

# Designing and Comparing Time Rewind Mechanics in 2D Interactive Game

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*This paper complements and extends three time rewind mechanisms proposed by previous scholars, including restricted, unrestricted and external. Currently, most literatures research on narrative games as a whole, only a few of them focus on the time rewind as a core mechanic in interactive storytelling and even less to summarize an operate guide for the game designers systematically. Consequently, based on the case study, the author will design a 2D narrative game to figure out the differences and application of various time rewind mechanics from the perspective of a game developer.*

**Keywords**— game design, rewind mechanics, interactivity, 2D

## I. INTRODUCTION

Much like rules, all games have mechanics, and these mechanics are often used both colloquially to describe what happens in a game and technically as the elements that engage players in satisfactory gameplay [1]. In fact, the relation between mechanics and gameplay seems to be so close. A growing number of various narrative games utilize time rewind as their core mechanic to provide a new gameplay, and focuses on rewind as a form of narrative [1]. Traditionally, rewind mechanic means the player would manually rewind the game by replaying from an old save file and remake a past choice when they did not like the game, it is up to the player to choose whether or not to rewind the plots [2]. However, an ingenious rewind mechanic that the player can receive the plots passively will make a different immersive experience to the player. In *Groundhog Day* [3], for instance, the character is trapped in an infinite loop of one day and remakes his choices based on what he learned in the previous loops.

Time rewind mechanic was commonly designed into three patterns: restricted rewind, unrestricted rewind and external rewind [2,11]. Currently, most literatures research on narrative games as a whole, only a few of them focus on the time rewind as a core mechanic in interactive storytelling and even less to summarize an operate guide for the game designers systematically. Consequently, the research question has been put forward: how to design the time rewind mechanic in narrative games?

In order to evaluate the impact of different time rewind mechanics, following the methodology of practice-based research, the practice team with the author as the leader started to design a 2D narrative game called *The Loop*<sup>1</sup>. In the development process, The author was mainly responsible for storyline design, the game mechanic design and programming, as well as audio design. Therefore, this essay will focus on the mechanic of our 2D narrative game, rely on the research methods of systematic review, case studies and interview, then aim to figure out the research question from the perspective of a game developer.

<sup>1</sup> The walkthrough video of practical game project, *The Loop*, is available from <http://www.shiyutong.org/THELOOP.html>

## II. BRIEF ILLUSTRATION OF GAME

*The Loop* [6], an RPG, 2D psychological art game, is developed on Unreal Engine (see Fig.1). Inspired by a similar game named *Every Day The Same Dream* [4] and the films named *Groundhog Day* [3] and *Happy Death Day* [5], the character, Dennis, will be trapped in an infinite loop of one day until he completes all the game plots as instructed. The game, which focuses on school bullying, is divided into two stages. The player plays the victim of school bullying in the first half, followed by another half where the player will become an abuser of school bullying, through which new plots are triggered. Finally, in the rooftop scene, the player will witness a shadow who jumps from the rooftop to commit suicide.

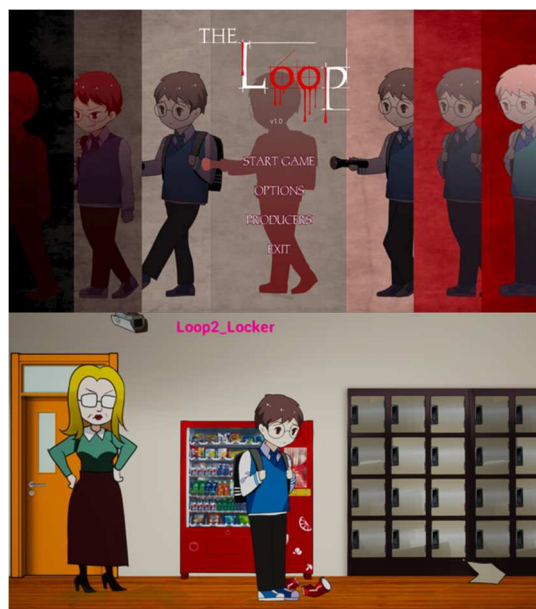


Fig. 1. 2D psychological rewind game *The Loop*

## III. THE STRUCTURE OF REWIND

According to Kleinman's [2] theory on time rewind mechanics, there are three rewind patterns: restricted rewind, unrestricted rewind and external rewind (see Fig.2.3.4). The author researched three corresponding games respectively, and made a comparative study on the specific rewind patterns adopted by these games. Subsequently, the author analyzed and practiced them in the game project, *The Loop*. Meanwhile, the user experience in these games was evaluated as well.

