Gemelody - Harmonizing Mental Health and Well-being Through Musical Game Design

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Abstract—This study presents a game designed to integrate the principles of music therapy and an interactive game aimed at improving mental health. The game is accompanied by relaxing music and it explores the potential of combining rhythmic synchronization and visual impact as a novel approach to support well-being and foster a state of mental relaxation.

Index Terms—Music Therapy, Digital Gaming, Well-being, Rhythmic Synchronization, Mental Relaxation, Visual Impact, Gamified Relaxation

I. MUSIC THERAPY

The intersection of technology and mental health interventions has opened new avenues for therapeutic practice, particularly through the innovative use of music therapy in a digital gaming environment. Music therapy, which uses elements of music to promote health and well-being, is used in clinical settings to address a variety of physical, emotional, mental, and social problems. The emergence of digital technology, especially in the form of interactive games, provides a great opportunity to expand the accessibility and availability of music therapy and make it available to a wider audience in a more fun and flexible way. Exploring the theoretical foundations of music therapy and applying them to digital games illuminates the mechanisms by which music can exert therapeutic effects. In addition, this discussion addresses the practical implications of this innovative approach, such as making music therapy more accessible to a wider audience and useful as a preventive tool for mental health. Through this analysis, we aim to enrich the growing field of digital mental health interventions and demonstrate the benefits of incorporating music therapy principles into digital platforms to promote well-being.

II. GAME DESIGN

A. Architecture of the Music Therapeutic Game design

At the heart of game design of Gemelody [1] is a conceptual framework that prioritizes the psychological experience of the user. This framework is based on music therapy and mindfulness-based interventions that aim to create an immersive environment that facilitates relaxation, stress reduction, and emotional regulation. Game architecture is based on the principle of therapeutic intervention by engaging every element, from play mechanics to auditory and visual stimuli, to contribute to the therapeutic goal. The game is designed to stimulate a reaction to every beat of the audio so as to spawn a gameobject. The synchronization of the beat with the object pleases the human visual and auditory sense. This helps the users mind to relax and enjoy the game.

B. Auditory Engineering for Therapeutic Outcomes

In developing therapeutic games that use music to promote mental health, accurate sound analysis is essential to align game mechanics with therapeutic goals. An effective way to analyze audio in games is to use the Fast Fourier Transform (FFT) and the Hamming window, which allows the extraction of audio spectrum information. FFT with Hamming windowing can be used to process music and sound effects in games, to synchronize game events with specific audio tracks, and improve the processing efficiency of the game environment.

1) FFT and Audio Spectrum Analysis:

Fast Fourier Transform (FFT) is a mathematical algorithm that extracts the frequency component of a signal and converts it from the original time domain to the frequency domain. This variation is necessary to

[1] Gemelody itch.io page

understand the spectral characteristics of sound, which includes different frequencies and intensities. In the context of therapeutic play, sound spectrum analysis allows us to design game mechanics that respond to specific frequencies or changes in music, creating a dynamic and interactive experience. *2) Hamming Window Function:*

The application of FFT involves dividing the audio signal into small frames or samples, which are then individually transformed in the frequency domain. A Hamming window of a certain window function is used in this segmentation process to reduce spectral leakage. Spectral leakage occurs when frequencies outside the target frequency range affect the analysis, leading to inaccuracies in spectrum representation.

Hamming windowing solves this problem by weighing the signal samples, with the central samples receiving a higher weight than those at the edges. This method will reduce the sharp cut in each segment, thereby reducing spectral leakage and producing a more accurate representation of the audio spectrum.

C. Interactive Dynamics

Players interact with the game environment through a cursor controlled by mouse input designed to simulate a cutting tool. The cursor is visually enhanced with background effects, simulating fluid-like dynamics to enhance the tactile feedback and aesthetic appeal of player movements. This trail feature not only serves as a visual guide for the player's actions, but also contributes to the overall healing environment of the game through soothing visual features.

D. Dual Categorization of 'Gem' Objects

Gems in Gemelody are divided into two main categories, 'Friendly Gems' and 'Enemy Gems'. Brightly colored Allies gems intended to be collected and interacted with, and will earn player points after successful 'cut'. In contrast, Enemy Gems are distinguished by their lighting and unique flashing animations, indicating to the player that they must avoid these gems to avoid penalties. This dual categorization introduces an element of cognitive challenge by requiring players to quickly distinguish and respond to gems based on visual cues, requiring cognitive processing and focus in a therapeutic context.

