Sonic Lead: A Survey of Sound-First Games

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ABSTRACT

Since their inception, music and sound in digital games have predominantly played supportive roles, with game states and events typically triggering the playback of sounds or changes in the music. This survey shifts the perspective to games where this relationship is reversed: music and sound are at the forefront, driving interactions and shaping the flow of gameplay. These sound-first games are significantly less common than their traditional counterparts and span a narrower range of gameplay styles and genres. Most often, they fall under the category of music and rhythm games that focus on performing timed actions synchronized with music. Beyond this genre, only a small number of platformers, shooters, and RPGs have adopted a sound-led paradigm, while a few music-making and educational applications feature playful approaches, placing them in a space that blurs the boundaries between games and music production tools. In this survey we address the lack of current categorizations for sound-first games by identifying examples and classifying them by genre, form of audio interaction, and style of control. It also identifies areas for future growth, including the development of richer sound-based mechanics, the fuller integration of spatial audio as a core gameplay element, and the exploration of more nuanced listening modes that extend beyond simple sound triggers.

Keywords

Game design, audio, music, sound-driven

INTRODUCTION

The significance of music and sound in games can vary. It may range from holding a leading role to merely providing auditory support for the action on the screen. When sound and music fulfill a supportive role, they are triggered and affected by the game state and game events. For example, firing a gun may trigger a shooting sound; being

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discovered in a stealth game may change the music so that it would reflect the newly alarmed state of the enemy.

In this survey, we focus on games where this relationship is reversed. When music and sound fulfill a leading role, they act as initiators of game events and provide a structure for interactions. For example, the rhythm of a game's soundtrack may require players to perform their actions in sync with the beat, or the sounds of an in-game environment may hold important clues to solving a puzzle. We call this type of games in which gameplay and interactions are driven by sound and music, *sound-first games*.

Sound-first games[1] are rather rare when compared to the number of games released overall. Furthermore, they span a narrow range of gameplay styles and genres, with rhythm-based games centered on performing timed actions to a rhythm comprising the majority. Beyond rhythm, some games employ spatialization gameplay that focuses on listening, as well as sandbox gameplay that facilitates free-form music making. In this paper, we survey and examine games across these three categories.

The first music game is generally considered to be Human Entertainment's 1987 exercise game DANCE AEROBICS for the Nintendo Entertainment System (Webster 2009). However, it was not until a decade later, with the release of titles such as *PaRappa the Rapper* (Nana-On Sha 1996) and *Dance Dance Revolution* (Konami 1998), that music and rhythm games gained popularity. This genre peaked in the mid-2000s, with the release of the first titles in the *Guitar Hero* (2005-2015) and *Rock Band* (2007-2017) series, arguably the most well-known music game franchises.

Music games' prevalence until the late 2000s may be explained by its unique appeal compared to other genres. Early music games were among the first to feature interactions with music by popular artists, often employed easy to learn control schemes, and introduced movement-based controls to a broad audience. In the 2000s, karaoke titles and peripheral-based games introduced an unprecedented level of embodiment and social play that attracted gamers and non-gamers alike. The use of popular songs in these titles may have helped to draw in audiences by allowing them to engage with musical content that they already know instead by experiencing them for the first one. By the late 2000s, a lack of innovation and oversaturation of the market led to the well-documented decline of music games as a mass genre (Stuart 2011). With that, the more diverse field of sound-first games emerged, incorporating gameplay beyond music performance and often combining it with various genres, including platformers, shooters, and role-playing games.

At present, no established categorizations exist for sound-first games. In this review, we aim to address this gap by identifying such games and categorizing these by genre, type of interaction with music and sound, as well as control type and scheme. Ultimately, the goal is to identify and explore the potential for new design approaches in music- and sound-led games. For this purpose, we will first define our understanding of sound-first games and delimit the scope of this research in the next section. In the second section, we identify various game genres that integrate sound-first gameplay. In the third section, we present a typology of sound-first gameplay. In section four, we establish a connection between different listening modes and gameplay. In section five, we describe the control devices employed by sound-first games and introduce a categorization of control types. In section six, we explain our

methodology for identifying and curating our surveyed selection of sound-first games. We then discuss our findings and end with our conclusions.

DELIMITATION

Among games that feature music and sound in a leading role, this prominence can manifest in various ways. Austin (2016, 2) defines music games as "those in which the formal elements of the game (rules, rhetoric, dynamics, etc.) are musical in nature." We expand this definition beyond music, to encompass games where interactions with both musical and non-musical sounds play a structural role in shaping gameplay. To frame this expanded scope, we draw upon Salen and Zimmerman (2004, 154), who categorize games as formal systems structured by rules, experienced through play, and contextualized by culture. Rules, in Salen and Zimmerman's framework, define the constraints and possibilities for player action, while dynamics emerge from the interactions between the players and the various game systems governed by these rules. Our review focuses on the constraints and possibilities of sound-first interactions and the dynamics that stem from them.

This review deliberately excludes metonymic music games, those that symbolically reference musicianship or music-making (Austin 2021, 154) but where removing the auditory component would not affect the core interaction. For instance, in *The Legend of Zelda: Ocarina of Time* (Nintendo EAD 1998), the titular ocarina enables players to perform magical spells by playing a short succession of notes. These spells lead to changes in the environment or allow for traveling through time and space and must be performed at several points in the game to achieve progress. However, playing the right tune to trigger a magical spell does not require rhythmic synchronization or other sound-driven mechanics. Here, music has a minimal influence on the rules and dynamics of the game.

On the other end of the spectrum are games where music and sound consistently shape the gameplay experience. This may include instances, "where everything happens with the permission of the sound engine" (Flanagan 2024), as is the case in the puzzle adventure game *FRACT OSC* (Phosfiend Systems 2014). Here, an underlying music system not only generates a real-time synthesized soundtrack that is influenced by the player's interactions, but it also controls animations and provides all incidental sounds arising from those interactions.

Beyond such all-encompassing implementations of music and sound as leading components, many games focus on individual auditory features to lead the gameplay. For instance, games that focus on rhythm may require players to perform synchronized, timed actions. Games that focus on pitch on the other hand may require players to match a given melody, for example, by singing, as is the case in karaoke games. While most sound-led games focus on music, with an emphasis on rhythm and pitch, we also consider sound-led gameplay beyond music. For example, some games, such as *Blind Drive* (Lo-Fi People 2021) and *Unheard: Voices of Crime* (NEXT Studios 2019), require the player to listen attentively and derive meaning from the game's sonic environment to achieve progress. Another indicator for music and sound being leading components in games is when interactions with them can trigger winning or losing conditions: for instance, finishing a song with a high score by performing the correct moves in a dancing game or hitting the right pitches in a karaoke game, or failing a virtual song performance due to not timing one's actions with a given rhythm.

