ESSAY / DENEME

THE HISTORY AND PROBLEMS OF EXPERIMENTAL DIGITAL PINBALL AND DEVELOPING A PINBALL VIDEO GAME CONCEPT BASED ON MUSIC

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Ertan, E. (2023). The history and problems of experimental digital pinball and developing a pinball video game concept based on music. *Etkileşim*, 11, 421-431.
doi: 10.32739/etkilesim.2023.6.11.203
This study complies with research and publication ethics.
Bu çalışma araştırma ve yayın etiğine uygun olarak gerçekleştirilmiştir.

Pinball games may have lost their popularity over time; however, developers revived their features inside other video games or completely renovated them. While arcade pinball machines offer limited gameplay, digital pinball can be much more flexible. Nevertheless, according to the author's preliminary investigation, academic research is lacking in pinball gaming. This artistic paper attempts to close this gap by shedding light on experimental digital pinball games. Moreover, the author focuses on music visualization features of digital pinball games, and he developed an experimental pinball video game concept based on synaesthesia by answering a simple question, 'How does a classical music-based pinball video game would look like?'.

Introduction: Pinball History and Basics

The ancestors of arcade pinball machines can be traced back to the French "Bagatelle" in the 19th century, a wooden table game where players needed to get some balls past pins into the holes. The rise of arcade pinballs started in the 1920 and 1930s. They reached their peak around the 1950s, and finally, they were manufactured until the 1990s, when video games took over the lead. They are still manufactured today, mainly for collectors.

In classic arcade pinball machines, players change the ball's course with flippers located at the bottom of the playfield. The main aim is to prevent the ball from falling into the gap between flippers and play as long as possible for more scores.

The main problem in arcade pinball machines is that, as Wong et al. (2008) put it, the gameplay is fairly strict where the players need to make a series

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of predefined shots to advance the game. This limit can make gameplay unexciting since they quickly become monotone (2008, p. 6). Despite adding more flippers and balls to the game field, the monotony problem remained the same both in the arcade and digital pinball. However, some pinball video games managed to bring experimentality to break the uniformity of gameplay. In the next chapter, the author will mention essential experimental pinball video games in chronological order.

The Development of Experimental Pinball Video Gaming

Classic pinball video games began to appear around 1977, such as "Video Pinball" (1977) (*Atari*'s integration of machine and video game), and they still exist today with the support of 3D elements or visual effects, such as *Zen Studios*' "Pinball FX3" (2017). It can be said that a new genre was born when *BudgeCo* (later *EA*) released the "Pinball Construction Set" in 1982 for *Apple*, *Atari*, and *Commodore*. In the game, players can build their personalized 2D pinball video game and also add attributes such as gravity and physics.

The First 3D (as an orthographic view) and flippers-free attempt came from *Atari*'s "Marble Madness" (1984), developed by Mark Cerny. Inspired by M. C. Escher's (1898) optical artworks, the game was an amalgamation of pinball and golf where the player must directly guide a ball through obstacles and enemies. On the other hand, 2D pinball games were still being produced, such as *TOSE*'s "Pinball Quest" (1989) for *Nintendo* combined 'RPG (role-playing)' elements with pinball. Later on, RPG elements were improved in *Rare*'s "High Speed" (1991) for *Nintendo* and *Tengen*'s fantastic sorcery game "Dragon's Revenge" (1993) for *Sega Genesis* with positive reception. Here, it is worth mentioning a game named "Kirby's Pinball Land" (1993) by *HAL* for *Nintendo* regarding its cartoonish visuals.

At the dawn of the mid-90s, it was inevitable to use 3D technology for video games. *PF Magic*'s "Pataank" (1994) for the *3DO*, players can have complete control of a UFO-shaped ball in a 3D area full of confusing billboards. Each playfield has an objective, and players can apply limited thrust to the ball as in the car racing games. While on the subject of car racing, the author feels obliged to mention *Stainless Games*' iconic car racing game "Carmageddon" (1997) for PC due to its pinball mode. In this vehicular combat video game where the vehicles are destructible (with physics), pinball mode can be taken accidentally or deliberately on the map. The mode lasts for a few seconds, and the player loses control of the vehicle. During this mode, the vehicle behaves like a ball, hits the surfaces, and bounces back. Moreover, it takes damage and loses some of the body parts based on physics. If the vehicle hits hard enough, the engine bursts into flames, but the vehicle is repairable with earned credits. In this context, "Carmageddon" has brought physics to the 3D pinball video game genre.

