19. A Framework for Researching Sound Within Educational Games

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Abstract: Using an ecological, player-interactivity approach to game sound, this paper describes a research framework for sound in educational games. This analysis describes the prior attempts to create research frameworks for sound for educational multimedia and presents perspectives from game studies, film theory, and sound perception to ground a phenomenological discussion of sound in educational games. In discussing this framework, the shared essential meanings from a phenomenological study of sound in educational games are applied within a phenomenological sound listening framework. I use this framework to reflect how participants' experiences were affected by the ways they used game interfaces, interacted with game characters, experienced game narrative, and described the game's environment. This framework further illustrates the possibility space for potential experiences of sound in gameplay as determined by the choices players make, the game's state of play, and the degree of synchresis present between what players hear and what they see as they play.

Literature Review

How do educational researchers study sound within educational games? The scope of the available research in this area is extraordinarily limited, and few direct studies of sound within educational games offer a coherent process to examine this aspect of the game experience. One approach used by Petri and Gresse von Wangenheim (2017) examined sound as a component of the user experience (UX) of games. Researchers employed a survey measurement system to evaluate the overall UX of the game experience and concluded that inclusion of sound effects and sound design elements were important components in gameplay, and that "sound UX can therefore be considered an important determinant of user learning" (p. 142). In addition, they concluded that decisions that lead to appropriate *media matching* are important to game design. The notion of media matching is similar to the notion of appropriate pairing of audiovisual interactions, known in film theory literature as *synchresis* (Chion, 1994). However, little direction is given beyond this analysis to direct future researchers on how to best design for sound overall in an educational game. In their discussion of digital game design, Kostolny and Bohacik (2017) also discuss the potential application of sound design, together with narrative and visual components important to enhance a game's "Catchiness" (p. 2). Authors then illustrate the use of sound within an analysis of varying states of gameplay within an educational game. It is notable that sound is described as an integral component of game design; however, no direction is provided to inform future research, and no conceptual models are discussed on which to base the analysis of the sound discussed.

Educational Multimedia

Although frameworks for studying game sound within educational games are lacking, frameworks for studying sound within educational software and multimedia do exist. Bruce Mann proposed one such framework to design sound for multimedia in 2008. Mann's structured sound function (SSF) model for multimedia sound was intended to help designers "control attention to visual events" (Mann, 2008). This model outlines a number of categories to describe a range of uses of sound to support temporal, point of view, location, and character-based sound functions. Mann's notion that sound should be paired with visuals is novel. The model is predicated on the design of sound to manage cognitive load, and it proposes five functions and three structures for sound to "help learners to focus their attention on visual events in multimedia" (Mann, 2008, p. 1165). However, a convincing rationale is not presented for the decisions that led to the five sound function categories or to the structures that outline how sound should affect visual events in his model. In addition, the research to codify this model cannot be found, and no theoretical grounding is provided to explain how sound and visuals work together in immersive environments in ways that support ludic engagement. In 2001, Bishop and Cates also proposed a framework for sound in multimedia and based the framework on a model of an instructional communication system. This model assumes that learners move through a process to select and analyze information before finally constructing new knowledge with the information presented (Bishop & Cates, 2001). Bishop and Cates's sound model expands on this communication system and seeks to address problems introduced by noise in the system that occurs when learners work through problems to acquire, process, and retrieve information. According to Bishop and Cates, sound is able to direct attention, communicate information, and "elaborate on visual stimuli by providing information about invisible structures, dynamic change, and abstract concepts almost impossible to communicate visually" (p. 11). Moreover, sound can help connect learners to content while "creat[ing] a systematic auditory syntax for categorizing main ideas" in addition to focusing learner attention by "employ[ing] novel, bizarre, and humorous auditory stimuli" (p. 15). Bishop and Cates (2001) illustrate how to apply this framework to design sound by describing a potential multimedia module to teach the concept of information processing, as a way to describe aspects of their framework. On the surface, this framework is promising; however, it is limited to describing how auditory cues can be used to grab learner attention and provide a cue for future presentation of content. No discussion of auditory cues and visuals is provided, and no review of sound design within either multimedia or game environments is presented. In addition, no research model is made available to ground this investigation from a sound-listening perspective. In a follow-up study, Bishop, Amankwatia and Cates (2008) examined sound events present in lessons from four software applications and investigated how these learning tools used sound to support information processing. They studied the frequency of sound events in 12 lessons from these programs and used content analysis to analyze applications for sounds present. Sound was predominantly used to manage attention and support organization of information. However, learner perspectives of sound were not incorporated in their research. Neither Mann (2008), Bishop and Cates (2001), nor Bishop et al. (2008) explain how sound and visuals relate to communicate information or create immersive experiences. None of the frameworks reviewed provide a comprehensive strategy by which to guide the design of sound for educational games or address how sound and visuals work together to affect how people experience gameplay. Scant research is available within educational technology to examine participant experiences of gameplay, and no suitable frameworks can be found for conducting research into sound and educational games.