Furthermore, we focus on games where music- and sound-led gameplay is consistently featured throughout the game, foregoing games that feature only small sections led by sound and music. This includes optional in-game music making or music mini games, i.e., works where such gameplay is featured but not a leading factor and is not required to achieve progress. For example, the competitive online shooter *Fortnite* (Epic Games 2017) features the Fortnite Festival mode (Epic Games 2024), an optional game mode that offers rhythm-based gameplay similar to the one popularized by games such as *Guitar Hero* (Harmonix 2005) and *Rock Band* (Harmonix 2008).[2] *No Man's Sky* (Hello Games 2016), an open world sandbox game that focuses on space exploration, integrates musical gameplay via the ByteBeat device, a tool that allows players to create their own music using various modules. Multiple ByteBeat devices can be synchronized with each other, allowing players to collaboratively make music. These examples demonstrate relevant uses of sound and music in games. However, they are not central to the overall gameplay experience, and as such, they warrant separate investigations.

All in all, in this review we focus on digital games and playful applications that are led by free-form interactions with music and sound.

GAME GENRES

Games led by sound and music have been featured in different game genres. The conventions and rules of a game genre provide a host structure for music and sound-led gameplay that defines and shapes possible interactions. The following list highlights game genres we have identified as hosts of musical gameplay, based on games whose core gameplay integrates and focuses on music and sound.

Music: Music video games explicitly—and often exclusively—focus on interactions with music. This is often evident in their presentation, where music-related names may be featured, such as *Rock Band*, *Audiosurf*, or *Sound Shapes*. Music games comprise the majority of sound- and music-led games and typically feature gameplay where players interact with a musical piece in various ways.

Austin (2016, 12) identifies three subcategories of music games: *Music-matching games* require players to either perform actions to the rhythm of the music or sing to match a given pitch. *Music-mixing games* let players rearrange a selection of pre-packaged sounds. *Music-making games* let players create their own music or feature free-form music making.

Puzzle: This category features games in which players focus on solving cognitive tasks. In *puzzle action* games, there is typically a sense of urgency that requires players to think and react quickly, whereas *puzzle adventure* games tend to be slower-paced and focus on the exploration and traversal of environments that embed various riddles the player must solve to make progress.

Shooter: Usually involving a ranged weapon, shooter gameplay focuses on an aiming and shooting in a 2D (top-down or side-view) or 3D (first- or third-person perspective) environment (Adams 2014).

Platformer: Typically involves traversal of vertically exaggerated environments through jumping and running, while avoiding obstacles and battling enemies (Ibid.).

Role-playing game (RPG): Focuses on the solving of quests and development of a character, often featuring exploration, resource management, and possibly battle mechanics, as well as puzzles (Ibid.).

Action: This category features games that generally require players to react quickly and do not fit into the puzzle action, shooter or platformer categories. This genre focuses on solving problems using the physical means of the game, rather than through thinking.

Toy: Playful applications that lack defined goals or losing conditions, allowing players to freely interact with various interactive elements. Unlike applications that are specifically aimed at music-making and production, such as digital audio workstation software, toys are not necessarily intended to facilitate the productive use of their sound or music output.

Educational: Applications that focus on teaching players a skill or knowledge.

TYPOLOGY OF AUDIO GAMEPLAY

We define audio gameplay as the primary mode through which players interact with the auditory elements of a game. In the following, we outline various audio gameplay modes and offer examples of games that incorporate each type of interaction.

Rhythm

In rhythm games, the focus lies on performing timed actions, synchronized with music. Certain musical elements may indicate when a specific action must be performed, for example, pressing a specific key on the downbeat of a kick drum or singing the right pitch at the indicated moment in a karaoke game.

For example, in *Hi-Fi Rush* (Tango Gameworks 2023), music is the central theme that is consistently featured in the game's presentation, narrative, and game mechanics. Everything is synchronized with the music: The speed and timing of the player character's walking animation, the dynamic environment that is constantly moving to the beat, including gameplay-related elements such as platforms the player must traverse, and decorative objects that visually underpin the given rhythm. The game's combat system requires performing actions in the rhythm of the music to execute combos and special moves, increasing the damage and effectiveness of the player in combat situations. Furthermore, *Hi-Fi Rush* features occasional quick-time segments that require players to push certain buttons or perform joystick movements, resembling the gameplay from other rhythm games, such as *Elite Beat Agents* (iNiS 2006). In most sound- and music-driven games, interactions with rhythm make up the primary mode of audio gameplay. There are several subtypes of rhythm games, which we will present in the following.

Peripheral-based rhythm games: Many rhythm games rely on dedicated control devices to facilitate input (Austin 2021, 141). Such peripherals are typically designed for specific games and often come bundled with them. They may feature a specific set of interaction interfaces, such as buttons, tilt sensors, or touch surfaces, integrated into shapes that may resemble real musical instruments and accessories.

The *Guitar Hero* (2005-2015) and *Rock Band* (2007-2015) series, arguably the most well-known titles in this category (Ibid), feature peripherals that resemble guitars and drums. The guitar controllers feature one set of five individually colored buttons placed on the lower part of the neck, a strumming switch placed in the strumming area, and integrated tilt sensors that allow for triggering in-game actions by swinging the guitar controller upwards, with additional control elements that differ between the two franchises.[3] The *Donkey Konga* series (Namco 2003-2005) features a controller that resembles two bongo drums. Players interact with the game by hitting either drum with their hands, or by clapping, which is recognized and prompted by the game as a separate action.

Non-peripheral rhythm games: There are rhythm games that do not require a proprietary peripheral and can be controlled using common input methods, such as keyboards and gamepads (Austin 2021, 142).

In *PaRappa the Rapper*, players are shown symbols on the screen and must press the corresponding button on their PlayStation gamepad in the rhythm of the music. In the rhythm game *Thumper* (Drool 2016), players control a scarab-like creature that moves on a fixed rail winding through an abstract world, encountering obstacles whose arrival is always announced by the rhythm and musical cues of the ever-present soundtrack. Different musical cues indicate the various types of obstacles that each require the player to react in different ways, for example, holding a button to protect the scarab from incoming barriers, or pressing a button-and-joystick combination to make a sharp turn.