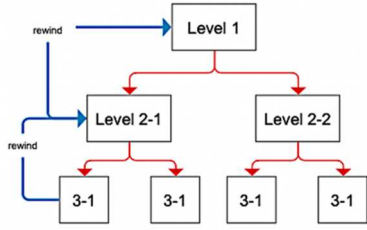


Fig. 2. Restrictive rewind structure

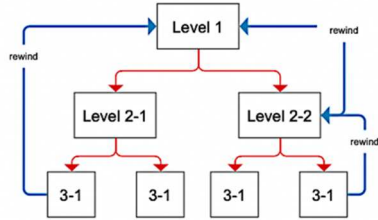


Fig. 3. Unrestricted rewind structure

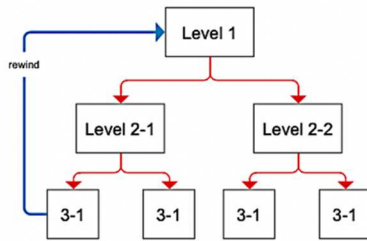


Fig. 4. External rewind structure

In order to understand the representative design patterns of time rewind mechanics, the author analyzed and reviewed three classic commercial games, which have adopted different rewind patterns, namely, *Zero Escape* [7] (unrestricted rewind), *Life is Strange* [8] (restricted rewind) and *The Stanley Parable* [9] (external rewind).

#### A. Unrestricted rewind mechanism

Unrestricted rewind means that any decision point in the game can be rewound without any restrictions on the player, which provides the player with greater flexibility to explore the story elements. A case in point is *Zero Escape* [7], in which the time and location of rewinding is unrestricted. Additionally, the players are allowed to review their previous decisions, and trigger new episodes by rewinding. In *Zero Escape*, a typical rewinding game, each plot has been designed as a block, the different branches of which are based on the specific choices of the players (see Fig.5). For instance, NPC provides the players with a chance to guess a coin at the beginning of *Zero Escape*. If it is correct, the players can be released from this dark dungeon. Otherwise, they will be forced to continue to play this game of life and death with NPC. No matter what the first decision is, the player can rewind to this decision point again, making a different choice to trigger other exciting game plots.



Fig. 5. Unrestricted rewind mechanism in *Zero Escape: Zero Time Dilemma*

#### B. Restricted rewind mechanism

In restrictive rewind games, players can rewind passively to the previous decision points. For instance, in *Life is Strange* [8], when the player has completed exploring the classroom scene and makes the decision to leave the classroom, the time will rewind passively to the previous decision point of classroom, and then other plots will be triggered with the player making another decision (see Fig.6). Unlike the unrestricted rewind mechanism, the players in the restricted rewind mechanism are neither free to choose all blocks, nor free to rewind to the beginning of the game. In this context, the players are required to repeatedly make various decisions at a single selection point, and observe and learn what happens after this decision every time, then rewinding to try another decision based on what they have learned. Once the player passes most of this selection point and chooses to move on, he will not be able to revisit previous decisions and plots.



Fig. 6. Decision points in *Life is Strange*

#### C. External rewind mechanism

External rewind mechanism, a manageable narrative style, is extensively applied to numerous low-cost independent games and students' works. A striking example is a classic independent metagame, *The Stanley Parable* [9], in which the player is required to replay the game from the beginning to the end in multiple iterations to explore the whole narration (see Fig.7). While the player can end this game with a one-time experience, a full comprehension of the story necessitates rewinding and replaying the game multiple times. Unlike the simple replayable games, the external rewind mechanism provides the players with an active experience option, enabling them to experience different plots in different rewind times and decisions.

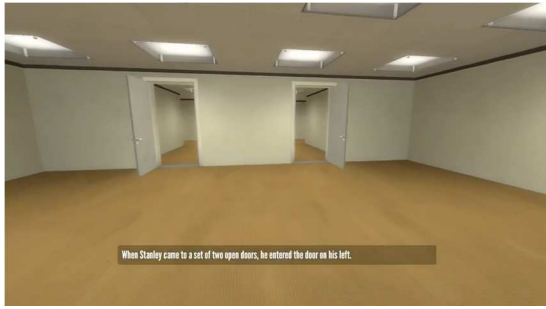


Fig. 7. External rewind mechanism in *The Stanley Parable*

Restricted rewind mechanism limits the changes of a specific plot for the players, whereas unrestricted rewind mechanism brings players different overall changes due to different decisions. However, external rewind generates changes from the beginning to the end, which are related to the times of rewind. Therefore, the overall plot can be improved by external rewind. In a word, the various time rewind mechanics in these games not only enrich the narrative plot, but also improve the length of time, along with the playability of the game.

