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The Impact of Music on Narrative Interactivity in VR Game Development

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Abstract:

Significant advancements in the gaming industry have been kindled by the rise of Virtual Reality (VR) technology, bringing forth novel developments in game design. This paper seeks to explore the impact of music on the storytelling process in VR games, an area that has been overlooked in previous research. This work employs a design-based research approach, focusing on a VR game, named Spine, in which music is an essential component of gameplay. The designers have embedded story clues within the accompanying soundtrack, guiding players towards the game's different outcomes. The findings indicate that music can truly enrich narrative interactivity. However, there is a need for further refinement in areas such as synchronizing music with the 3D environment and ensuring the clarity of narrative cues inside music. In conclusion, while music serves as a powerful tool for enhancing storytelling in VR games, optimizing its integration is vital for maximizing its impact on player engagement and narrative effectiveness.

Keywords: VR; game design; musical experience; narrative interactivity.

1. Introduction

During recent years, the emergence of Virtual Reality (VR) technology has sparked a significant revolution in the gaming industry, opening up boundless opportunities. Enthusiastic gamers can now indulge in fully immersive experiences from head to toe [1,2,3]. Unlike traditional 2D games, when players start a VR game with their headsets on, they can not only enjoy a panoramic view of the game environment but also feel as though they are actually present in the game. This expanded sense of space encourages exploration and free movement. With the assistance of VR, players can now partake in interactive adventures that bridge the gap between the virtual and physical worlds. As VR technology continues to progress, we can look forward to even more innovative as well as immersive experiences becoming accessible.

In the field of VR games, music has always been an indispensable part. Among the present gaming market, it is usually performed in various ways, including background soundtrack, vocal singing, audio effects, and so on [4,5]. In most cases, music is used to increase tension (e.g. during thrilling occasions) or evoke players' emotions (e.g. during touching occasions), so as to enrich their gaming experience. Different from written text and visual scenarios, music can trigger people's feelings in a particular way that allows them to immerse in the environment body and

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soul [6,7].

Existing research has already discussed the diverse applications of music in VR game design, such as mental treatment [1] and musical education [2]. Apart from this, however, the importance of how music can complement the main plots has been largely overlooked. Few papers have shed light on the possible impact of music on the narrative interactivity of the game [8,9,10].

In light of this, this work has decided to develop a VR game whose interactions are closely related to its background music. Considering the preference of youngsters (the game's target audience) nowadays, the soundtrack has been designed in the style of modern rock, which is currently gaining popularity among the young generations. In this project, named *Spine*, the main responsibility shouldered by music is to provide players with clues, hinting at the direction of the story. As a consequence, players have to pay close attention to the music. Besides appreciating it, they should also listen carefully and try to understand what kind of emotions it conveys.

2. Game Design & Methods

2.1 Background Story

This game aims to incorporate music into storytelling and restore people's interest in savoring the emotions consisted in music instead of habitually ignoring the background soundtrack. The game takes place in the modern age, where Modern Rock is becoming increasingly popular among the young generations. While most of them stay mere listeners of rock music, some of them have made up their minds to be creators. Berenice Claymore, Chrysopa, Edmund Winston, and Spina Winterglass are four youngsters sharing the same wish—to start a rock band. Even though they are of different origins, the four have congregated in a rented rehearsal room and formed a band of their own. The band has been named "Spine" based on Spina's firstname, as she has been elected to be the leader of the band.

In order to attract more fans, apart from covering the songs of other bands and performing in bars, Spina comes up with the idea to release their own single. There are different opinions among the four at first, but they manage to reach an agreement on the composition, and begin to work for this song wholeheartedly. Nevertheless, unexpected events occur during their preparation, which will be unfolded step by step in the main storyline.

2.2 Methods

2.2.1 Scene

The game is situated in the rehearsal room of the band (Fig.1). Players would see scores on the table (Fig.2), musical instruments around the room, even a group photo of the band on the shelf. This is where they usually discuss and run over their songs. However, none of the band members is in the rehearsal room right now, where they normally should be. Where are they? It's the player's task to find out.

Fig. 1 General game scene (without instruments) (Photo/Picture credit : Original)

Fig. 2 A close shot of the scene (Photo/Picture credit : Original)

The modeling of the scene is done with Unity according to a draft that has been drawn beforehand (Fig.3).