Sound and Games

The use of sound in computer games (and arcade video games) is ubiquitous. The use of sound to draw attention and provide interactive cues can be traced to interactive entertainment of the 19th century (e.g., penny arcades) and can be found throughout popular video game titles from the 1980s through currently available titles (Collins, 2008). Sound has been used to "reward" successful game interactions and to reflect choices people make in games. For instance, the game *The Legend of Zelda: Ocarina of Time* (Nintendo EAD, 1998) used "melodic foreshadowing" to integrate music with in-game puzzles, while melodic passages were used as environmental cues through a subtle blending of "danger music" and "attack music" as the player approaches an enemy (Belinkie, 1999; Gibbons, 2009; Whalen, 2004). Sound and music in games can also regulate player affective responses. Straightforward sound-design techniques such as modulating volume levels and adjusting the timing of effects have been shown to increase anxiety, fear, and suspense in games, and giving players choices over the music they hear has been shown to reduce anxiety (Toprac & Abdel-Meguid, 2011; Wharton & Collins, 2011).

Game Audio and Player Interactions

Karen Collins (2008) offers a compelling analysis of game audio from the perspective of player interactivity, and she provides a framework that explains how sound and visuals work together in games to provide players with immersive gameplay experiences. In Collins's framework, games use sound in ways that provide players with cues for action and feedback for choices. In addition, game design can also use sound to respond to player decisions as well as to changes that occur during gameplay. Collins's framework organizes a discussion of game audio from the perspective of diegesis and "degrees of player interactivity" (p. 125). Collins (2008) draws from film sound theory to describe diegesis as the way in which a game player perceives the source of the sound being played at different points during gameplay. Sounds that both the player and game characters can hear are diegetic sounds. However, sounds that can be heard only by the player are nondiegetic. Within Collins's (2008) framework, game sound can be interactive and designed to respond to player actions. Game sound can also be adaptive and change in response to a state within the game. Alternatively, game sound can also be nondynamic. Interactive, adaptive, or nondynamic audio can either be diegetic or nondiegetic. Game sound provides a crucial connection to the audiovisual illusion provided by the interaction of game visuals with sound, and at times it is mediated by player choices and changes in the game. This illusion enables players to create semantic meaning from play and helps to establish a realistic game setting. Notably, Jorgensen (2008) and other game sound theorists describe the role of game sound from the ecological perspective of the events conveyed by sound instead of from the technical perspective of the sounds themselves. An ecological, everyday listening approach to describing the role of game audio is crucial if, as Bishop et al. (2008) suggest, designers of educational software hope to use sound to "represent content … depict a context … or illustrate a construct" (p. 481). A synchretic, ecological approach to examining sound as paired with visuals can also help to derive a framework by which to understand learner perspectives of their sound-listening experiences while playing educational games. Such a context-driven, learner-centered, and synchretic perspective is missing from current scholarship, and thus it presents an opportunity to examine game sound from a phenomenological perspective.