Movement-based rhythm games: Some games rely on full-body movement for interaction, with dancing games being a prominent example. For instance, *Dance Dance Revolution* uses a dedicated dance pad controller placed on the floor and requiring players to step on directional pads to follow a sequence indicated on the screen. In the VR game *Beat Saber* (Beat Games 2019), boxes move toward the player in sync music, and players must slash them as indicated by the associated symbols, performing corresponding movements with their VR motion controllers.

There is a significant overlap between movement-based rhythm games and peripheral-based, as well as non-peripheral rhythm games. Some games, such as *Dance Dance Revolution* and its dance pad controller, require a dedicated input device. Others, like *Beat Saber* are compatible with most VR controllers. Additionally, some games may not use physical controllers at all and may instead perform position and movement recognition with camera accessories such as Microsoft's *Kinect* or Sony's *PlayStation Eye*.

Musical shooters: These include both rail and first-person shooters. While rail shooters move the player along fixed paths, first-person shooters allow for unconstrained movement in the game environment. Both types of shooters may require players to perform tasks in sync with a given rhythm or trigger certain events as part of the overall musical structure.

For example, in *Rez* (United Game Artists 2001), the first music- and sound-led game that features rail shooter mechanics, players fly through an abstract world along a predetermined path, aiming at enemies, with shots automatically being fired in the rhythm of the music. *Pistol Whip* (Cloudhead Games 2019) implements the musical rail shooter concept in VR, featuring a first-person perspective where the player is

rewarded for timing their shots to the rhythm. The first-person shooter roguelike *BPM: Bullets per Minute* (Awe Interactive 2020), on the other hand, offers free movement. Players explore the many rooms of a procedurally generated dungeon, where hostile monsters await them. They must shoot the monsters to survive and collect loot. Unlike in *Pistol Whip*, timing is not optional here. Shooting must happen in the rhythm of the music, since players can only pull the trigger on the beat. Enemy movement and attacks are also synchronized to music. Certain actions must be timed to the beat, such as reloading or performing a second jump mid-air. Some abilities are more effective when performed to the rhythm. For example, when dodging on the beat, players are less likely to get hit by enemies' ranged homing attacks.

Spatialization

Some games require the player to rely solely on auditive cues to derive the course of action. These games often lack visuals beyond providing a user interface for input or game settings. Sound is implemented in such a way that it holds crucial information required to successfully proceed. Spatialization is not intended to signify a distinct category of sound-first games. Rather, this mode of sound-first gameplay may be implemented as a listening-focused mode that can occur across genres.

In *Blind Drive*, the player character is driving on a road while blindfolded. Therefore, players must rely on auditory information to determine whether an obstacle is on the left or right. The user interface allows the player to steer their car and displays the amount of health. To evade the obstacle, the player must steer the car in the opposite direction by tapping the respective side of the interface on the screen (mobile versions) or pressing a key (PC version). Health can be recovered by crashing into oncoming cyclists, whose approach is indicated by the ringing of a bicycle bell. Over time, the game introduces various auditory distractions and variations in the sounds to augment difficulty.

Sandbox

Sandbox audio gameplay does not require the fulfilment of specific music-related goals but instead facilitates free play and musical experimentation, allowing players to set their own goals. As with spatialization, sandbox gameplay does not represent a specific game genre but can be integrated across various types of sound-first games.

For example, *Electroplankton* (indieszero 2005) is a collection of ten different scenes, each featuring different mechanics for making music that make use of the Nintendo DS' touchscreen, stylus, buttons, and microphone. *Otogarden* (Olivera, C. 2021) is a game centered around musical improvisation, in which players control a character and interact with various objects in a garden by moving over them, resulting in various sounds of different timbres and pitches. Players can record their movements over these objects, which results in short looped musical phrases.

We emphasize that sandbox audio gameplay does not fully overlap with what is generally considered sandbox gameplay in games. While *Electroplankton* and *Otogarden* follow the generally goal-free approach of sandbox games, sandbox audio gameplay may still be part of games that feature concrete attainable goals. This is evident in *FRACT OSC*, where musical experimentation integrates into the puzzle gameplay. Here, not only are the player's interactions underlined musically, but puzzle solutions contribute to the overall soundtrack heard in-game, down to individual

notes and different timbral characteristics. Since one puzzle can allow for multiple solutions, this is also reflected in the multitude of possible musical outcomes.

GAMEPLAY AND MODES OF LISTENING

The typology of audio gameplay above emphasizes different aspects of sound and music that require players to listen in different ways. This in turn impacts overall gameplay and possible interactions, since accommodating listening in a specific mode requires a game to be designed such that it facilitates player engagement in the required listening mode.

Chion (2019, 22), in reference to the work of Pierre Schaeffer (1910-1995), lists three modes of listening: *causal*, *codal*, and *reduced*.

Causal listening: Refers to the identification of a sound's source. Here, the listener is focused on who or what is producing the sound, trying to understand its origin. Chion (Ibid, 22-23) argues that the absence of visual information reinforces causal listening. Therefore, games that feature spatialization gameplay and lack visuals most likely facilitate this mode.

For example, in *Blind Drive*, the player must differentiate between the sounds of car horns and motor sounds that indicate the approach of oncoming cars, i.e., danger that must be evaded, and bicycle bells that indicate the approach of cyclists, where crashing into them holds a benefit.

Codal listening: Involves deriving meaning from a sound based on a set of learned rules and conventions, with a common example being spoken language (Ibid, 25). Similarly to spoken language, our acquired musical language also follows a set of rules that help us to perform musical actions.

In *Guitar Hero* and *Rock Band*, the player's accuracy in hitting a note is indicated by an accompanying sound. Missing a note triggers a sound that resembles a guitar player's fingers slipping on the strings. In *Dance Dance Revolution*, successfully completing a sequence of steps triggers chimes and cheering sounds that indicate good player performance. However, sounds that prompt codal listening are not limited to music and rhythm games and are frequently used to inform the player about various aspects of the game state. For example, in *Ocarina of Time*, low player health is indicated by a repetitive beeping sound. Furthermore, item collecting sounds are common in a large variety of games, signifying success in gameplay and potentially motivating players to collect more. For example, this is the case when collecting rings in *Sonic the Hedgehog* (Sonic Team 1991), or coins in *Super Mario Bros.* (Nintendo R&D4 1985).

