked, and cannot move ahead until they use the gravity gun. The players then learn how to use the gravity gun offensively.

3 Method

To investigate how helpful scaffolding is in different scenarios, we created a custom game based on information from the previous research in the field, as well as the use of scaffolding in a number of games, in particular titles from the 'Mario', 'Zelda' and 'Half Life' series.

3.1 Experiment Design

We created a small game specifically with the purpose of being able to conduct a uniform experiment, as opposed to having participants play parts of different games. The design of this game, and how it fits into the overall experiment is detailed next.

3.1.1 Game Design

Based on various scenarios in existing games, three different scenarios were created within the same custom game. Each game scenario has three different versions. In no particular order: a version using indirect teaching, one using text to teach the objective, and a control version, which has neither scaffolding method. The objective of each scenario is to find a key, and the players are instructed that this is their goal before they start the experiment. The scenarios are depicted in Figs. 3, 4 and 5. Each scenario is based on scenes from existing games as explained next:

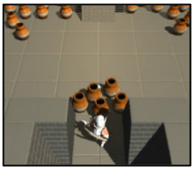

Fig. 3. The 'Pots' scenario with indirect scaffolding.

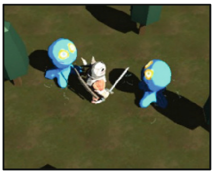

Fig. 4. The 'Trees' scenario with indirect scaffolding.

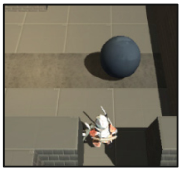

Fig. 5. The 'Ball' scenario with indirect scaffolding.

In the ‘Pots’ scenario (Fig. 3), the players have to smash the pots in the back to retrieve the key. In the version with indirect teaching, the pots blocking the entrance make sure that the players know how to smash pots before they proceed. This scenario is inspired by the sawblade scenario from Half Life 2 [4].

In the ‘Trees’ scenario (Fig. 4), the players have to cut down a row of trees to get to the key. They are taught that they can cut down trees by being forced to fight enemies right next to the trees – accidentally hitting a tree will cut it down. This scenario is inspired by the tree scenario in Zelda: Phantom Hourglass [10]. The control version lacks the trees that the player can accidentally hit while fighting the enemies.

In the ‘Ball’ scenario (Fig. 5), the players have to push the ball to the lowered floor tile. Their attention is led to this objective by the line on the ground. This scenario is inspired by the mushroom puzzle in Zelda: The Minish Cap [11]. The control version does not have the darker colored line on the floor to direct the attention of the player.

Finally, the text versions of the scenarios are similar to the control versions but contain the following lines as the players enter the puzzle areas, all based on the same template:

Pots: “Hm, maybe there is a way to smash these pots”.
Trees: “Hm, maybe I can use my sword to cut down obstacles”.
Ball: “Hm, maybe this ball can be used for something”.

3.1.2 Experimental Design

For the final test, we employed a chi-squared design with a fixed randomization. With three scenarios with three versions each that meant that nine tests were the least possible amount of tests needed to have one starting with each different version.

The whole experiment was estimated to take less than 10 min for each participant, depending on how long they take on each scenario. The breakdown is 1 min for an introduction, 2 min for each scenario (6 min total) and then 2 min for a post-test questionnaire, with 1 min extra for getting them set up.

During the test, the screen, as well as a video feed from the web camera was recorded. This recording was used to see if there were any errors in the logging of the times from the test.

3.1.3 Post Test Questionnaire

After the test participants finished the test, they were asked to answer a very short questionnaire. First, they were asked how long they think they spent on each task. This was used to hold up against their actual completion times to measure if they were in a state of flow. However, the data collected on this proved inconclusive.

Secondly, they were asked to rate the three test scenarios based on three different factors; how interesting they were, how good they felt about completing them, and how hard they thought they were. The ratings were based on participants sorting the challenges from least interesting to most interesting, and the same for the other categories.

The questionnaire looked as follows:

For each puzzle, estimate how long they took to complete (in seconds)
Pots: _________ *Trees:* ________ *Ball:* __________
Sort the puzzles based on how interesting they were (least interesting first)

Sort the puzzles based on which you felt the best about completing (worst first)
Sort the puzzles based on difficulty (easiest first)

3.1.4 Apparatus

1 × PC with keyboard, mouse and web camera.

4 Results

Eighteen test participants went through the experiment – all were from an IT related education. Fifteen participants were male, three were female. p-values are based on a standard unpaired student's t-test. All results are based on the questionnaires filled out by the test participants after they completed the puzzles.

