

Behaviour, Realism and Immersion in Games

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ABSTRACT

Immersion is recognised as an important element of good games. However, it is not always clear what is meant by immersion. Earlier work has identified possible barriers to immersion including a lack of coherence between different aspects of the game.

Building on this work, we designed an experiment to examine people's expectations of how a game should behave and what would happen if that behaviour was deliberately made to be incoherent. The idea then is to understand immersion through seeing how immersion can be broken. The main manipulation was to alter the behaviour and realism of the graphics in the course of a simple game situation.

Surprisingly, results indicated that participants could be so immersed within a simple environment such that even significant changes in behaviour had little effect on the level of immersion. In some cases, the attempted disruptions went completely unnoticed.

These results suggest that immersion within an application can overcome effects which are completely against user expectations.

Author Keywords

Games, immersion, realism, behaviour

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI):
Miscellaneous.

INTRODUCTION

Immersion is a term widely used in the video game industry both to promote, review and describe the gaming experience [2][8]. Video game designs have successfully incorporated positive user experiences, leading players of the games to play for hours at a time. This persistent willingness to play is associated with immersion but from previous work [1][7] it is clear that immersion is not a simple concept. Instead, there are different levels of immersion and games must not block the achievement of

these different levels if a player is to achieve immersion. Even so, players did not expect to be fully immersed (present) in the game all the time.

One particular barrier to immersion was thought to be caused when the different aspects of the game did not cohere across different modalities [1]. The aim of this study is to further analyse the notion of immersion in terms of the coherence of the different modalities. Specifically, in this particular study, we considered the notion that the graphical realism of the game should cohere with the behavioural realism. However, immersion is notoriously difficult to define or measure and asking a gamer to self-report on immersion is likely to destroy the sense of immersion. Therefore, the main manipulation was intended to artificially put up a barrier to immersion midway through a simple game. Thus, by deliberately breaking immersion, it may be possible to understand what the experience of immersion was and what specifically removed the immersion. This methodology is similar to how scientists have studied the correct functioning of the human brain by observing those which have been damaged in some way previously (due to stroke or other accidents) [3].

There are many extreme ways in which modal incoherence could be achieved. However, it was felt that the break should still result in a consistent experience even though not consistent with what had gone before. In this way, the break in immersion could be safely attributed to the change in coherence rather than to any inherent weirdness. For example, the height a person could jump could become radically different but a wall would remain an obstacle fixed in space. The next section describes the details of the experiment followed by the results. The most surprising result is that some players failed to notice any change in behaviour at all let alone become less immersed. This has significant implications for our understanding of immersion in games as discussed in the final section.

EXPERIMENTAL METHOD

Overview

The goal of the experiment was to see to what extent it is possible to reduce immersion in games by reducing coherence across modalities. The experiment centred on a simple game like environment. During the course of a single game, the qualities of behavioural and graphical realism [9] were manipulated. We use the term graphical

realism to represent the combination of illumination and geometric realism as described by Slater et al. [9] (i.e., the realism of the lighting, shadows and shape of the objects). Behavioural realism represents how closely objects and characters act in comparison to the same object in the real world (for example, how high a person can jump). In order to help interpret the effect of the manipulations, players were first asked about their expectations based on screenshots of the game. The details are described in the following sections.

Participants

14 participants were studied, who had varying levels of gaming experience. The sample included 8 male and 6 female participants, all of whom had a minimum of 10 years of computer experience with the exception of one participant who reported 6 years of experience with computers. To limit the scope of the experiment, the age range of the participants was limited to adults between the ages of 18-45.

The participants currently owned or previously owned a mean of 1.2 video game consoles. Level of video gaming engagement and preferences in genre ranged greatly. Some reported very rare engagement with video gaming whilst others reported a casual commitment of several times a month. One participant reported that video games on their personal computer (PC or Mac) were a regular hobby whilst another reported similarly for video game consoles. Most mentioned a variance dependent on their other commitments. For example, one participant reported playing for hours on a daily basis but also not playing any games for weeks when project deadlines approached.

The Game Environment

The game used in the experiment was constructed using the popular game construction system, *Unreal Tournament 2003* (UT2003). This enabled the rapid production of a first player game with the ability to make the sorts of manipulations required in this experiment. The objective of the game was that the player, from a given start point, had to find an object. This object was deliberately placed at the opposite end of the game to ensure that player would traverse all the rooms to find the object. These rooms required the players to jump on platforms, to make large objects move out of their way and to solve a puzzle. This gave enough variety to offer the possibility of immersion and also to exhibit different “physical” behaviours such as friction and gravity.