The scene was at first imagined to be a classroom inside a college where students have musical lessons, as the game was originally designed to be taking place in a school, advancing through the characters' daily events on campus. However, on second thoughts, student was found to be an identity that would limit several aspects of the characters, including outfits, age, viewpoint, past experiences, etc. Consequently, the scene has been finally moved outside the school as a rented apartment, thus making it possible

for people of diverse backgrounds to meet here. The four band members usually gather in this room to rehearse their shows. In some cases, one or two of them would be living here for a night or two when the rehearsal runs too late or when their residence is under construction. This room offers enough space for them to store their musical instruments, walk around freely, or sit down to have a discussion. A refrigerator is set next to the wall to preserve their snacks and drinks. There are several stools placed around the room, as they are often needed when the members play the instruments or conduct free chats.

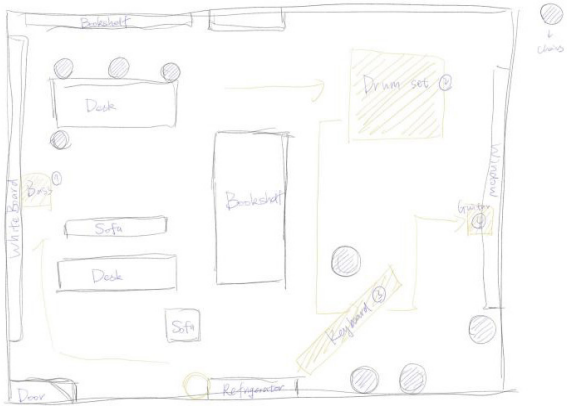

Fig. 3 Draft of the scene (Photo/Picture credit : Original)

As players will be required to examine the details of the objects around the room, the modeler has decided to make the scene within an appropriate size, so that it will not take the players too much effort to explore. Players are restricted to this rehearsal room through the whole game, but they are not getting bored so easily. There are plenty of interesting details which will not be discovered until players walk up towards them.

2.2.2 Character

The young generations usually have particular dreams that they are enthusiastic to chase after. In this work, the four characters share one common interest: music. Consequently, in spite of their distinct backgrounds, they gather together and start the band “Spine”. In order to tell a vivid story, the characters have been intentionally set by the designers to display diverse traits, so that they will make very different decisions when faced with the same problem.

Spina Winterglass (22 years old)

The designers want to create a central character that can connect the other characters with each other and be the core of the main storyline. So Spina Winterglass was born. Spina is the guitarist and lead singer of the band. She is the captain as well as the backbone of “Spine”, since she is the one who has taken the trouble to organize and recruit this band (Fig.4 and Fig.5). She is reliable and ambitious. Spina is a representative of rock music lovers who regard their dreams of becoming somebody in this field the most important thing in their life, so this character may be observed to devote herself and everything to developing the band throughout the game.

Fig.4 2D portrait of Spina Winterglass (Photo/ Picture credit : Original)

Fig.5 3D model of Spina Winterglass (Photo/ Picture credit : Original)

Berenice Claymore (19 years old)

As the story partly aims to disclose the dark side of fan culture, the designers felt the need to create a character that is simple and unsophisticated. Berenice Claymore has been expected to display a stark contrast between her original self and the one after going through all the events. Berenice is the keyboardist of the band (Fig.6 and Fig.7). She is a definite idealist and optimist. In the meantime, she would do anything for someone she cares. In this case, that “someone” is Spina Winterglass.

In some branches of the storyline, the other band members

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hide the truth of the tragedy from Berenice so as to protect her, while in one other branch, Berenice learn about the truth and seeks revenge, ending up behind the bars. The plots are expected to reveal how the insanity of fan culture can destroy one's life.

Fig.6 2D portrait of Berenice Claymore (Photo/Picture credit : Original)

Fig.7 3D model of Berenice Claymore (Photo/Picture credit : Original)

Chrysopa (23 years old)

Far from people's perceptions, a large portion of young music lovers are rather unsociable, even eccentric. Chrysopa has been created to act as an atypical part of the band. Although every member is yearning to develop their band, it is easier said than done. Conflicts occur every now and then, and sometimes lead to severe problems. Chrysopa is the drummer of the band. He has suffered from autism as a child, and is relatively selfabased and introverted. Sometimes he fails to regard other's feelings, which results in the conflict between him and Edmund (Fig.8 and Fig.9).

The designers hope to reflect the realistic image of marginal groups among music lovers through the story of Chrysopa. In the meantime, the designers also call upon players to care for people with ASD (autisticspectrum disorder) in real life.