#### IV. GAME DESIGN: THE LOOP

After reviewing the other typical interactive patterns based on rewind mechanism, the author discovered found that the player often rewinds over and over again, so as to get more hidden storylines, thus realizing that the plot of the game is not as simple as they have imagined. In addition, each loop should be interrelated, thereby allowing the player to get immersed step by step [1]. Also, there is a striking difference between the beginning and the end of the game, which gives the player a sense of exploration and immersion as the game plot changes.

Our game is inspired by *Every Day The Same Dream*, a 2D narrative game adopting the external rewind mechanism. In this game, the player plays as an ordinary white-collar worker, who is exposed to the boredom and depression of the contemporary white-collar life through the infinite loop of one day. Its game mechanics include the salient feature of the external rewind mechanism, that is, the storyline becomes clearer with the times of rewind increasing. By providing a narrative interpretation of rewind, this design attempts to immerse the player into the game world.

Based on the analysis of the above games, the author developed an interactive game about school bullying named *The Loop*, which includes two versions: unrestricted rewind and external rewind pattern. Due to the limitation of production time, the author was incapable of developing a restricted version, considering that significant adjustments have to be made to our game story and they cannot be directly applied to the existing game narration. Therefore, in the following part, the paper will elaborate on the design principles of these two rewind patterns in this game and the impact of their differences on the immersion of the players, aiming to offer useful experience for designers interested in using rewinding in narrative games.

##### A. Story Design

A core issue for storytelling in rewind mechanism is how to create a story which procedurally varies as a result of the player's actions, and still feels like a story [10]. For the sake of clarification, both versions of the game have been

developed into 2D desktop platforms with the same storyline. This interactive storyline has been designed specifically to motivate rewinding, which has fundamentally transformed how the players perceive the story, and motivated the player to rewind and replay the game to reexamine the specific storyline associated with this new perspective [10]. In our game, *The Loop*, the player needs to choose the rewind pattern at the beginning to determine how the story will develop in the game (see Fig.8). Playing Dennis, an ordinary school boy, the player is trapped in the infinite loop of one day. At the beginning, Dennis is bullied by other students and ignored by the teachers as well. Subsequently, he grows to be a bad bully student after several loops. This story attempts to arouse the awareness that every abuser of school bullying may have been confronted with an unknown experience. Meanwhile, it is intended to motivate students to focus on school bullying and rescue those students who have suffered from similar unfortunate experiences.



Fig. 8. Select the play mode at the beginning

Dennis woke up from his bedroom with the sound of the alarm clock as usual. Meanwhile, his clothes was in tatters, his reflection in the mirror was injured (see Fig.9), the green bud on his way to school was dying, and the thugs on this way were still using verbal violence against him. All this showed a tragic experience for the character. The atmosphere in the school was even more depressing with the dirty words on his locker, the bullies with long sticks, and the dean who did not allow him to escape. The only thing Dennis could do was to move forward passively. The violence in the classroom was even worse. Dennis thought the door out of the classroom would lead to a safe space, but it led rewind to another desperate loop.

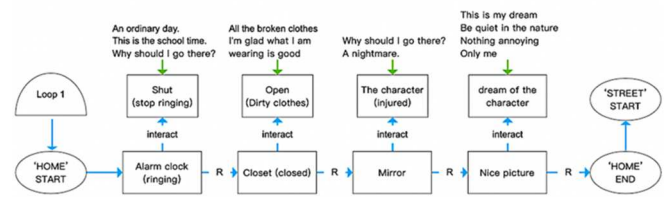


Fig. 9. Storyline and interaction design for Home scene

The player intends to explore the game scenes through the guidance of the game plots, thereby obtaining the whole story. However, in both rewind versions, due to the absence of some fragmented plots, the character is likely to be trapped and the exploration process can be hindered. Under this circumstance, it is a must for the player to rewind to make other decisions to obtain the lost episodes.

