Exploring ways to evaluate the effect of time-loop systems on player experience in video games

Fabian Fröding
University of Skövde
Skövde, Sweden
fabian.froding@gmail.com

***Abstract*—In most video games time does not have an impact on the progression of the game's main story without the player's interaction. Everything remains in a somewhat static state until the player chooses to take an action - the game world revolves around the choices of the player. This creates an inaccurate and bizarre reflection of how time and events in the real world works. However, there are a few games that use alternative time-systems where the main story progresses regardless of the player's actions or presence, which creates a more realistic representation of how time and events work in real life.**

In this report previous research that discusses temporality in video games was investigated, and two games that use alternative time-systems where the main story progresses independently of player actions were also analyzed from the perspective of the findings in the previous research.

The study found that previous research provides some useful terminologies and concepts that may be applicable to future research on how to evaluate the effect of time-loop systems on player experience, and that more work is required to evaluate the direct effects of time-systems on player experience.

Keywords—video games, user experience, time.

I. Introduction

Temporal frames is a conceptual framework by Zagal *et al.* [1] for analyzing temporality in video games. The framework consists of a set of events and the relationship between those events. Four different temporal frames are defined as:

- Real-world time
- Game-world time
- Coordination time
- Fictive time

Real-world time refers to the events taking place in the physical world. Game-world time refers to the events taking place in the gameworld, including events triggered by gameplay actions. Coordination-time refers to events that coordinate the actions of players or agents. Fictive time refers to events with socio-cultural applications or narrative events.

Zagal uses the game series Final Fantasy [9] to describe an example of the difference between temporal frames. The Final Fantasy-series uses a real-time system for allowing the player to navigate through the game overworld, while the combat system is turn-based. During the combat, everything in the game remains in a stasis while the player chooses his or her actions during their round. But outside of combat, the temporal frame shifts into a state where world events may happen without waiting for input from the player.

Temporal anomalies is another concept defined by Zagal. Four types of anomalies are defined as:

- Temporal bubble
- Temporal warping
- Nonuniform temporality
- Hardware related anomalies

A *temporal bubble* is when different locations or states in a game pauses the game-world time (but with the player still in control). *Temporal warping* is when two temporal frames overlap and creates an inconsistency between them. *Nonuniform temporality* is when there is an uneven distribution in the game's temporal segments (for example rounds). *Hardware related anomalies* is when non-perceived hardware issues occur and is usually unrelated to player experience.

Lastly, Zagal presents the concept of *temporal manipulation* and presents its most common forms:

- Manipulating coordination time
- Pausing, starting or stopping gameworld time
- Manipulating the relation gameworld time and real-world frames
- Manipulating the relation between gameworld frames
- Manipulating the fictive frame

Temporal manipulation refers to when the player has the ability to manipulate the described temporal frames. *Manipulating coordination* time is when the coordination time of a game is influenced, such as "passing on a round in a turn-based game. *Manipulating gameworld time* is when the gameoworld time is suspended or frozen, such as pausing the game. *Relations between gameworld frames* is when there is an overlap between the player's earlier actions and the present actions, such as racing against a visual representation of the player's earlier playthrough. Finally, *manipulating the fictive frame* refers to when the player has an ability to manipulate the gameworld time, often in forms such as time-travel.

M. Nitsche [2] presents study on the role of time in video games and attempts to create a mapping of time from game state to player experience. Nitsche breaks down previous research into two concepts called the *formalist approach* and the *experiential approach*. The formalist approach is described as a mapping of *play time* and *event time*, a concept introduced by J. Juul [3], which will be introduced in more detail later. Briefly, the play time refers to the time taken by the player in the physical world whereas the event time is the time taken in the fictional game world. The formalist perspective is a useful model for time in games but does not cover how time is experienced. The experiential approach refers to the player's comprehension of temporal situations in games and describes cognitive and emotional involvement. Nitsche combines the two approaches and introduces two relevant concepts; *changing temporal conditions* and *changing experience of time*.

To describe the concept of *changing temporal conditions*, Nitsche references Genette [7] who provides another toolbox for temporal analysis in which he distinguishes between *narrative time* (such as film scenes) and *story time* (such as games with changing temporality). The toolbox describes *order, duration* and *frequency* of events, of which the order can be used to trace temporal conditions in games. The order of events can look different depending on the form of media, and in the case of *narrative time* it can be more complex as in Figure 1 [2].