As more games are being released and the growing global player base continues to grow, game literacy is increasing among players. As game literacy develops, so does players' familiarity with and understanding of established conventions within games. In the context of sound and music, this familiarity with conventions means that players are increasingly likely to engage in codal listening, as they become more adept at recognizing and interpreting a wide range of audio cues embedded within gameplay. However, we argue that facilitating codal listening does not necessarily follow a sound-first approach, since these codes are often meant to convey information about aspects of the gameplay that are not sound-related or triggered by

a sound event – they are part of the multimodal feedback that games typically employ, encompassing visual, haptic, and sonic signals.

Reduced listening: Here, the focus lies on the sound itself, independent of its source or meaning (Ibid, 25-26). This is also the case in rhythm games, where rhythm, as part of a piece of music, directs the gameplay. When players focus on identifying a regular beat in rhythm-based gameplay, anticipating the structure of the music and any upcoming timing cues, they engage in reduced listening. However, the shift toward codal listening described above may also happen with a player's increasing familiarity of a song in a music game: In *Guitar Hero*, players might learn to associate certain required actions with specific song sections. Nevertheless, when this is not the case, reduced listening may create room for attentive exploration of sound. In *FRACT OSC*, every player interaction with puzzles leads to an audible sonic outcome. Flicking a switch or turning a knob is reflected in changing rhythmic patterns, pitch, or timbre of a sound. While listening to these changing outcomes rarely provides clues about the state of the puzzle solution, the constant feedback invites playful experimentation that facilitates an attention to sound.

CONTROLS

Control devices and schemes vary across different game genres and platforms. Since controls provide the interface between player and game, they can have a significant impact on how the game is experienced. Collins (2013, 63) identifies game controllers' ability to encourage role-play and engagement with sound. Particularly games that support interaction through gestures and body motion enable players to enact and exaggerate the emotion behind an in-game action through expressive movements, which in turn heightens their own emotional engagement (Ibid). In the context of music games, this may range from pressing a button on a gamepad to the rhythm of a game's soundtrack, to using full-body movement, swaying with the beat.

In the following, we focus on the control devices and types that are employed when interacting in the context of sound-first gameplay, rather than the navigation of menus. Based on the control schemes employed in our selection of sound-first games, we identified the following control devices.

Gamepad: A hand-held controller device. Modern gamepads usually offer several digital buttons, allowing for discrete input, as well as analog sticks and shoulder triggers for continuous input. Some gamepads may integrate additional means of control, such as touch pads and motion sensors.

Motion controller: Combines the functionality of a gamepad with a motion sensor, often in a wand-like shape. While the features of both gamepads and motion controllers may largely overlap, especially in the case of motion-enabled gamepads, motion controllers are primarily intended to be moved around. These controllers often come in pairs, one for each hand, such as the Nintendo Wii Remote with Nunchuk attachment and most VR controllers, including the Meta Touch Plus.

Keyboard: Keyboards feature many buttons that games often allow to freely map to any game action. However, they lack analog controls which would allow for fine movements, only allowing for discrete input.

Mouse: Hand-held controller device that is typically moved on a flat surface, such as a desktop, often controlling a pointer on the screen. Most mice have two buttons as well as a scroll wheel that can be turned up or down and often functions as a third button when pressed. In many first-person and third-person 3D games, the mouse movement controls the player's gaze or camera movement.

Touchscreen/touchpad: Touch-sensitive surface that may include a screen, with a stylus or finger touch as an input method.

Instrument controller: Proprietary hardware controllers that usually mimic real-world instruments in shape and appearance, including electric guitars and drums such as the instrument controllers bundled with the *Rock Band* and *Guitar Hero* games.

Dance pad: Physical control surface that is usually placed on the floor and used by tapping on it with one's feet, often resulting in dance-like movement when being used.

Camera: Performing motion recognition via visual input using an accessory, such as Sony's *PlayStation Camera*, or Microsoft's *Kinect*.

We differentiate between three control types that employ the above devices.

Manual: Physical input performed by hand. Includes joysticks, buttons, pointers controlled by a mouse or stylus, and touch input via touchscreens or touchpads.

Motion: Controls that employ body movement, either by using controllers with motion sensors or other techniques that recognize user body movement, e.g., via camera recognition.

Voice: Singing or speaking into a microphone.

SURVEY OF SOUND- AND MUSIC LED GAMES

In this chapter, we compile and classify a selection of music- and sound-led games based on the categories described in the previous chapters. Our selection spans games released from 1987, marked by the debut of *Dance Aerobics*, the first music video game, to 2024, encompassing all common gaming platforms.

Our methodology involved identifying candidate games using Steam and Metacritic. Steam, the largest digital distribution platform for PC games (Quarneti 2023), provided a basis for our search through its "music" and "rhythm" subcategories within the "arcade & rhythm" category. Additionally, we reviewed a list of user-applied tags frequently applied to games on Steam. From this list, we identified the following relevant tags, in descending ranking of popularity (i.e., number of users who applied the tag): "music", "rhythm", "music-based procedural generation", "electronic music", "instrumental music", "rock music", and "8-bit music". These tags were applied to search for games fitting our criteria, as Steam's search functionality allows filtering only by the most popular tags.

The tags "rhythm" and "music-based procedural generation" yielded the most relevant results. Other tags returned a broader range of entries, while search results using all other tags also included entries that are either not games, including non-game content such as soundtracks and movies, or games that did not fit our criteria.

To refine our search results further, we combined “rhythm” and “music” with tags representing various genres, including “shooter”, “platformer”, and “on-rails shooter”. While Steam only features PC games, several of the chosen releases are also available on other platforms.

Metacritic aggregates reviews of various media, including digital games. Titles can be searched by year, platform, and genre. Metacritic lists “rhythm” as the only genre relevant to our inquiry. Search results can be sorted according to their Metascore, the weighted average of game critics’ reviews for a game (Metacritic 2024), and average user score. The search does not allow for genre combinations: Selecting multiple genres, such as “rhythm” and “puzzle”, lists all games of either category. Sorting by Metascore yielded 200 search results, while sorting by user score yielded 129 results. The difference in search results per sorting method can be attributed to not all games having both a Metascore and a user score, therefore only appearing in one of the two lists.

Based on these searches, we curated an initial selection of titles and regarded their leading gameplay features and controls. From this information, we identified the genres that act as hosts for sound-first gameplay, derived the categories of audio gameplay, and listed the featured control devices and schemes.