Fig.8 2D portrait of Chrysopa (Photo/Picture credit : Original)

Fig.9 3D model of Chrysopa (Photo/Picture credit : Original)

Edmund Winston (24 years old)

This character almost possesses an opposite set of traits compared with Chrysopa, which inevitably results in constant quarrels. This character is also created to portray the image of music lovers, yet he belongs to the bad-tempered ones. His conflicts with Chrysopa play an active role in advancing the main story and placing twists and turns. Edmund is the bassist of the band. He is outgoing and arrogant, thus he sometimes hurts others without even realizing it (Fig.10 and Fig.11).

Youngsters sometimes find themselves at loss and thus tend to make decisions on the spur of the moment. Edmund does so, and it costs him dearly. Such design mainly aims at reminding players to be discreet about every decision in their life.

Fig.10 2D portrait of Edmund Winston (Photo/Picture credit : Original)

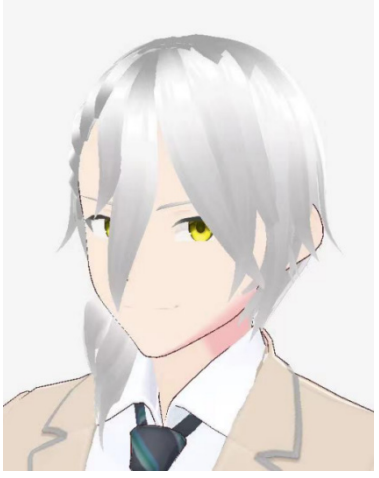

Fig.11 3D model of Edmund Winston (Photo/Picture credit : Original)

2.2.3 Modeling of characters

The images of the characters have been painted out by hand, and then modeled in VRoid Studio. The face of Chrysopa and Edmund are relatively longer and narrower as they are male characters. Meanwhile, the iris size of their eyes are also smaller, and the distance between their upper and lower eyelids are shorter, so that they can resemble young men in real life more vividly. On the other hand, Spina and Berenice have been assigned rounder faces. Their eyes are larger and have twinkles inside. The characters are designed to have colorful hair so as to be more impressive. Even though there are only four of them, the designers still worry that players may have trouble telling them apart. It is necessary for players to remember their individual details in order that they will not get confused when going through the narration.

There are more than one color in Spina's and Berenice's hair. During the editing of hairstyle, in order to model out their highlights, a second material (the color of their highlights) has been added (Fig.12). After finishing the models, the designers paid extra efforts to adjust the four characters' clothing to avoid looking out of place when they appear together, considering that they are going to show up as one crowd in most cases.

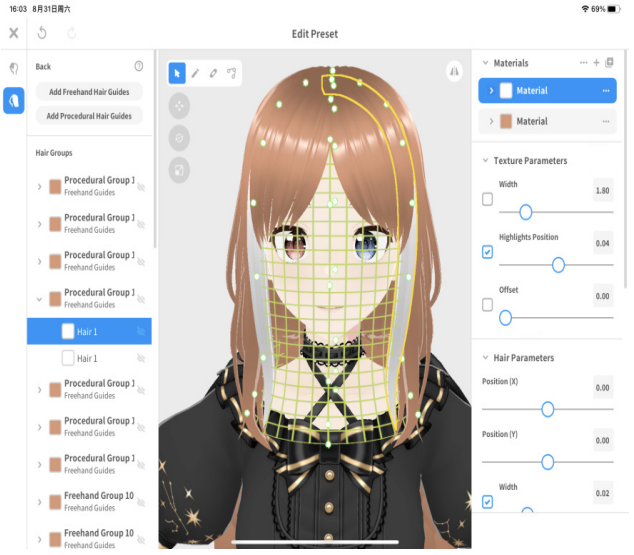

Fig.12 Screenshot of the hairstyle editing process (Photo/Picture credit : Original)

2.2.4 Gameplay

In *Spine*, the main task of the player throughout the game is to walk around the room and investigate the truth behind the absence of the four members.

When players explore the room, they will see the four musical instruments (including a guitar, a keyboard, a bass, and a drum) which the members use to perform music. They will be guided to walk up to them and have a closer look. There are items placed next to the instruments, respectively belonging to different characters (Fig.13). Players are free to choose which one they want to conduct further investigation, but they are only allowed to choose one at a time. After the investigation, they will be unable to look at the other two choices. When players have made their choice, the view before their eyes will change to show a scenario from the past (Fig.14). Players will hear voices of the characters, and they need to infer what has occurred during the latter's conversations. When the conversation ends, players can walk around the memory scene freely. If they go near the characters, they can hear their inner voices.