While 3D visualization usage in digital pinball seems unstoppable, it was time to deal with the audio part. In *Vivarium*'s interesting attempt "Odama" (2006) for *Nintendo*, players have control of a gigantic ball named "Odama" that is capable of destroying enemy lines in a medieval game field. The signature of this tactical war game is that the players can control the battlefield with voice by using the *GameCube* microphone. For instance, saying "March right." enables your army to flank the enemy from the right side of the battlefield.

After the mid-2000s, the development of pinball video games gained more speed and wisdom in the framework of experimentality. *Atomic Elbow*'s "Switchball" (2007) for *Playstation* and *Xbox* brought more hybridity to the genre by combining 3D puzzle elements and rolling a marble ball. The ball can acquire unique physical powers such as pushing, dashing, magnetizing, or jumping based on accurate physic engines on a platform full of puzzles.

In *ACE Team*'s iconic saga "Rock of Ages" (2011-2020) for *Xbox*, *Playstation* and PC, developers finally managed to combine the sense of humor with pinball and tower defense elements, inspired by British surreal comedy troupe "Monty Phyton"s visuals and animations. Furthermore, the players can race against each other by constructing obstacles to prevent each other's balls from rolling with the same physical features as "Switchball" (2007).

Until now, as we can see from the development of pinball games above, the developers reduced the dependency on flippers and gave more space to the ball's direct control in general terms. But after 2015, developers bent the rules more than ever. *DreamSoftGames*' "Match 3 Revolution" (2015) for *Windows* offers a variety of pinball games based on physics. Players can smash lots of balls at each other in different environments such as vertical-horizontal platforms or water, play the iconic game "Galaxy Invaders" version of pinball, and so on. While we see the emergence of the water element in "Match 3 Revolution", *RunServer*'s "Liquid Pinball" (2016) for *Windows* took it much further. Here, instead of controlling the ball, players must tilt the field to move a liquid ball. Ultimately, apart from balls and flippers, players are now able to control the pinball field.

The next step would be combining multiple genres with pinball elements, bending the playfield, and adding more aesthetics. *Gembem*'s "Orb the Ball" (2017) for *Windows* is the almost exact equivalent of the next step. In the game, players can only control the environment with additional control mechanics instead of the ball. Independent developer Tim Rachor's "Galler One" (2018) restores the masterpiece paintings in a fancy way; players must roll a ball over masterpieces, soak different colors to multiply the score and find the shortcuts between dye buckets to beat the high score.

Stitch Heads Entertainment's multiplayer action game "Kabounce" (2018) for *Windows* achieves to create an aesthetically pleasing and high-tech-look-

ing 3D environment for up to eight players to control their balls to steal each other's points. On the other hand, *Devonian Interactive*'s "Super Steampunk Pinball 2D", as its very name signifies, prefers to go back to a 2D world with a retro steampunk environment. Finally, all of these attempts brought us to the first *Metroidvania* game with highly artistic visuals and overwhelmingly positive reception in the genre, "Yoku's Island Express" (2018), developed by *Team17* for *Windows*. In this side-scrolling game with a large interconnected map with role-playing elements, a character (*Yoku*, a bug) is attached to the ball, creating more complicated physics and a unique blend of pinball mechanics.

Another changing element over time is the rounding of the classic rectangular pinball game field that can be observed in *Flying Mantis'* "Suprapong" (2018) for *Windows*. In this 2D fast-paced multiplayer game, players must prevent the balls from entering their side in a completely circular arena. The aesthetically pleasing and vectorial-looking 3D adventure game "Pinball Wizard" (2019) by *Frosty Pop* for *Macintosh* does also have circular maps. Despite these changes, some developers still insist on releasing classic 2D pinball games limited by flippers. Yet, some of them became successful due to their artistry, such as *Flarb LLC*'s "Demon's Tilt" (2019) for *Nintendo*, *Playstation*, *Windows*, *Mac*, and *Xbox*.

Before 2020, fractal simulation technology was already on the rise, and it was inevitable for digital pinball to take benefits from it. *Codeparade*'s open-sourced "Marble Marcher" (2019) for *Windows* did the first thing that came to mind; controlling a ball on continuously evolving 3D fractal surfaces with an individually developed dynamic fractal physics engine. Similar to golf, players need to guide a ball to a hole through challenging and moving fractal masses.