For the ratings based on how interesting participants thought the puzzles were, the overall average for indirect puzzles was 2.22 (standard deviation σ = 0.94). This puts it significantly higher than the control puzzles, which had an average of 1.83 (σ = 0.70), with a p-value of 0.015. In addition, the indirect puzzles were also rated significantly higher than the text based puzzles, which had an average rating of 1.94 (σ = 0.80), with a p-value of 0.028 (Fig. 6).

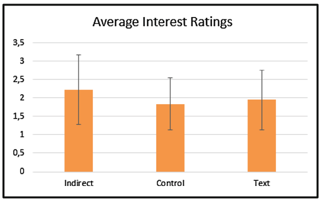

Fig. 6. Test participant ratings on how interesting they found the puzzles.

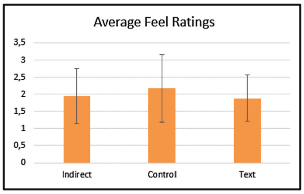

Fig. 7. Test participant ratings of how accomplished they felt when completing the puzzles.

Moving on to the ratings on how good they felt when completing the different puzzles, participants actually felt significantly better about completing the control puzzles, which had an average rating of 2.17 (σ = 0.98), compared to the 1.94 (σ = 0.80) of the indirect puzzles, and the 1.88 (σ = 0.68) of the text based puzzles. Control versus indirect had a p-value of 0.052, and control versus text had one of 0.048. It makes sense that people felt more accomplished when completing the control test, as participants did not receive any assistance in completing the puzzles (Fig. 7).

Finally, the participants rated the three puzzles based on how difficult they thought they were. The assumption here was – based on the results from the previous set of ratings – that the test participants overall would rate the control test the most difficult. This however, did not turn out to be the case, with every result based on these ratings being insignificant. The control puzzles had an average difficulty rating of 2.0 (σ = 0.84), versus 2.16 (σ = 0.70) of the indirect puzzles, and 1.83 (σ = 0.92) of the text puzzles.

The fact that none of the types of scaffolding (indirect, control, text), were rated significantly different in terms of difficulty was likely due to the difference in the three scenarios. The 'Ball' scenario received the highest rated difficulty across all three types, indirect, text and control, with an average rating of 2.88 ($\sigma = 0.32$), compared to the control and text, which both had an average of 1.55 ($\sigma = 0.61$). It was thus hard to tell if indirect was any different from control and text (Fig. 8).

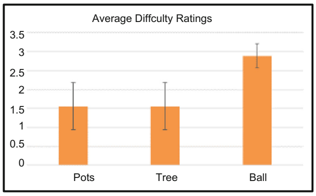

Fig. 8. Test participant ratings of how difficult they found the different scenarios.

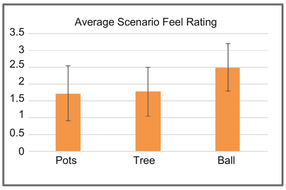

Fig. 9. Test participant ratings of how accomplished they felt when completing the different scenarios.

The assumption that test participants felt better when completing a task that they also rated harder is supported by the 'feel' ratings as seen in Fig. 9. 'Pots' had an average difficulty of 1.72 ($\sigma = 0.82$), 'Trees' were right behind with 1.77 ($\sigma = 0.73$). This put the average 2.5 ($\sigma = 0.7$) of the 'Ball' puzzle highly significantly above both, with p-values of 0.000044 for ball versus pots and 0.00013 for ball versus trees respectively.

The results for the different scenarios are consistent across the different types of scaffolding.

5 Discussion and Conclusion

As it turned out, most players found the puzzles with indirect scaffolding significantly more interesting than the control puzzles – however, they felt slightly worse about completing them than the control puzzles. There is clearly a balance to be struck here, but finding the best level of scaffolding is complicated and presumably depends on many factors.

If the developer of a given title just wants the players to complete the game as fast as possible, text prompts appear to be the most efficient way of allowing the players to quickly figure out how to complete a given task, but at the cost of making the players less interested in the puzzle overall.

The fact that the players felt more satisfied when completing the tasks that they rated as more difficult can potentially be attributed to the fact that the players were all students in an IT related education. This means that they are more likely to have a technological background than the average person, which may influence the type of game they prefer playing.

In conclusion, indirect scaffolding led to players being more interested in the challenges they faced, but there appears to be a tradeoff between making challenges more interesting, and providing a stronger feeling of accomplishment. It will vary from game to game if the developers think the tradeoff of feeling accomplished versus having interesting scenarios is worth it.

In case this is investigated further, more attention must be paid to making sure the different puzzles are more even in terms of difficulty, as some significant results in this test might have been overshadowed by the vast difference in difficulty in the different scenarios.

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