The interactions are accompanied with background music, and players' choices will profoundly affect the story ending that they are heading towards. The details will be explained in the later parts.

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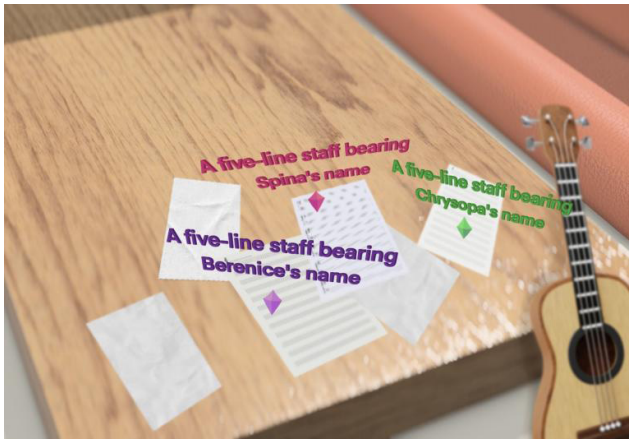

Fig.13 Players' perspective when interacting with the guitar (Photo/Picture credit : Original)

Fig.14 Scenario Shown During Interaction with the Guitar (Photo/Picture credit : Original)

2.2.5 Soundtrack

Players would hear music during interactions with the four instruments. It will be an independent track of music coming from the specific instrument they interact with. For example, if the player interacts with the guitar (or the items placed around the guitar), a period of music played by guitar will rise. In addition, as there are three choices for each instrument, each choice will trigger different music. They share the same melody, but are played in different tones, such as joyful, grave, or just normal. The tone of the music actually hints at the ending that this choice leads to. Thus, players have to pay close attention to the music every time it is played. At the end of the game, when the player arrives at the ending CG (computer graphic), the four tracks serve to form a complete song, which is exactly the band's first single. The designers have prepared four different endings for the game, so it is possible to hear four versions of the single.

By incorporating the soundtrack with the narration, the designers hope to provide players with a novel experience, during which they unfold the story by their ears. It is common to require players to observe details in the scene carefully, discover the visual patterns, or search for certain clues around the scene, so as to propel the storytelling of the game. What the designers are looking for is to let the players be capable of learning about the story even when their eyes are closed. Players do not watch the story; they listen to them. Just as Caroux & Pujol [3] demonstrated in their paper, the presence of music in games accounts for a relatively positive effect on players' gaming experience. The designers aim to not only bring music into this work but also ensure the maximization of its effectiveness. This is why in *Spine*, compared to the models, environments, and CGs, music plays a more important role in telling the story.

2.2.6 Storyline

This work has prepared four different types of ending for the story. The ending CGs will be shown in the form of 2D paintings. In order to fit in the 3D environment of VR, they are arranged to be photos that have been collected into an album. When players finish the main part of the game, they will be led to investigate the album, where the CG will be displayed, along with voices of the characters explaining the situation.

Ending 1: Happy Ending

The single has been successfully released and received excellent feedback. "Spine" immediately becomes a hit. The band members hold a victory banquet to celebrate their success (Fig.15). As the broker, the player has not been invited.

Fig.15 Ending CG of Happy Ending (draft) (Photo/Picture credit : Original)

Ending 2: Bad Ending

Shortly after the single has been released, "Spine" is accused of plagiarism by a famous band (which is not the

truth). Spina gets attacked by insane fans of the other band. After that, Berenice seeks revenge and ends in jail, Chrysopa experiences mental breakdown, and Edmund walks away. Their outcomes are shown respectively in the CG (Fig.16).

Fig.16. Ending CG of Bad Ending (draft) (Photo/Picture credit : Original)

Ending 3: Open Ending

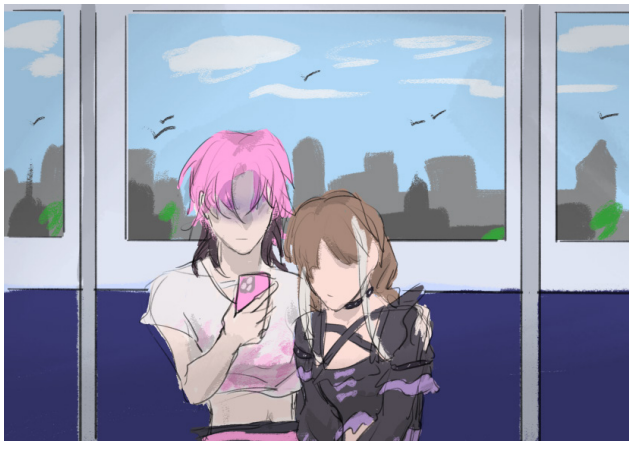

Fig.17 Ending CG of Open Ending (draft) (Photo/Picture credit : Original)

The single has failed to make a hit, signifying that all their efforts have been in vain. The band is faced with dissolution: Edmund leaves the place at once, and Chrysopa disappears. Berenice stays with Spina and is hid from the fact that the band has reached its end (Fig.17).