As we categorized the alternative or individual developers' digital pinball attempts, blockbuster developers also used pinball elements in their games. The outstanding usage would be *Blizzard*'s "Overwatch" (2016) for *Playstation*, *Xbox*, *Nintendo*, and *Windows*. *Overwatch* is a team-based multiplayer first-person shooter game. In 2018, *Blizzard* introduced a new hero named "Wrecking Ball" to the game, controlled by a hamster, a ball with rolling and walking modes that can anchor to an area and swing to kill enemies. It can also slam onto the ground to give general damage in a limited diameter.

Finally, 2020 and afterwards brought more hybrid games with unique experimentality. *Self Published*'s "Evade Zero" (2020) for *Windows* is a fast-intense multiplayer arcade action game with pinball elements that takes place in dynamic and complicated areas. Similarly, *Dot Product*'s "Marble Odyssey" (2020) for *Windows* also offers mesmerizing visuals as a ball-rolling adventure game. But *Shiny Snail LLC*'s "Marble Muse Arcade" (2021) is one step ahead of others, as it offers a multi-dimensional playfield. Last but not least, classical pinball video games are still being released, such as *Zing Games*' "Zombie Rollerz" (2021) for *Windows* as a role-playing game on a pinball battlefield.

It would be a challenge to categorize the development of pinball video games due to the crossing of hybrid models and different types of releases from different developers. For instance, while "Carmageddon" blends pinball elements in the game as a hybrid model in 1997, we still see the hybrid models more and more today, as in "Overwatch" (2017). Moreover, flipper-limited pinball games are still produced, such as "Zombie Rollerz "(2021). But one thing is for sure; the control limit started with flippers and continued with the ball and platform, respectively. Today, successful developers mostly release hybrid model games such as "Yoku's Island Express" (2018) regarding pinball gaming. As a result, a rough diagram can be seen in *Table I*.

Table 1. Rough development of Pinball games

Rough Timeline	Control is limited by	Examples
1980s	Flippers	Arcade Machines, First Video Games
1990s	Ball / Hybrid	Marble Madness
2015s	Platform / Hvbrid	Orb the Ball
2020s	Mostly ball / Hybrid	Yoku's Island Express

Pinball and Music Visualization

While pinball machines mainly refer to movies and popular music, music-related pinball themes are usually based on rock music. For instance, the playfield includes several physical items that appeared on famous rock songs and stage shows by AC/DC, such as "Hells Bells" and "Rock n Roll Train" (Edler, 2020, p. 63). In this regard, pinball machines are table games that take the highlights from popular movies and songs, place them in a box as audiovisual elements. As Edler (2020) notes, it gives a player the feeling of being immediately 'immersed' into the quickly and spontaneously changing 'story' taking place on an (artistically) animated and interactive map-like pinball playfield based on popular culture such as movies, music, etc. (Edler, 2020, p. 64).

Swedish composer and engineer Martin Molin (1983) goes a step further and builds "Marble Machine" (2016), a music box made of many complicated mechanical components using 2000 metal balls that are moved through the funnels, pulleys, and tubes of the device. The result is the activation of vibraphone, bass, drum, cymbal, and other instruments in the device to play some loops in a similar way to American 3D visualization of MIDI-based music company *Animusic*'s "Pipe Dream" (2010), where a bunch of instruments is played by balls through pipes.

Developing a Pinball Game Based on Classical Music Regarding Synaesthesia

Surely, experimental pinball video games come with sound and music. However, music has never been a top priority. Here the author pushes the music forward and asks the question, 'How does a classical music-based pinball video game based on synaesthesia would look like?'. One may think if AC/DC pinball game includes "Rock n Roll Train," a pinball game based on Mozart would offer items such as his bust, piano, or phaeton. Another solution would be completely abstract, a pinball video game that is based on 3D geometric shapes with colors of Russian abstract painter Wassily Kandinsky's (1866) paintings as his works' primary aim was the visualization of classical music. For instance, as Kandinsky (1946) puts it, in music, the absolute green is best represented by the placid, long-drawn middle notes of a violin (Kandinsky, 1946, p. 66).