Study Overview Phenomenology

I took an interpretive, phenomenological approach to examine what it was like to experience sound while playing educational games. This phenomenological approach enabled me to address this question and explore participants' lived experiences of playing educational games while listening to sound. The study of experience is central to phenomenology, and the method has been applied within educational technology research to examine student experiences within learning environments (Cilesiz, 2009; Miller, Veletsianos, & Doering, 2008). I applied phenomenology to address the central question, "What is it like to experience sound while playing educational games?" I incorporated participant perspectives that arose out of their immediate descriptions of sound in games, their reflections of past experiences, and their description of personal significance of their experiences participating in this research. I applied these perspectives when searching for essential meanings, and as I structured the reductive, analytical process (Dahlberg, Dahlberg & Nystrom, 2008; Giorgi, 1997; Giorgi & Giorgi, 2003; Moustakas, 1994; Rosenblum & Hughes, 2017), I used these phenomenological approaches to learn about the structure and essential meanings of my participants' experience of sound as they played educational games. According to Merleau-Ponty (2002), "The structure of actual perception alone can teach us what perception is" (p. 4, Kindle ed.). I derived this structure by gaining access to the "totality of lived experiences" (p. 2) of sound in games as described by my participants.

Data Collection and Analysis

I selected and interviewed six participants for this study. I asked each participant to play three games and participate in interviews over three temporally separated interview sessions (Cilesiz, 2010). I preselected educational game titles based on an analysis of game sound from the perspectives of acoustic ecology and player interactivity (Collins, 2008; Gaver, 1993; Schafer, 1993). The games selected included a 2D strategy game, an interactive story game, and a 3D problem-based learning game. During each session, I asked people to play games while I digitally recorded their gameplay and audio/video recorded the interview session. I applied a stimulated recall and think-aloud protocol to play back their gameplay and to ask questions about their experiences. I subsequently coded interview transcripts, reduced data, and derived essential meanings in this research (Rosenblum, 2014; Rosenblum & Hughes, 2017). The eight shared essential meanings derived in this study represent various ways in which sound affects participant experience of playing three educational games. These meanings indicate that sound: conveyed a sense of the game's interface in addition to the environment in which play was situated, supported the presentation of characters in the game, and worked to communicate the game's narrative to the player. Music in the games studied helped to provoke thought and also conveyed an emotional context for play. Sound was essential for players to remain engaged with their gameplay. People noticed when sounds heard and visuals seen did not match.

Sound and Silence

One of the challenges in this investigation was to design a phenomenological investigation to enable an "opening up" of the phenomenon of sound. From an ontological perspective, the experience of sound may be thought of in what Don Ihde terms as "auditory horizons." Ihde's (2007) auditory horizons are an extension of Husserl's idea of phenomenological horizons, which connote the background of understanding within which one explores a given phenomenon (Ricoeur, Ballard, Embree, & Carr, 2007). One way to demarcate horizons is to identify their boundaries. For auditory horizons, one such boundary that Ihde describes is silence. As Ihde observes, unless one is bereft of hearing, one does not really lose the ability to hear sound: Even in perfect silence one hears the sounds that characterize one's physical being, such as breathing and heartbeat. However, an interesting aspect of silence is that is even if one does not passively receive auditory input through one's ears, one exercises what Ihde and others have described as an "auditory imagination." That is, one hears "inside" one's own head even in the absence of sound. Such a distinction becomes critical to note, especially given the role that auditory imagination plays in asking people to explore horizons related to their experiences of sound.