To ensure coverage of all relevant gameplay types, platforms, and control schemes, we have identified additional titles that were featured on either Steam or Metacritic but did not fit our initial search parameters. For example, UNHEARD fits our selection criteria for a sound-led game, despite not featuring any music- or sound-related user tags on Steam and being listed under the “adventure” genre on Metacritic. Furthermore, many playful music making applications are not featured on Metacritic, as they are not generally classified as games, nor are they widely distributed on Steam. To address this gap, we employed our expertise in the domain of music making applications to identify titles that exemplify playfulness in interaction design. As a result, we included *Bloom* (Eno, B., Chilvers, P. 2008) and *Patatap* (Lullatone 2014), both of which illustrate innovative approaches to sound-first interaction.

Some of the selected games are part of a series. We include the earliest fully featured title of a series as a representative example in terms of audio gameplay. For example, the *Guitar Hero* series features a total of seven games, excluding spin-offs. The first title in the series, *Guitar Hero* (Harmonix 2005) featured only a guitar controller, *Guitar Hero: World Tour* (Neversoft 2008) introduced drums and singing, and *Guitar Hero 5* (Neversoft 2009), added a new control interface to the guitar controller in the form of a touch pad. On the other hand, *Audiosurf* (Fitterer, D. 2008) and its sequel, *Audiosurf 2* (Fitterer, D. 2015) do not differ significantly in audio-related gameplay, prompting us to feature only the former.

Beyond similarities in gameplay within a series, similar or nearly identical gameplay may also occur across otherwise unrelated titles. We aimed to avoid overlap by omitting titles whose gameplay is already represented by another title in the table. To further reduce the number of initially selected titles, we focused on titles we deem to be landmark releases, either due to their popularity, critical success, or innovative design.

Name	Year	Platform[4]	Genre	Audio gameplay	Control type	Control device
Dance Aerobics	1987	NES	Music	Rhythm	Motion	Dance pad
PaRappa the Rapper	1996	PS1	Music	Rhythm	Manual	Gamepad
Dance Dance Revolution	1998	Arcade, PS2	Music	Rhythm	Motion	Dance pad
Space Channel 5	1999	DC, PS2	Music	Rhythm	Manual	Gamepad
Vib-Ribbon	1999	PS1	Music	Rhythm	Manual	Gamepad
REZ	2001	DC, PS2	Shooter (rail)	Rhythm	Manual	Gamepad
Taiko no Tatsujin	2001	Arcade, PS2	Music	Rhythm	Motion	Instrument controller
Donkey Konga	2003	NGC	Music	Rhythm	Motion	Instrument controller
Lumines	2004	PSP, PS2, PS4, XOne, Switch, PC	Puzzle action	Rhythm	Manual	Gamepad, keyboard
SingStar	2004	PS2	Music	Rhythm	Voice	Microphone
Electroplankton	2005	NDS	Toy	Sandbox	Manual, voice	Stylus, gamepad, microphone
Elite Beat Agents	2006	NDS	Music	Rhythm	Manual	Stylus
Osu!	2007	PC	Music	Rhythm	Manual	Mouse, graphic tablet
Audiosurf	2008	PC	Puzzle action	Rhythm	Manual	Gamepad, keyboard, mouse
Bloom	2008	iOS	Toy	Sandbox	Manual	Touchscreen
Wii Music	2008	Wii	Music	Sandbox	Manual, motion	Motion controller
DJ Hero	2009	PS2, PS3, Wii, X360	Music	Rhythm	Manual, motion	Instrument controller
Guitar Hero 5	2009	PS2, PS3, X360, Wii	Music	Rhythm	Manual, motion, voice	Instrument controller
Bit.Trip Runner	2010	Wii, 3DS, Switch, PC	Platformer	Rhythm	Manual	Gamepad, keyboard
Chime	2010	PC, X360, PS3	Puzzle action	Rhythm	Manual	Gamepad, keyboard
Rock Band 3	2010	PS3, X360, Wii	Music	Rhythm	Manual, motion, voice	Instrument controller, microphone
Sound Shapes	2012	PSVita, PS3, PS4	Platformer	Rhythm	Manual	Gamepad
Dance Central Spotlight	2014	XOne	Music	Rhythm	Motion	Kinect camera
Fract OSC	2014	PC	Puzzle adventure	Sandbox	Manual	Gamepad, keyboard, mouse
Patatap	2014	Web, iOS, Android	Toy	Sandbox	Manual	Mouse, touchscreen
Crypt of the Necrodancer	2015	PC, PS4, Switch	RPG	Rhythm	Manual	Gamepad, keyboard, mouse
Metronomicon: Slay the Dance Floor	2016	PC, PS4, XOne	RPG	Rhythm	Manual	Gamepad, keyboard, mouse
Thumper	2016	PC, PS4, PS5, PCVR, iOS, Android, Switch, XOne	Music	Rhythm	Manual	Gamepad, keyboard
Beat Saber	2018	PCVR, PSVR	Action	Rhythm	Motion	Motion controller
Just Shapes & Beats	2018	PC, Switch	Puzzle action	Rhythm	Manual	Gamepad, keyboard

Pistol Whip	2019	PCVR, PSVR	Shooter (FPS)	Rhythm	Manual, motion	Motion controller
Sayonara Wild Hearts	2019	PC, Switch	Music	Rhythm	Manual	Gamepad, keyboard
Spin Rhythm XD	2019	PC, Switch, PS4, PS5	Music	Rhythm	Manual	Gamepad, keyboard, mouse
Unheard: Voices of Crime	2019	PC, XOne, PS4, iOS	Puzzle adventure	Spatialization	Manual	Mouse, touchscreen
BPM: Bullets Per Minute	2020	PC, PS4, XOne	Shooter (FPS)	Rhythm	Manual	Gamepad, keyboard, mouse
Fuser	2020	PC, Switch, PS4, XOne	Music	Rhythm	Manual	Gamepad, keyboard, mouse
Midinous	2020	PC	Toy	Sandbox	Manual	Mouse, keyboard
Blind Drive	2021	PC, iOS, Android	Action	Spatialization	Manual	Gamepad, keyboard, touchscreen
Otogarden	2021	PC	Toy	Sandbox	Manual	Mouse, keyboard
Beat Hazard 3	2022	PC, PS4, XOne	Shooter	Rhythm	Manual	Gamepad, keyboard, mouse
Rocksmith+	2022	PC, PS4, PS5, iOS, Android	Educational	Rhythm	Instru-ment play	Guitar, bass, piano (real instruments)
Hi-Fi RUSH	2023	PC, XS	Action, platformer	Rhythm	Manual	Gamepad, keyboard, mouse
Oddada	2024	PC	Puzzle	Sandbox	Manual	Mouse, keyboard

Table 1: Categorization of games with sound and music as the leading elements.