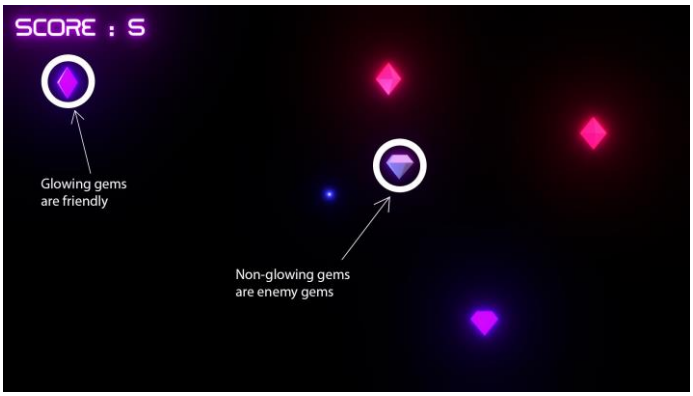

Fig. 1. Dual Categorized Gems into Friendly Gems and Enemy Gems.

E. Visual Effects

Gemelody's visual design incorporates advanced fluid simulation techniques to render the cursor tracking, providing an attractive, enhanced glossy effect that mimics the behavior of fluid dynamics. This option enhances the tactical feel of the game, providing a more engaging and immersive experience. Likewise, the effect of sparkling on gems not only has a function in gameplay, but also contributes to the creation of a visually stimulating environment that supports the goal of game therapy.

It combines sound processing with visual and interactive design principles to create a rhythm-based gaming experience. Through its innovative use of dynamic object manipulation, interactive mechanics, and eye-pleasing effects, the game combines entertainment and digital health support to provide an advanced example of how digital games can be used for mental relaxation.

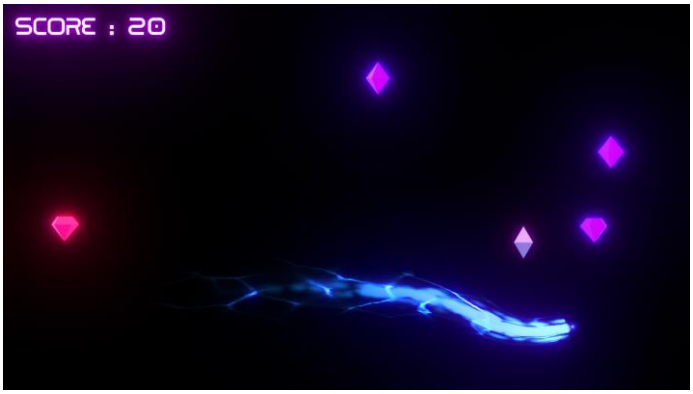

Fig. 2. Trail Visual Effect along with the glow of gems.

F. Intuitive Interaction Design

At the heart of Gemelody's interaction design is the principle of sensitivity. The game's interface and controls are designed to be instantly intuitive, allowing players to navigate and interact naturally in natural environments with plenty of natural awareness. The mouse-controlled cursor, central to the game's interaction model, uses familiar cursor point-and-move mechanics, ensuring that users can work hard on the core task of mining gems. This approach lowers barriers to entry for users of all ages and tech skills, promoting inclusivity and broad access.

G. Feedback Cues

Gemelody includes a feedback mechanism to guide and motivate players throughout their experience. Visual cues, such as the sparkling and vibrating effects of gems, provide immediate and clear feedback about the game's objectives and challenges. Auditory feedback is synchronized with gameplay actions, reinforcing positive behavior and reminding players with specific sounds that correspond to successful and unsuccessful interactions. This multimodal feedback system is essential for keeping players engaged and fostering a sense of achievement and growth.

III. CONCLUSION

Gemelody represents an innovative approach to stimulate mental relaxation through digital games, combining music therapy and interactive games. Using Fast Fourier Transform with a Hamming window for dynamic music analysis, the game synchronizes its mechanics with the rhythm of the background music, providing an immersive and immersive experience. With a focus on intuitive control, adaptive feedback, and aesthetic design, Gemelody is affordable and fun, proving its therapeutic potential. The inclusion of music therapy in games represents a promising direction for the development of therapeutic games in the future, emphasizing the important role of digital activities in supporting cognitive activities.

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