It is difficult for people to describe what they hear (Jorgensen, 2008). As Jorgensen (and others) point out, humans have no "earlids" with which to filter (and therefore evaluate) perception of sound. As Don Ihde (2007) points out, it is difficult to describe sound because the listener is situated in a horizonal field while experiencing sound. Ihde describes phenomenological horizons as the descriptions and perspectives that shape how one perceives an experience. Ihde characterizes and illustrates this horizonal field as a "Focus Field Horizon Structure" (p. 106). Moreover, the boundary of this horizonal field is a point where the phenomenon is not relevant to our experience. In the case of sound, this boundary is delimited by what Ihde (2007) calls a "horizon of silence" (p. 52). Taking Ihde's Focus Field Horizon Structure, I interpret his notion of a horizonal field to describe all possible sound horizons, and his notion of focus within this field to describe the immediate focus on sound. I pair this interpretation of sound horizons with Ihde's notion of silence as a horizonal boundary to illustrate the placement of the listener's focus on sound within a space of potential sound horizons. In his model, a large circle represents a possibility space for events that comprise one's possible experiences of sound at any given time; in other words, it encompasses what someone might say about sound. A smaller, concentric circle in the middle of Ihde's field represents the immediate focus on sound as it is experienced. A horizon, therefore, is a point within these circles that represents one of many facets of experience. However, herein lies a paradox. According to Ihde, one cannot turn off the perception of sound. Sound is what Merleau-Ponty would describe as an embodied experience (Merleau-Ponty, 2002). If one is physiologically capable of hearing—and even if one were to completely muffle sounds that can arise as a result of sound waves impacting the ears—one would still have the experience of hearing the physical self—that is, the heartbeat. From a philosophical perspective, Ihde (2007) maintains that instead of silence, one experiences "auditory imagination" in which one fills in the perceptual blanks in the absence of sound. This perspective on auditory imagination is in turn borne out in neurological studies by researchers such as Kraemer, Macrae, Green, and Kelley (2005) and Zatorre and Halpern (2005), who conducted brain imaging studies on people who listened to music and who experienced "gaps" of silence in the music. Interestingly, the auditory cortex of study participants continued to remain active throughout the experiment, a phenomenon described by Voisin, Bidet-Caulet, Bertrand, and Fonlupt (2006) as "listening in silence." Therefore, asking players to play a game silently would naturally lead them to "listen in silence" to the game as they played, even as they missed the cues and information normally provided through sound. People bring with them the sum total of their individual expectations and perspectives for what they think (consciously or not) they should hear (Neuhoff, 2011). These neurological perspectives are crucial to understanding phenomenological perspectives of sound, silence, and gameplay.

Silence Within Study Design

I incorporated silence into my current study by asking that people play games with the sound turned on and interviewing them, while allowing for the natural silences present in the game to form the horizons that they experience. The advantage of this approach is that the horizons that they identify are derived from the game's individual design strategies for sound use. Descriptions therefore are less likely to be affected by large gaps of silence and participants are less likely to describe or compare their experiences based on what they imagine. Another (perhaps equally important) advantage of this approach is that they can climb the learning curve of the game more readily with sound (Jorgensen, 2008). Because of the difficulty faced when concentrating on our experiences of sound (Ihde, 2007; Jorgensen, 2008), I let people play games with sound but used silence in ways that helped people to cleanse their perceptual palate. Thus, I bracketed my experience as a sound designer and sound researcher and periodically turned off sound when participants indicated difficulty in describing their experiences with sound. In this way, I purposefully activated their process to listen in silence and in doing so used the contrasting experience as a perceptual prompt to enliven their descriptions of sound in educational games. Such an approach has the phenomenological effect of shifting the focus of their perception of sound in their experiential field (Ihde, 2007). In doing so I moved their focus from the "middle" of the horizontal field to its boundary (i.e., silence) and back again. This process of purposefully shifting the phenomenological focus thereby helps ensure that people experience multiple possible horizons for sound during their play of educational games. A key goal of phenomenology research (Giorgi, 1997) is to identify as many possible horizons of an experience as possible. This strategy can be critically useful in helping to open up the phenomenon of sound in educational games while also having the intangible benefit of helping to make people more aware about the ways in which they perceive sound. In practice, I asked people to play games with sound. However, I also periodically turned off sound during play when I encountered areas in the game that either raised additional interview questions or were otherwise difficult for people to describe what they were hearing. In this way, I could use silence as a fine-tuned tool to help people to clear their perceptual palate and attend to what they heard.

An Applied Phenomenological Framework

It is critical that designers of games in general, and of educational games in particular, have a framework by which to consider how sound affects player experiences of games. Educational environments offer fertile ground for such investigations. Gershon (2017) makes the case for attention to sound as a strategy to inform the design of educational curriculum and draws upon ecological approaches to sound listening in this discussion. According to Gershon, educators should reconceptualize learning environments from an aural point of view and use it to shape design of curriculum, what Gershon describes as a “sound curriculum” to “brea[k] frames and ope[n] ears” (Gershon, 2017, p. 2). This investigation frames an investigation of sound through a phenomenological lens. This study’s philosophical design draws upon Don Ihde’s (2007) phenomenological perspective of sound and relies upon his Field Focus Horizon Structure to explain the phenomena of sound listening and silence. I therefore propose an applied phenomenological framework to research sound that incorporates Ihde’s framework for sound and silence, that draws upon perspectives on player interactivity by Karen Collins (2008), and that also incorporates the findings from this investigation (see Figure 1).