We selected 43 titles, 19 of which are music games, comprising the vast majority of sound-first games. Beyond music games, the remaining titles span a variety of genres, including puzzle action (6 titles), shooters (4 titles, split between FPS and rail types), platformers (3 titles), RPGs (2 titles), and puzzle adventure games (2 titles). Additionally, 6 titles are classified as toys. In terms of audio gameplay, rhythm-based mechanics dominate the dataset, accounting for 36 of the 43 titles. Almost all listed music games feature rhythm gameplay, except for *Wii Music* (Nintendo EAD 2008), whose sandbox classification can be attributed to its lack of losing conditions and general emphasis on musical improvisation. Sandbox gameplay is present in 8 titles, with all toys residing in this mode. Spatialization gameplay is the least represented, appearing in only 2 titles, *Blind Drive* and *Unheard*.

Control schemes span a diverse range of input methods and devices, with buttons being the most common input method (22 titles). Movement-based controls are utilized in 10 titles, particularly in music and rhythm games. Pointer-based controls, touch input, and voice each appear in a smaller subset of games, while 7 titles integrate unique input devices, including instrument controllers and dance pads. *Rocksmith+* (Ubisoft San Francisco 2022) is a notable exception, being the only title on the list that utilizes input from real musical instruments.

We note that some titles employ multiple control methods simultaneously in their gameplay, while other titles offer these as alternatives to choose between. For example, the guitar controller in *Guitar Hero 5* integrates buttons, movement, and touch controls that are all utilized during gameplay, while *Audiosurf* features distinct control schemes for gamepad, keyboard, and mouse, respectively. In some games, control types may vary according to platform. *Unheard* uses mouse controls in the PC version, while utilizing touch controls in the iOS version.

Some sound-first games, including the featured toy-sandbox titles, may reside on the edge between games and non-games, such as educational software or apps for music creation. We note that our chosen terms *toy* and *sandbox* imply playfulness. It is this playfulness from which productive outcomes, such as musical compositions, may emerge. Therefore, it is reasonable that some audio applications gravitate toward the realm of games, and that certain games allow for their musical output to be used productively. Even if a game like *Electroplankton* does not allow to save its musical output, it is possible to record it using the Nintendo DS' headphone jack, and sample it in external audio production software. Whether an application is perceived as a game or productive software may depend on the way it is marketed and presented. For example, *Midinous* (Nornec 2021), a MIDI sequencer that features a node-based system to generate notes, is exclusively distributed via the Steam platform, which focuses on digital game distribution. *Midinous*, according to its developer, "controls like a game but generates ideas like a jam partner", (Rin 2024) however, its internal capabilities to generate sounds are limited, requiring the user to connect it to other software for sound generation. When *Rocksmith* (Ubisoft San Francisco 2011) was originally released, it was marketed as an "authentic guitar game" (Ubisoft 2011), positioning it as a competitor to the *Guitar Hero* and *Rock Band* franchises that set itself apart by allowing the game to be played using a real guitar, teaching how to play a real instrument. Its sequel, *Rocksmith 2014* (Ubisoft San Francisco 2013), streamlined its visual design and gameplay for a more serious and educational tone. In 2022, *Rocksmith+* was released as a subscription-based music education service. The *Rocksmith+* website presents the title as a "music learning service" (Ubisoft 2024), further removing it from its original presentation as a game toward being educational software.

DISCUSSION

In Table 1, we show that the range of sound-first games remains dominated by music games with rhythm-based interactions. This dominance may stem partly from the universal human affinity for rhythmic patterns. Musicking activities like dancing and clapping, common across many cultures (Trainor & Hannon 2013, 432), do not demand specialized skills or equipment. In addition, we constantly experience rhythm in our bodies. Heartbeats, breathing, and physical activities involving repetitive actions such as walking support an intuitive sense of timing (Ibid.). Further, research in neuroscience suggests connections between motor activity and rhythm perception (Grahn & Brett 2007), which may benefit this intuitive understanding of rhythm. By contrast, pitch-based gameplay remains rare and is limited to karaoke-type games. The preference of rhythm vs. pitch mechanics may be due to the lower complexity of rhythmic information. While melodies present temporal patterns combined with variations in pitch, rhythm focuses solely on the former. This lower information complexity may be easier to grasp for the average player. Rhythmic-centric gameplay also translates efficiently into multimodal feedback, such as visual cues that support players in anticipating the moments when they must perform certain actions, or

tactile feedback in the form of controller vibrations that occur in the rhythm of any given music, enabling players to anticipate actions and enhancing accessibility for those with limited hearing or with suboptimal sound equipment. Considering nuanced features of sound such as timbre, the dynamic, often fast-paced nature of games and their lush soundscapes may interfere with its perception. It is possible that rhythm generally permeates such scenarios due to easily discernible temporal patterns which are less likely to be masked by overlapping sounds or complex auditory environments. As a result, we observe an absence of pitch- and timbre-based gameplay in existing sound-first games.

A smaller but distinct category within this landscape is the group of sound-first titles that focus on sandbox audio gameplay. These titles, often closer to the toy genre than to traditional games, indicate that games facilitating musical improvisation and experimentation typically do not feature goals or losing conditions. *FRACT OSC* is a notable exception, integrating musical experimentation into a more goal-oriented framework, employing sound-based activity and interaction as a feedback mechanism shaping the environment.

Sound-first mechanics that rely on spatialization remain comparatively rare but hold promise for more attentive listening models. The fast-paced audio-only driving in *Blind Drive* and the slow-paced fly-on-the-wall investigating in *Unheard* present vastly different scenarios. However, both feature environments that put sound at the center of the player's attention, enabling and requiring causal and codal listening as dedicated acts. Despite this breadth, no existing examples fully embrace reduced listening beyond the anticipation of song structures in music games. While reduced listening—attending directly to the character of a sound, independent of its source—can emerge naturally in any game, game designers rarely transform it into a meaningful action that influences play. Insights into potential design approaches can be found in games outside the sound-first spectrum that feature sound-based interactions, especially puzzle titles such as *Riven* (Cyan 1997) and *The Witness* (Thekla, Inc. 2016). Furthermore, research such as Schafer's (1993) study of global acoustic ecologies, Feld's (1990) ethnomusicological inquiry, and experimental sound practices, such as Olivero's (2005) work on deep listening may provide further inspiration.