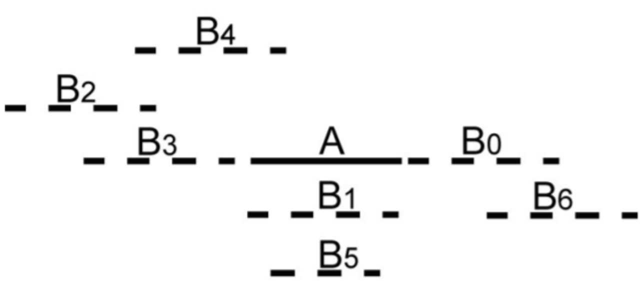

Figure 1: Temporal relationships between events.

In games, the arrangements of events can be more complex than just following a continuous order of events. They can overlap, have ellipses between them, distort relationships or happen in parallel.

Continuing on to the concept of *changing the experience of time*, Nitsche uses the game Prince of Persia: Sands of Time [8] as his subject of focus. In the game the player has the ability to freeze, slow down, or reverse time. The ability for the player to return to a previous time event (A) provides the player with knowledge about the game state and it's future conditions (B), see Figure 2 [2]. According to Nitsche, the probability of the player successfully navigating event (B) drastically increases as the player reverts back to event (A), and can cause players to experience event (B) as smaller than event (A) because of the increase of the player's knowledge about the game world.

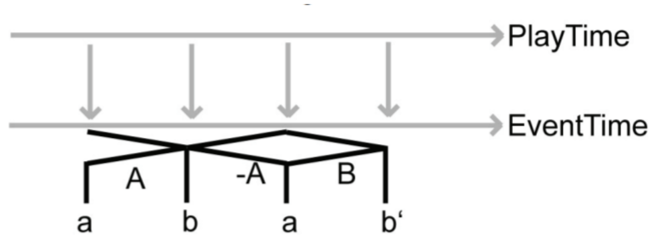

Figure 2: The Prince of Persia: Sands of Time; time reversal.

J. Juul [3] explores time in video games and proposes a model for examining variations in a game world and how to connect to the player's relation to the game.

Juul presents the terms *play time* and *event time* and introduces a mapping-model between the two. Play time refers to the time in the physical world that the player takes to perform a task in the game, while the event time refers to the time taken in the game world. For example, in strategy games, a task in the game can take two minutes in the physical world but correspond to a year in the game world, while in action games the time taken to perform a task in the game world could correspond to the same time taken in the physical world, i.e. a 1:1 mapping between play time and event time.

Juul continues by describing the experience of time in games as a byproduct of the play time/event time relationship and the tasks and choices presented to the player, which hopefully results in an enjoyable experience for the player. The play time/event time relationship is described as a mapping between the player's actions and the game world; the player's time and actions are projected into a game world. The moment of a mapping-event is that of a moment with a sense of happening now, in the present.

Another concept invoked by Juul is that of *dead time*. Dead time is the time the player spends on doing repetitive and monotone tasks in a game for the sake of a higher goal [3]. For example in RPGs the term *grinding* or *farming* refers to when the player repeatedly battles and defeats the same type of enemy to gain experience points or gather collectible items. The game designer Sid Meyer makes an argument that a game is a series of interesting choices with no obvious best-choice option, and that the usage of such obvious choices contributes to a dull and uninteresting game [3]. However, Juul argues that the concept of dead time can be meaningful to the player since they are in pursuit of a greater goal.

Like Zagal, Juul draws comparisons between real-time games and turn-based games, and describes the difference such as turn-based games do not change their state while the player remains idle, but in real-time games things can happen even if the player is not doing anything.

In addition, the term *flow* is discussed and described as a mental state of enjoyment that alters the sense of duration in the subject, hours can pass by but seem like minutes [3]. Flow is therefore closely tied to the play time/event time relationship.

In The Legend of Zelda Majora's Mask [4] (simply referred to as Majora's Mask for the remainder of this paper) the player has three in-game days to stop the moon from falling down on the gameworld, which results in the player's defeat. The player obtains an ocarina which has the ability to revert time back to the beginning of the first day, without losing important progress to the game's main objective. The descent of the moon and the NPCs (Non-playable characters) follow their own fixed routines independently of the player's actions during the timespan of the three days - the player is therefore not the main catalyst for the events in the game.

Outer Wilds [5] is a game that takes place in a fictional solar system where the player has a fixed amount of time to explore the planets before the sun lapse into a supernova, which results in the destruction of the solar system. When the sun explodes, the player dies and returns to the beginning without losing the key progress of the game's main objective. The events surroundings the planets are independent of the player's actions - the player is not the main catalyst for the events in the game.

To avoid potential confusion, the type of games such as Majora's Mask and Outer Wilds will be referred to as *time-loop games* for the remainder of this paper to distinguish the difference between them and real-time games (which refers to games that operate in a continuous time setting opposed to turn-based games which operate in a round-based setting).