There were three variables that could be altered in the game: the character graphics, the environment graphics and the physics behaviour. Two different characters were used: a realistically rendered man and a cartoon rendering of a rabbit (resembling the Warner Brothers character *Bugs Bunny*). The environment which the character was in was also modified. In one environment, the textures and walls used were of a granite or concrete structure. The second

environment was rendered with flat colours using a palette from a room in the popular animation *The Simpson*. Finally, the behaviour of the environment was adjusted through the physics. Gravity was altered and large objects were given different masses so that moving them was easier or harder than might appear.

To bring about the break in immersion, the game was divided into two identical halves. To complete the game, the player was required to complete both halves (the second in reverse of the first). At the halfway point, the environment graphics and physics were swapped from the first half. For example, players may travel through concrete level with realistic gravity and behaviour then find themselves in a cartoon environment with tenfold the gravity. Due to technical limitations of UT2003, it was not possible to swap the character graphics within the game. A plan of the game is show in **Figure 1** with the halfway point indicated by the dotted line.

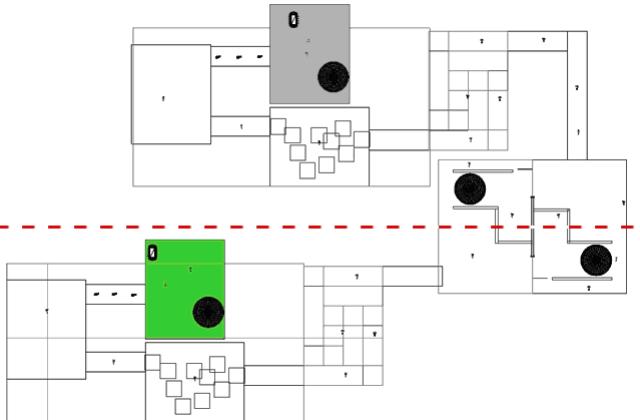


Figure 1: Plan View of Game

Measuring Realism Expectations

To measure participant expectations, several static screenshots of the game were shown. The static screenshots were divided into two scenarios derived from the game: one involving the character in the game jumping and the other involving the character pushing a giant ball. The objective of these two scenarios was to indicate a clearly identifiable action and subsequently ask the participant to predict the reaction. To put this test in the terms used by Slater et al. [9], the graphical realism was modified between the screenshots whilst participants predicted the behavioural realism.

For the jumping scenario, a character was shown in a room standing adjacent to a wall. The participant is asked to mark, with a horizontal line, the highest point which they feel the character can jump as measured by the top of the character’s head.

In the ball scenario, participants were asked to mark, with a vertical line, the point where they believe the ball will move to given a single push from their character (**Figure 2**).

In each of the two scenarios, the character and environment variables could also be altered resulting in a combination of 6 different screenshots. The order of the screenshots shown was randomized to minimize linearity effects.

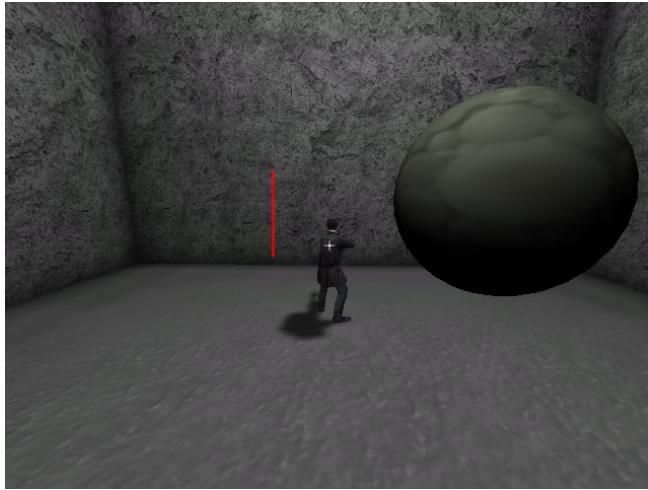


Figure 2: Sample Ball Scenario

Breaking Realism and Immersion

Following the recording of the participant's expectations, they were introduced to the game. Participants were given a quick tutorial on the controls of the character. In order to minimize ordering effects, the starting point was automatically randomized such that a player could conceivably start from either of the starting areas. Also, each participant was given a different combination of environment and behaviour, which was subsequently reversed at the halfway point of the game to break immersion.

As the participant progressed through the environment, their facial expressions were also video recorded. Analysing player preference through body language and facial expression has become a more established practice [5] and we aimed to utilize this type of data collection in our experiments.

Verbal protocol (think aloud) during the experiment was *not* enforced for this segment, nor was it discouraged. This unusual decision was made to ensure a minimal set of variables which would impact the participant's immersion. The test administrator also left the room during the interactive component to avoid instigating any pressure to perform within a certain time.