Control schemes across sound-first games vary widely, especially in music games that once depended on specialized controllers that use embodied engagement. Although the popularity of dedicated dance pads and instrument controllers diminished after their heyday in the late 2000s, motion-based input remains central to contemporary music-driven interactions found in VR-enabled or motion-controlled titles like *Beat Saber* and *Pistol Whip*. As sensors have become ubiquitous, proprietary hardware has receded, but the principle of engaging the body remains central to sound-led game design.

CONCLUSION

Early music games provided novel ways of experiencing music and drove innovation by offering embodied interactions that foreshadowed the trend of motion-controlled games. Although the novelty and popularity of music games waned, sound-first games have become increasingly diverse, integrating sound-based interactions into a growing variety of genres, albeit typically with a strong focus on rhythm gameplay. In comparison, pitch and timbre are underused, likely because the dense soundscapes

and often fast-paced nature of games complicate the interaction with more nuanced auditory features. We also note a lack of awareness for a sound-first principle, demonstrated by the absence of relevant tags and categorizations that would allow for easily finding relevant titles. However, the past success of music games has highlighted a widespread interest in sound-first games. Nevertheless, it is likely that the diversification of sound-first games will continue and incorporate more variation in audio gameplay. However, despite ongoing diversification, recent sound-first games still predominantly focus on music and rhythm as the driving auditory elements, which limits the range of possible interactions and player engagement with sound. We therefore identify potential for games that focus on interactions with non-musical sound and facilitate listening practices beyond recognizing enemies by their footsteps or anticipating musical structures. Such practices move beyond the frequent causal and codal listening modes and incorporate reduced listening practice that puts sound at the center of the player's attention. While the often visual-led nature of games may compete with such intentions, introducing novel and engaging interactions with sound and music interactions may lead to a more balanced gaming landscape

ENDNOTES

[1] For the purposes of this paper, we will use the terms *music- and sound-led games*, *sound-led games*, and *sound-first games* interchangeably to describe these experiences.

[2] The first *Guitar Hero* game and the *Rock Band* series were developed by Harmonix, which was acquired by Epic Games in 2021 and is now responsible for the development of musical experiences in *Fortnite*.

[3] The *Rock Band* variants have an additional set of buttons in the lower part of the neck, the *Guitar Hero* variants (since *Guitar Hero 5*) have an additional touchpad for supporting finger slide motion.

[4] Breakdown of platform designations and abbreviations, clustered by manufacturer and ordered chronologically by release year, where applicable.

Arcade: Collective term for various arcade machines.
DC: Sega Dreamcast.
PC: Desktop computer, running either Windows, MacOS, or other operating systems.
PCVR: PC virtual reality systems, such as Oculus Rift, Meta Quest, or HTC Vive.
NES: Nintendo Entertainment System, NGC: Nintendo Gamecube, NDS: Nintendo DS, Wii: Nintendo Wii, 3DS: Nintendo 3DS, Switch: Nintendo Switch.
PSX: Sony PlayStation, PS2: PlayStation 2, PSP: PlayStation Portable, PS3: PlayStation 3, PSVita: PlayStation Vita, PS4: PlayStation 4, PS5: PlayStation 5, PSVR: PlayStation VR.
Web: Browser-based.
Xbox: Microsoft Xbox, X360: Xbox 360, XOne: Xbox One, XS: Xbox Series S or X.

REFERENCES

Adams, E. 2014. *Fundamentals of Game Design* (Third edition). New Riders.

Ahlgrimm, S., Hoffmann, M., & Clausdorff, B. 2024. *Oddada*. PC. Ahlgrimm, S., Hoffmann, M., & Clausdorff, B.

Austin, M. 2016. "Introduction – Taking Note of Music Games." In *Music Video Games: Performance, Politics, and Play*, edited by M. Austin, 1–22. Bloomsbury Academic.

Austin, M. L. 2021. "Music Games." In *The Cambridge Companion to Video Game Music*, edited by M. Fritsch and T. Summers, 140–158. Cambridge University Press. https://doi.org/10.1017/9781108670289.011.

Awe Interactive. 2020. *BPM: Bullets Per Minute.* PC, PS4, Xbox One, Switch. Awe Interactive.

Beat Games. 2019. *Beat Saber.* PC, PS4, PS5, Meta Quest. Oculus Studios.

Berzerk Studio. 2018. *Just Shapes & Beats.* PC, Switch, PS4, Xbox One, Xbox Series. Berzerk Studio.

Brace Yourself Games. 2015. *Crypt of the Necrodancer*. PC, PS4, Switch. Brace Yourself Games.

Chilvers, P., & Eno, B. 2008. *Bloom*. iOS. Opal.

Chion, M. 2019. *Audio-Vision*. Translated by C. Gorbman. Second edition. Columbia University Press.

Cloudhead Games. 2019. *Pistol Whip*. PC, Oculus Rift, PSVR. Cloudhead Games.

Collins, K. 2013. *Playing with Sound: A Theory of Interacting with Sound and Music in Video Games*. The MIT Press.

Cold Beam Games. 2022. *Beat Hazard 3*. PC, PS4, Xbox One. Cold Beam Games.

Cyan. 1997. *Riven: The Sequel to Myst*. PC, iOS, Android. Red Orb Entertainment.

Drool. 2016. *Thumper.* PC, PS4, PS5, PCVR, iOS, Android, Switch, Xbox One. Drool.

Epic Games. 2017. *Fortnite*. PC, PS4, PS5, Xbox One, Xbox Series, iOS, Android, Switch. Epic Games.

Epic Games. 2024. "What Is Fortnite Festival?" *Fortnite Festival Support*. Retrieved November 6, 2024, from https://www.epicgames.com/help/en-US/c-Fortnite_Festival/c-Fortnite_FestivalGameplay/what-is-fortnite-festival-a000086559.

Feld, Steven. *Sound and Sentiment: Birds, Weeping, Poetics, and Song in Kaluli Expression, 3rd Edition with a New Introduction by the Author*. Duke University Press, 2012.

Fitterer, D. 2008. *Audiosurf*. PC. Fitterer, D.

Flanagan, R. E. 2024. “FRACT OSC 10 Year Retrospective Playthrough and Director’s Commentary” [Video recording]. Retrieved November 25, 2024, from https://www.youtube.com/watch?v=NFeo0qAYQFo.