It is also important to make a note about the difference between real-time games and time-loop games. In most real-time games the events that happen independently of player actions are trivial, such as environmental objects animating, NPCs moving around, sounds playing etc. In time-loop games, it is the *main story* that progresses independently of the player's actions. An example of a regular real-time game would be The Elder Scrolls: Oblivion [6] or the previously mentioned Final Fantasy series [9], where the environment and NPCs move about regardless of player presence, but the main story (or any story in that matter) are all triggered by player actions and choices.

II. Methodology

To explore the topic of how time-systems in video games could affect player experience the following research questions were formulated:

- RQ1: How are existing methodologies and frameworks applicable to evaluate the effect of time-systems on player experience in video games?
- RQ2: How can existing methodologies and frameworks be improved to evaluate the effect of time-systems on player experience in video games?

To answer the research questions, the methodologies and frameworks from the presented research were reviewed. Two video games, namely The Legend of Zelda Majora's Mask [4] and Outer Wilds [5], both of which make use of time-loop systems, were used as example subjects from the perspective of the found methodologies and frameworks. Majora's Mask has been played numerous times by the author prior to the writing of this paper, and Outer Wilds was played as a first-time experience in parallel with this study.

Finally, future methodologies or frameworks inspired by the findings in the previous research were discussed in terms of how to evaluate the impact of time-systems on player experience in games user experience.

III. Discussion

The *temporal frames* presented by Zagal *et al.* [4] provide some useful terminology for analyzing the temporality in video games. For the scope of this study, the interesting type of temporal frame to look closer at is game-world time since that is the frame mainly being used and manipulated in time-loop games.

In addition, Majora's Mask [4] have occurrences of *temporal bubbles*, such as when the player is in the central clock tower (an in-game location where time is non-existent), or in dialogue or menus (states), but that is not something that is unique to time-loop games. Majora's Mask also makes use of *manipulating the fictive frame* (temporal manipulation), through playing an ocarina and returning the day one (time travel), while Outer Wilds [5] does not have any form of temporal manipulation.

While discussing the case for multiplayer games, Zagal argues that instead of relying on data-driven methods to understand temporality in video games we can also rely on our own experiences, field-notes from play sessions, and reviews. Using this approach has the drawback of being inapplicable to a larger range of games and their temporalities, but allows for more detailed feedback on player experience, specifically on the passage of time. From a personal perspective, this is not only true for multiplayer games and could be used when evaluating the effect of time-loop systems on player experience.

Besides the temporal frames, Zagal also discusses games in terms of state machines and how the events in the gameworld impacts the state of the game, and that a game can have an onerous number of states determined by the possible combinations of these events. J. Juul [3] also discusses games in terms of state machines which receive input (player actions) and produce outputs (game states).

Unfortunately, the temporal frames-framework itself does not seem to be of any use for evaluating the direct impact of temporality on player experience specifically.

The framework presented by Nitsche [2] becomes interesting to consider for use in time-loop games. Specifically, in the concept of changing temporal conditions, and with Genette's toolbox of narrative time and the order of events [7], one could apply the framework to the rounds of the time-loop system rather than events itself, where each round is evaluated as an event. The results from using the framework in that manner could help indicate how the repetitive loop-cycles of the game affects the player's experience.

Nitsche also writes that successfully navigating a subsequent event or round (B) drastically reduces the positive player's experience of event or round (A) and results in a perception of a smaller game world. Similarly, the previously mentioned game designer Sid Meyer makes the argument that interesting choices with no obvious best-choice option is essential for a game to be enjoyable [3]. Looking at the case of time-loop games, these arguments would claim that the time-loop mechanic would result in a game world with predictable scenarios and uninteresting gameplay. Perhaps the researcher's did not consider the complexity of time loop-systems. Both Majora's Mask and Outer Wilds have received positive ratings since their release, with Majora's Mask having a score of 9.1/10 on metacritic [10] and Outer Wilds having overwhelmingly positive reviews on it's steam page [11].

Sadly, Nitche's study concludes that a lot more attention and future research is necessary in the experiential approach on how exactly time affects player experience.

The mapping-model by J. Juul [3] does not seem to be a likely candidate for evaluating the effects of time-loop systems in player experience. However, some of his discussions are interesting to consider when applied to time-loop games. For example, his discussion about *dead time* may seem highly relevant to the time-loop cycles. However, the cycles in Majora's Mask and Outer Wilds are far from being categorized as repetitive and mundane, based on my own personal opinion having played both of the games. In each cycle of the games, the previous cycle has the potential of opening up new content to explore, without having to redo the most demanding segments. Time-loop games do therefore not share the same repetitive aspects used in in-game activities such as grinding.