Once the participant completed the goal, they were asked to fill out two sets of Likert surveys. The first measured the player's perception of the level of realism of the environment graphics, the character graphics, the character behaviour and the environment behaviour. The second

survey referred to the overall environment and asked the participant to describe the experience by rating the applicability of a number of adjectives. These adjectives were a mixture of positive and negative adjectives which were felt to potentially apply to a game including: confusing, difficult, realistic, enjoyable, challenging, etc.

Based on these results, the participants were given an informal unstructured interview. The questions primarily probed the participant to describe the aspects of the game which were most enjoyable, least enjoyable and most surprising. This line of questioning was designed to probe the impact of the internal inconsistencies of graphical and behavioural realism.

RESULTS AND FINDINGS

The static screenshots used to measure realism expectations yielded predictable, though not conclusive results. For realistic graphics, participants had a generally more consistent and conservative response to their expectations. In contrast, the unrealistic graphics had large standard deviations, illustrating a more subjective assessment. Also, the expected jump height was significantly higher for the cartoon rather than the man character ($F_{1,13}=14.06$, $p<0.01$) reflecting the expectations attached to the character behaviour. However, no other significant effects were found across the scenarios. Given this finding, we suspected that the tenfold change in gravity at the midpoint of the experiment would have an adverse effect on immersion.

The Likert questions posed to the participants following the test also confirmed that the game differed in graphical realism from one half to the next.

However, when reviewing the videos and interview data, we found that participants were largely not affected by the changes in behavioural realism. Video analysis synchronised with the changes in game behaviour showed in all cases no discernable impact on the participants' immersion.

In the case of the interviews, none of the participants indicated a poor experience. Also, participants did not indicate the change in behaviour as a surprising factor. Perhaps most surprising, however, was that several participants indicated that they had not even noticed a change in behaviour while playing the game but upon mention of such, acknowledged that a change indeed did occur.

DISCUSSION

The final part of the results was most surprising but also the most informative. The aforementioned participants were engaged with the game at such a level that they did not notice a tenfold change in their character's jumping ability, despite being forced to utilize jumping on several occasions to complete the level.

Our initial experiment attempted to use deleterious usability to instil a break in immersion. By evaluating when and how

severe these breaks in immersion would be, we hoped to understand the properties of immersion in more detail.

However, the result was that immersion overcame the deleterious usability elements. Due to immersion, participants completely failed to notice what had been determined to be modal incoherence – a mismatch between graphical and behavioural realism compared to what the participant expected.

This result extends the previous finding of Brown & Cairns [1]. Whilst they found that poor coherence could be a barrier to immersion, once immersion has been achieved coherence is not necessary. That is, incoherence of modalities seems to be acceptable only if some level of immersion has been achieved already.

This immersive state need not be at the level of presence as defined by Brown [1]. In fact, the simplicity of the game's goal to find another room suggests that a low level of immersion – engagement or engrossment – is sufficient to overcome incoherence in modalities.

This finding therefore fits with Norman's ideas that attractive products are more usable [6]. However, it extends the notion of attractive from an aesthetic and emotional response to something more cognitive, though possibly no less visceral, of an immersive response.

Another application of the results is within the concept of flow [4]. In a state of flow, the person can lose self-consciousness and awareness of time. Our results indicate that immersion has similar properties but extend to enable a loss of awareness in poor usability. That is, a state of flow could perhaps aid in maintaining flow.

However, an interesting question is raised with these results. If incoherence in modalities can be overcome with immersion, what of situations where a break in immersion is not only acceptable but desirable? An example would be an operator at a power plant who is immersed in his or her work and fails to notice an alarm. Further research would be necessary to determine then, the threshold at which the immersion can be overcome.

At a less critical level, we now understand that those immersed in their task (or in a state of flow) can overcome certain aspects of usability believed to be detrimental. It would be instructive to discover what other established barriers to user experience can be overcome in such a state. By discovering and breaking down these myths, we may be able to use previously overlooked solutions to problems.

One example is the use of changes in music in a programming environment to indicate problems with the code [10]. While the expectation may be that changing

music is distracting to the immersive experience, this may in fact not be the case.

CONCLUSIONS

Achieving immersion and understanding the depths of what creates an immersive experience is still difficult to determine. The original intention was to evaluate the impact of sensory engagement on an immersive experience. Based on the hypothesis of Brown et al., we expected that inconsistencies in realism would have a negative impact on immersion. Our studies show, however, that an immersive experience, once achieved, could in fact help to overcome other usability issues.

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