FreeStyleGames. 2009. *DJ Hero*. PS2, PS3, Wii, Xbox 360. Activision.

Gaijin Games. 2010. *Bit.Trip Runner*. Wii, 3DS, PC, Switch. Gaijin Games.

Grahn, J. A., and M. Brett. “Rhythm and Beat Perception in Motor Areas of the Brain.” *Journal of Cognitive Neuroscience* 19, no. 5 (May 1, 2007): 893–906. https://doi.org/10.1162/jocn.2007.19.5.893.

Harmonix. 2005. *Guitar Hero*. PS2. RedOctane.

Harmonix. 2006. *Guitar Hero 2*. PS2, Xbox 360. RedOctane.

Harmonix. 2007. *Rock Band*. PS3, Xbox 360, Wii. MTV Games.

Harmonix. 2008. *Rock Band 2*. PS3, Xbox 360, Wii. MTV Games.

Harmonix. 2010. *Rock Band 3*. PS3, Xbox 360, Wii. MTV Games.

Harmonix. 2020. *Fuser*. PC, Switch, PS4, Xbox One. NCSoft.

Herbert, D. 2007. *Osu!*. PC. Herbert, D.

Hello Games. 2016. *No Man’s Sky*. PC, PS4, Xbox One. Hello Games.

Human Entertainment. 1987. *Dance Aerobics*. NES. Bandai.

indieszero. 2005. *Electroplankton*. Nintendo DS. Nintendo.

iNiS. 2006. *Elite Beat Agents*. Nintendo DS. Nintendo.

Jae, Rin. n.d. *Midinous*. MIDI Association. Retrieved October 31, 2024, from https://midi.org/innovation-award/midinous.

Konami. 1998. *Dance Dance Revolution*. Arcade, PS2. Konami.

Lo-Fi People. 2021. *Blind Drive*. PC, iOS, Android. Lo-Fi People.

London Studio. 2004. *SingStar*. PS2. Sony.

Lullatone. 2014. *Patatap*. Web, iOS, Android. Lullatone.

Metacritic. n.d. “About Us.” *Metacritic*. Retrieved December 2, 2024, from https://www.metacritic.com/about-us.

Namco. 2001. *Taiko no Tatsujin*. Arcade, PS2. Bandai Namco Entertainment.

Namco. 2003. *Donkey Konga.* GameCube. Nintendo.

NanaOn-Sha. 1996. *PaRappa the Rapper*. PS1. Sony.

NanaOn-Sha. 1999. *Vib-Ribbon*. PS1. Sony.

Neversoft. 2007. *Guitar Hero 3: Legends of Rock*. PS3, Xbox 360, Wii. Activision.

Neversoft. 2008. *Guitar Hero World Tour*. PS3, Xbox 360, Wii. Activision.

Neversoft. 2009. *Guitar Hero 5*. PS3, Xbox 360, Wii. Activision.

NEXT Studios. 2019. *Unheard: Voices of Crime.* PC, Xbox One, PS4, iOS. NEXT Studios.

Nintendo EAD. 1998. *The Legend of Zelda: Ocarina of Time*. Nintendo 64. Nintendo.

Nintendo EAD. 2008. *Wii Music.* Wii. Nintendo.

Nintendo R&D4. 1985. *Super Mario Bros.* NES. Nintendo.

Nornec. 2020. *Midinous*. PC. Nornec.

Oliva, C. 2021. *Otogarden*. PC. Oliva, C.

Oliveros, Pauline. *Deep Listening: A Composers's Sound Practice*. New York: iUniverse, 2005.

Phosfiend Systems. 2014. *FRACT OSC*. PC. Phosfiend Systems.

Puuba. 2016. *Metronomicon: Slay the Dance Floor*. PC, PS4, Xbox One. Akupara Games.

Q Entertainment. 2004. *Lumines*. PSP, PS2, PS4, Xbox One, Switch, PC. Bandai.

Quarneti, F. 2023. "This Online Gaming Platform Sets a New Record With 10 Million People Playing at the Same Time." *Benzinga*, January 17, 2023. https://www.benzinga.com/general/entertainment/23/01/30449678/this-online-gaming-platform-sets-a-new-record-with-10-million-people-playing-at-the-same-ti.

Queasy Games. 2012. *Sound Shapes*. PS3, PS4, PS Vita. Sony.

Salen, K., & Zimmerman, E. 2003. *Rules of Play: Game Design Fundamentals*. MIT Press.

Schafer, R. M. *The Soundscape: Our Sonic Environment and the Tuning of the World*. Rochester, Vermont: Destiny Books, 1994.

Simogo. 2019. *Sayonara Wild Hearts*. PC, Switch. Annapurna Interactive.

Super Spin Digital. 2019. *Spin Rhythm XD.* PC, Switch, PS4, PS5. Super Spin Digital.

Sonic Team. 1991. *Sonic the Hedgehog*. Sega.

Stuart, Keith. "Guitar Hero Axed: Five Reasons Why Music Games Are Dying." *The Guardian*, February 10, 2011, sec. Technology.

https://www.theguardian.com/technology/gamesblog/2011/feb/10/guitar-hero-axed.

Tango Gameworks. 2023. *Hi-Fi RUSH*. Xbox Series. Bethesda Softworks.

Thekla, Inc.. 2016. *The Witness*. PC, PS4, Xbox One, iOS. Thekla, Inc..

Trainor, L. J., and E. E. Hannon. "Musical Development." In *The Psychology of Music*, 423-497. Elsevier, 2013. https://doi.org/10.1016/B978-0-12-381460-9.00011-0.

Ubisoft San Francisco. 2011. *Rocksmith.* PC, PS3, Xbox 360. Ubisoft.

Ubisoft San Francisco. 2013. *Rocksmith 2014.* PC, PS3, PS4, Xbox 360, Xbox One. Ubisoft.

Ubisoft San Francisco. 2022. *Rocksmith+.* PC, PS4, PS5, iOS, Android. Ubisoft.

United Game Artists. 1999. *Space Channel 5*. Dreamcast, PS2. Sega.

United Game Artists. 2001. *REZ*. Dreamcast, PS2. Sega.

Webster, A. 2009. "Roots of Rhythm: A Brief History of the Music Game Genre." *Ars Technica*. Retrieved October 7, 2024, from https://arstechnica.com/gaming/2009/03/ne-music-game-feature/.

Zoe Mode. 2010. *Chime.* PC, Xbox 360, PS3. OneBigGame.