Like Nitsche [2], Juul mentions in his conclusion that much work is needed on how game time affects player experience. This indicates that the aim of this study may be difficult to conduct since the related research is so scarce - but it also presents an opportunity. Both Nitsche and Juul prephase their papers by aiming to evaluate how temporality in video games affect player experience, but none of them have a solid conclusion about it. This is probably because they are explorative papers in nature, but also because so little research on the topic has been done. A more systematic study with qualitative data collection would be needed to evaluate actual effects of time loop-systems in video games. Conducting a quantitative study on the effect of time-systems on player experience would arguably be hard to interpret. How would you ensure that the experience of the player is caused by the aspect of time, and not by other factors? Having carefully crafted surveys aimed at asking questions relating specifically to time would be more suited, as mentioned earlier in Zagal's approach about relying on experiences, subjective feedback and reviews rather than quantitative methods.

Both Zagal *et al.* and Nitsche talk about the aspect of allowing the player to manipulate time [1], [2]. Zagal defined the term temporal manipulation and it's subcategory *manipulating fictive time*, referring to some form of time travel mechanic to allow the player to change a fictive past to affect the fictive future. This description fits perfectly into the cases of both Majora's Mask and Outer Wilds. The combined *formalist* and *experiential approach* described by Nitsche attempted to evaluate a player's comprehension of temporal situations of a game by cognitive and emotional involvement rather than with mappings, and seems like a much more suitable approach to evaluate the effects of time-systems on player experience.

My personal motivator for investigating this topic is that, in my opinion, time-loop games feel more alive and realistic because in them, the game does not revolve around the player, he or she is just a small and insignificant part of the story - until they choose to intervene. Much like in the physical world, the events taking place do not revolve around you as a person, but you can influence the events if you choose to. In most *non* time-loop games, the player is the center of the gameworld, acting as a catalyst to all the events happening, which is perfectly fine and probably statistically more fun because that is what most players want to feel when playing a game.

Not surprisingly, time-loop systems in video games are a complex phenomenon, and measuring the effects of such systems on player experience is no easy feat. However, based on the methodologies and frameworks found in the referenced papers it might be worthwhile to adopt some of their concepts and to consider their role in future research about time-loop systems or time-systems in general.

IV. Conclusion

This report explored previous research to find methodologies and frameworks for evaluating the impact of time-loop systems in video games on player experience. Two games were also used from the perspective of the findings in the previous research.

Zagal *et al.* [1] presented terminology for describing different temporal states of a game, which may be useful when analyzing how time-systems impact player experience.

Niche [2] introduced an approach to evaluate how the order of events in relation to the time in a game could affect player experience. This approach is also applicable to time-loop games where the events could be replaced by the looping time-cycles, where events turn into rounds. The rounds can therefore be used to describe and investigate the player experience in subsequent playthroughs of the looping mechanic.

The research by J. Juul [3] presented some concepts such as dead time which was interesting to look at regarding time-loop systems, but in general, his study did not provide useful information for the aim of this study. His other concepts such as the mapping model between play time and event time may still be useful in other areas of research relating to time in video games.

References

[1] J. P. Zagal, M. Mateas, “Time in Video Games: A Survey and Analysis”, Simulation Gaming, August 2010.

[2] M. Nitsche, “Mapping Time in Video Games”, Situated Play, Proceedings of DiGRA 2007 Conference, January 2007.

[3] J. Juul, “Introduction to Game Time / Time to Play - An examination of game temporality”, 2004.
Available: https://www.jesperjuul.net/text/timetoplay/

[4] *The Legend of Zelda: Majora’s Mask*, (2000), Nintendo.

[5] *Outer Wilds*, (2019), Mobius Digital, Annapurna Interactive.

[6] *The Elder Scrolls: Oblivion*, (2006), Bethesda Softworks, Bethesda Game Studios, 4J Studios, Superscape.

[7] G. Genette, *“Narrative Discourse: An Essay in Method”*, Cornell University Press, Ithaca, NY, 1980.

[8] *Prince of Persia: Sands of Time*, (2003), Gameloft, Ubisoft, Ubisoft Montreal, Kudosoft

[9] *Final Fantasy*, (2001), Square Enix, Square, Koei Techmo Games, MER.

[10] *Metacritic.com*,
Available:
https://www.metacritic.com/game/nintendo-64/the-legend-of-zelda-majoras-mask
Accessed on 2021-12-05.

[11] *store.steampowered.com,*
Available: https://store.steampowered.com/app/753640/Outer_Wilds/
Accessed on 2021-12-05.