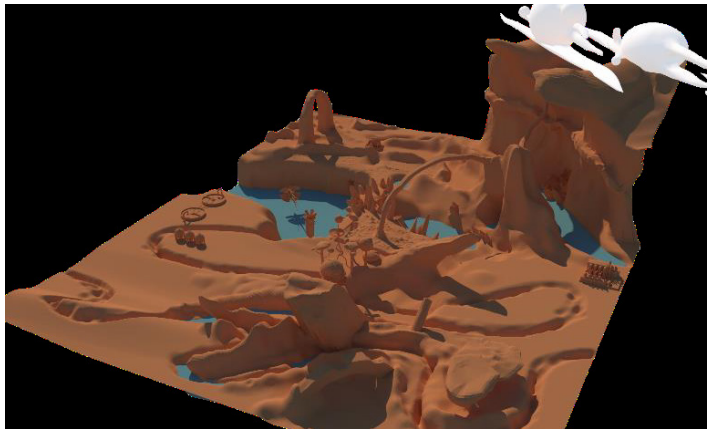
Kandinsky's individual experience between a violin and the color green can be explained by the neurological trait "Synaesthesia". A rare sensory phenomenon where individuals consciously experience events in one sensory mode due to the presence of stimulus in another (Mccabe, 2010, p. 12), synaesthesia played an important role in connecting the music and visuals in the history of art. Similar to Kandinsky, Russian composer Alexander Scriabin (1872) ascribed certain characteristics to colors: red is a "color of Abaddon," blue and violet, colors of "reason," and "spiritual" colors. Therefore, their juxtapositions are a matter of course: C major and F major are red and F sharp major, deep blue (Galayev & Vanechkina, 2001, p. 34). The effect of synaesthesia can be experienced in his tone poem "Prometheus: The Poem of Fire" Op. 60 (1910), composed for orchestra, piano, optional choir, and more importantly, "Chromola," a special color organ. The tone poem is always performed with a color show in the background, based on Scriabin's color system regarding synaesthesia.

If one borrows some game elements from experimental pinball video games, will developing a game concept in the framework of classical music and synaesthesia fill the gap in the genre? The answer partly lies in history, as the author mentioned in the previous chapter and *Table 1.*; the players mostly preferred controlling the ball in a large adventurous map with additional combat or puzzle elements over other elements. Some exceptional elements here would be building the map as in "Pinball Construction Set" (1982) or "Rock of Ages" (2011-2020) and directing the army with the voice in "Odama" (2006). Despite all, the ball is the primary gaming object on a map, especially in the iconic saga "Rock of Ages" (2011-2020).

Going back to the main question of this paper, the first element that needs to be taken care of would be the largest one; the playfield. Classical music listeners can be both introverts or extroverts, there is no solid data that support the demographics, however, *Knight Foundation* (2002, p. 83) suggests that the biggest portion of classical music concertgoers are alone and most people

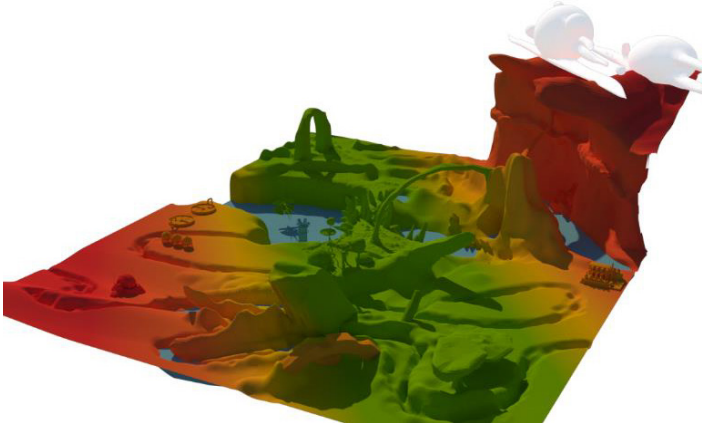
consider classical concerts to entertain visiting friends and family members (occasion value as extrinsic), while others far less likely experience them as artistic, educational or spiritual values (artistic or educational value as intrinsic (2002, p. 16) Additionally, *IFPI*'s music consumer insight report (2018) shows that classical music including opera is the least consumed music right after Soul/Blues, R&B and Metal (IFPI, 2018). In this context, the playfield can be a vast wasteland with the touch of wrecks, ruins, temples, and natural elements as the metaphor of a lonely soul (*Figure 1*) in a similar way to *Coffee Stain Studios'* "Satisfactory"s map (2019) with the minimalist 3D vectorial design as in *Frosty Pop'*s "The Pinball Wizard" (2019) to prevent lagging due to very large size of the playfield.