##### B. Adapting Different Rewind Structures to the game

*The Loop* consists of five major levels (1. Home 2. Street 3. Locker 4. Classroom 5. Rooftop) and one egg map about dream scene. Despite the variations of the structural design of

the two patterns for each version of the rewind mechanism, the players are allowed to the entire maps in both versions, with identical storyline. The main difference is how much story content is presented to the players in different scenarios, depending on the different versions of rewind design and final story structure. This is to make preparations for the user studies to be conducted in my rest work to ensure that all testers will experience the same story, regardless of which version they are playing.

### 1) External Rewind

The external rewind pattern requires the player to replay the game from beginning to end in multiple iterations of the game to explore different storylines. In *The Loop*, intending to continue exploration in this pattern, the players have to follow the game flow through three times of iterations before comprehending the whole story and triggering the final outcome (see Fig.10). This pattern is similar to *The Stanley Parable*, in which the players can continuously update their knowledge of the game world in iterations.

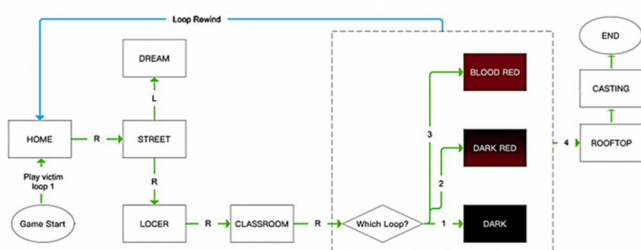


Fig. 10. The external rewind mechanism applied in *The Loop*

More specifically, given that the author wants to take rewind as the core mechanism of the game, players are incapable of reaching the final scene, the rooftop, after experiencing all these three loops. Each loop has similar game scenes and assets, but the interactive contents and the status of the character vary greatly. In the first loop, Dennis is a helpless student, constantly subjected to school bullying. However, in the following loop, he is still bullied by the outside world. Nevertheless, with different understandings of the environment, he remains resistant. In the final loop, Dennis is completely fed up with everything outside, and even becomes an abuser to avenge others. After these iterations, the player can trigger the final rooftop scene, where the Dennis witnesses a shadow jump down from the rooftop. Is the shadow a victim or an abuser, or a group of that people? That is exactly the thought the author wants to stimulate.

In the first game development test, the 12 testers put forward some ideas, which have guided the author to discover some problems in the draft game and generated some new inspirations.

- Tester 1: the signal at the beginning of each loop is not obvious, and the content of each loop is too similar, which makes me feel lack of originality.

As indicated by the interviews, most players want each loop to be independent and well defined, and meanwhile they are longing for some new information brought by each iteration. To improve this situation, the author has made some adjustments on the plots and sound design.

To be more specific, unique plots have been added into each loop. For instance, in the second loop, the home scene has been added with a part that Dennis can see his injured face

in the mirror, while the street scene has been added with a part that the player can walk to the left, entering a hidden dream scene (see Fig.11). Such adjustments not only enrich the game plots, rendering the story theme more prominent, but also enable the player to gain a new experience in each loop.