Ending 4: True Ending

This ending (Fig.18) reveals the truth behind the open ending. Chrysopa returns to his old band and releases a new single. Edmund has an traffic accident and dies young. Berenice finally learns about the actual situation, but it is too far gone.

Fig.18 Ending CG of True Ending (draft) (Photo/Picture credit : Original)

3. Experiment & Result

3.1 Details and Evaluation Criteria

In order to examine the effectiveness of the soundtrack in storytelling, this work has selected 20 volunteers of different ages, gender, and gaming experience as interviewees. The experiment takes the variable-controlling approach: the interviewees are divided into two groups (10 in each). Group 1 tests the game demo which runs without music while group 2 tests the one with music. After the test drive, they are asked to complete a questionnaire, in which they are required to assess their gaming experience from four aspects: artistic design, narrative informativeness, sense of immersion, and emotional arousal.

The questionnaire is designed on a scale of 1 to 10, where 1 represents “dissatisfying” and 10 represents “satisfying”. The “artistic design” is graded based on the general planning of the game, including scenario, characters, etc. The “narrative informativeness” is to evaluate whether the clues during interactions tells players a clear story. The “sense of immersion” assesses the extent to which players indulge in the game. The “emotional arousal” centers around whether the game is capable of arousing players’ feelings such as disappointed or pleasant during the course of the story.

3.2 Comparison of Results

The results are as follows (in Table 1 and Table 2).

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Table 1. Players' Assessment of Gaming Experience (Group 1)

	Artistic Design	Narrative Informativeness	Sense of Immersion	Emotional Arousal
Score (average)	8.8	7.8	7.2	9.0

Table 2. Players' Assessment of Gaming Experience (Group 2)

	Artistic Design	Narrative Informativeness	Sense of Immersion	Emotional Arousal
Score (average)	9.0	8.3	8.5	9.2

According to the data, the scores rise significantly when music is added to the game, especially the scores for "narrative informativeness" and "sense of immersion". The increase can be mainly attributed to the designers' innovations on the music setting. The song which accompanies players throughout the game has been intentionally composed in several distinct styles, in order that it can convey the messages clearly and presicely. Also, the song manages to embody many traits of the modern rock music, thus it goes with the story setting and background nicely, enhancing the immersion of the scene.

3.3 Limitations and Future Optimization

In the meantime, nevertheless, there is still room for improvement. The scores for "narrative informativeness"and "sense of immersion" fail to reach 9.0 in the feedback of both groups, meaning that these two aspects need further optimization. When the 20 players are interviewed after finishing the evaluation, several of them confess that they find it hard to grasp the whole storyline, about which music offers insufficient help. One of the reasons may be that the version they test is incomplete. What's more, the designers are also reminded to seek a better way of musical setting, since most interviewees express that the music sometimes sounds unintegrated within the 3D environment. They complain about the circumstances in which they can hardly hear the music when they start walking around the scene.

As for future optimization, the designers plan to substitute surround sound for the present sound source which is fixed in the scene, in order that the volume and quality of music will not alter when players move around the location. It is believed that when players stay in the centre of the music, they will be able to concentrate better on the game. Apart from this, a second playtest is going to be held when this project is completed, and the designers will observe whether the score for "narrative informativeness" rises as the players then will have access to the whole story.

4. Conclusion

This essay mainly sheds light on the VR game *Spine* which has been developed as an attempt to enhance the narrative interactivity through music. The designers have tried to incorporate specific soundtracks with the storytelling process, and conducted a test drive among volunteers to examine the effect. According to the results, the soundtrack is reported to have successfully enriched the narrative interactivity. Meanwhile, there is also still plenty of room for improvement, mostly in the location and sound effect of the music. Therefore, in the future development, the designers will have to focus on optimizing the way that music blends with the 3D environment. In addition, the designers also have to modify the composition of the music in order to present players with songs associated more closely with the storyline. To summarize, this project has proved to be a novel approach to create an immersive environment and interactive experience through playing music, and hopefully, it will make further progress after being optimized thoroughly.

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