Figure 1. The playfield



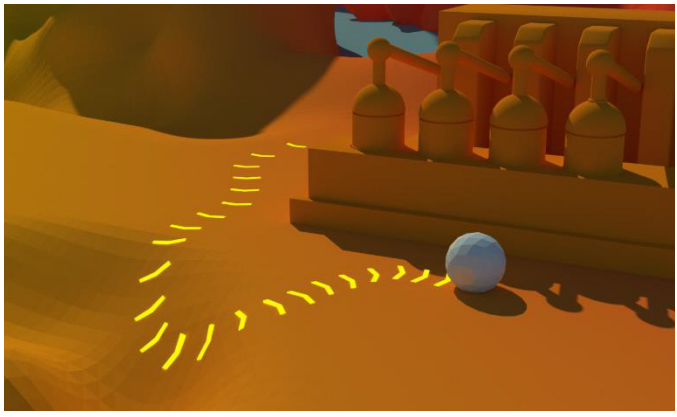
The second step would be dividing the wasteland into zones based on colors where each color can match the selected classical music piece's chords based on (individual) synaesthesia when the ball enters one of these zones. Here the synaesthesia is simplified such as entering the "coda" part is represented by a red-colored hill as an example, as the codas are usually vigorous and played in loud sound. The calm parts of the music can be heard when the ball enters the plain area, colored with green as a soothing color (*Figure 2*). As the player rolls the ball on the wasteland, the selected classical music piece is not heard. Instead, the player hears the rolling ball sound along with the wasteland elements such as waterfalls, whishing trees, or electronic sounds from wrecks to increase the isolation metaphor and for the sake of gameplay.

Figure 2. Colored version of playfield based on simplified synaesthesia



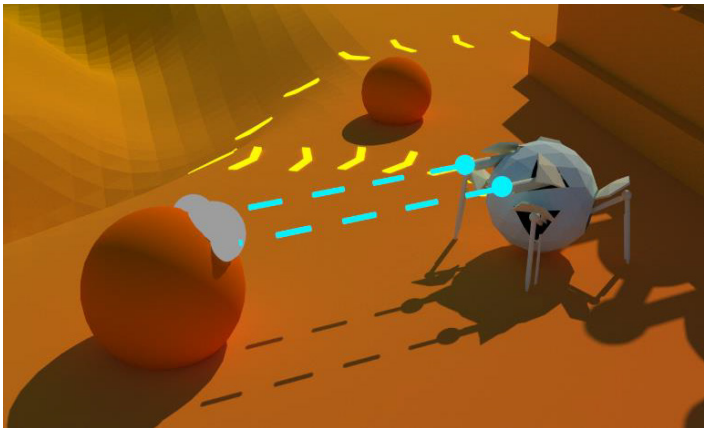
The main aim here is to find the hidden traces represented by arrows on the wasteland that triggers an event based on the selected classical music's parts. As the ball discovers the traces, the selected classical music piece is heard, and the events are seen, and synchronized with the music. The events are mostly located around the wrecks, temples, or ruins as signposts and hints. In this example, the pistons of the factory move up and down synchronized with the discovered music through the traces (*Figure 3*).

Figure 3. Traces and events



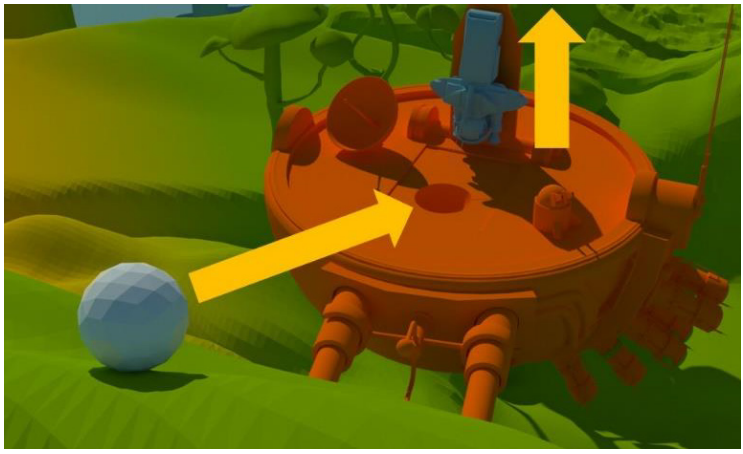
However, as the ball discovers the traces, it also attracts enemies in the form of red balls. As in "Overwatch"s "Wrecking Ball" (2018), a player's ball can be converted to a walking ball with guns, but this mod also decreases the ball's speed. If the player's ball cannot destroy the red balls and red balls hit the player's ball, it bounces around the map as in the pinball mode of *Stainless Games*' "Carmageddon" (1997) (*Figure 4*).