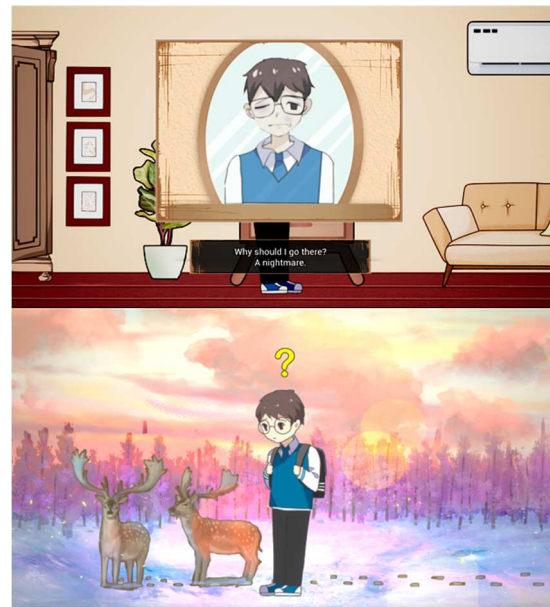


Fig. 11. Dennis can see his injured face in the mirror and a hidden dream scene

In addition, with regard to the adjustments of sound design, the research has focused on the specific sound effects and background music of each loop. In order to clarify the mark of the beginning of each loop, the author designed a bedside alarm clock in the home scene, which is the birth point of the player. Therefore, every time the rewind mechanism is triggered, the sign sound of the alarm clock will ring with a flashing red warning light, which can only be stopped when the player clicks on it. In the design of background music, the author has paid more attention to the mood and state of the character in each loop. In the first loop, Dennis, who has been constantly bullied by others, must have felt helpless and depressed, so the background music for this loop is slow and sad. However, in the third cycle, Dennis has been completely changed with the tendency of violence gradually emerging, and he has even turned to violence to get revenge on other students, so the background music of this loop is fast-paced and metal. The improvements of sound render each loop more unique, thereby allowing players to immerse themselves in the sound and graphics of the game world at the same time.

Blurred boundaries and similar content are common in the design of rewinding games, but by adjusting the plot and sound, the game developers can effectively improve this situation and enable the players to be more immersive.

- Tester 2: The ending is very clever, but it seems to lack some interactivity. I could only witness it happen, but I could not participate in it, which makes me feel a little bored.

In the design of most rewind games, their ending is the key issue. After the player has experienced rewind over and over again, at what point in time and in what way will the ending be considered wonderful? In this case, the author has gained some inspirations from the ending design of *Every Day the Same Dream*. For an external rewind game, the best position

for ending is after the player gets all the rest of story. At this moment, he has obtained all the clues and is eager to know the end of the story. Therefore, in *The Loop*, the ending position is designed after the third loop. In the draft version, when arriving at the final rooftop scene, the player merely witnesses a shadow jumping down from the building without any interaction. However, in the final version, the control of ending scene is in the hand of the player, who can walk around on the roof and choose whether to jump down or not. If the player chooses to jump down from the rooftop, an animated video with casting will be triggered, marking the end of the whole game experience (see Fig.12).



Fig. 12. The ending of final scene on the rooftop

## 2) Unrestricted rewind

Through the analysis of the classic unrestricted rewind games, the author has realized that unrestricted rewind cannot work properly without a visual map, because the players will lose track of where they are in the story. With the design of interactive map inspired by *Zero Escape* (see Fig.13), each level is designed in the form of a block. Different from how it is in *Zero Escape*, thumbnails have been added into the blocks of our interactive map, so that players can directly see the game scene these blocks represent. In order to maintain a consistent style throughout the game, the map is designed in a visually similar style to that of the campus decoration, which has been drawn by the author during the drafting process (see Fig.14).

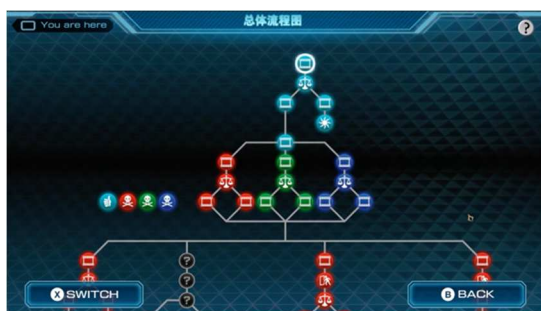


Fig. 13. visual map in *Zero Escape*



Fig. 14. the author made in *The Loop*

- Tester 3: the art and the story are great. One of my complaints is that interactive map make it easy to choose each scene, but I do not know the order of exploration, which leads me to get a distorted timeline that affects my understanding of the overall story.
- Tester4: all rewind leads to only one ending, which does not surprise me too much. I think such a design is relatively single, perhaps can develop many different endings.

The author has received many reports of testers' experience with the draft version, which has provided the game with many new ideas for future improvement and enriched the research as well. Unfortunately, due to the limitations of time and technology, the author has not finished the final version of the game in unrestricted rewind pattern, so the following improvement plans and research cater to the future production process.

Unrestricted rewind game primarily features the visual map. In the draft version of the game *The Loop*, each block in the interactive map is clickable, which brings great frustration to the players because they are not allowed to determine the order of exploration, resulting in a disordered timeline. The improved solution is to use blocks to represent a story segment, and a link to represent the choices of players. Green nodes indicate that the player has unlocked the segment, while grey blocks indicate that the segment is inaccessible and waiting to be unlocked. For the completion of the game, not all nodes have to be accessed, but at least one choice needs to be made at each selection point. However, our current story and single ending cannot support such a design, which is the reason why the plot has to be expanded and various endings need to be added in the future.

## ACKNOWLEDGMENT

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