Figure 4. War mode of the ball in the clash scene



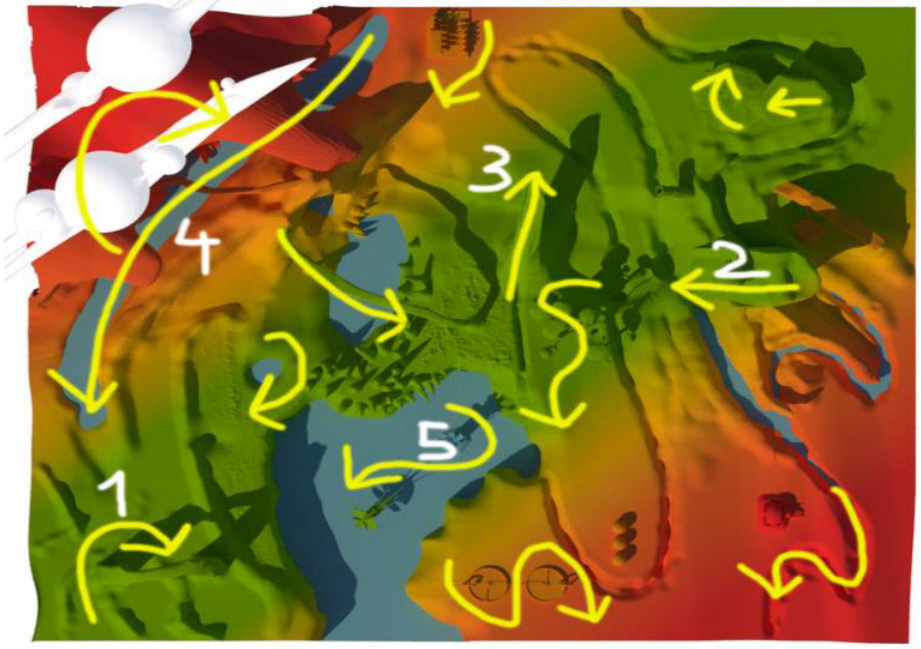
Players can also solve mini puzzles in or around the wrecks or ruins while revealing the traces, such as placing the ball in a spherical area may activate the machine; thus, the event is triggered similarly to *Atomic Elbow*'s "Switch-ball" (2007). In the example below, the ball needs to be placed in the hole to launch the rocket (*Figure 5*).

Figure 5. Mini puzzle elements in the playfield



Last but not least, the traces must be discovered in a specific order regarding the music's timeline. Trace number 2 cannot be discovered unless trace number 1 is revealed. Players must find all the traces of the selected classical music piece (*Figure 6*). If they complete the entire musical piece which lasts around 30 seconds to 1 minute by rolling the ball on the traces that were discovered, players can move on to the next game field with a different map, events, and music.

Figure 6. Trace numbers for selected music in the playfield



Conclusion

To sum up, players try to stay in line, should not get pinballed or derailed, and kill as many enemies as possible. As they play the game, the players can feel the connection between music and visual events and feel the music's chords with colored zones based on synaesthesia logic as the ball enters a specific color zone. Therefore, this paper offered an artistic experimental digital pinball game based on classical music and synaesthesia with some minor puzzle, and combat elements by combining the pinball elements from many successful games throughout the history of pinball gaming such as "Carmageddon," "Switchball," and "Overwatch" in the light of experimental digital pinball regarding music visualization with simplified synaesthesia.

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Conflict of interest: There are no conflicts of interest to declare.
Financial support: No funding was received for this study.

Çıkar çatışması: Çıkar çatışması bulunmamaktadır.
Finansal destek: Finansal destek bulunmamaktadır.