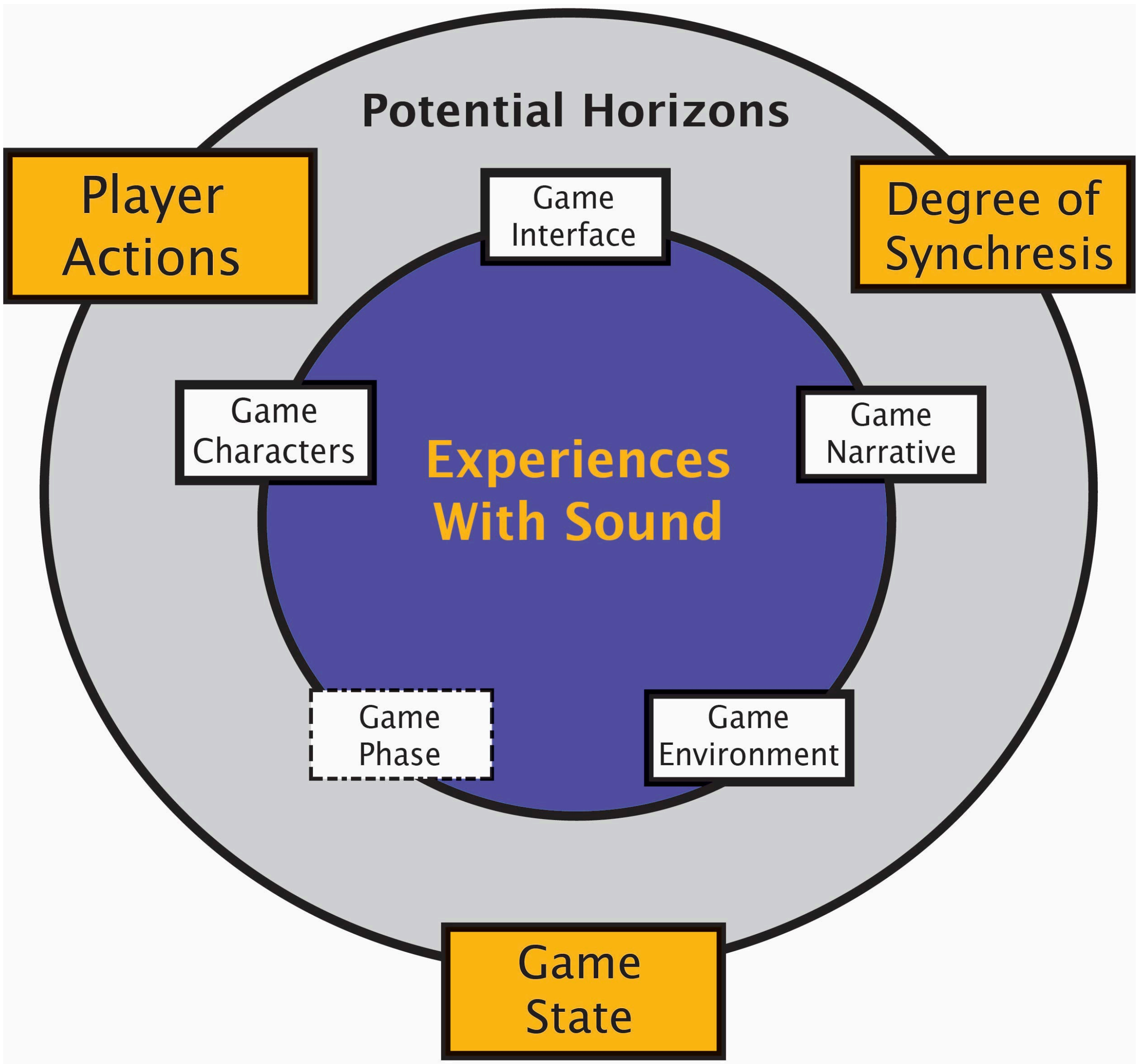

Figure 1. Applied phenomenological framework for sound in educational games.

In this applied phenomenological framework, the inner circle, Experiences With Sound, represents the player experience of sound heard in games. The outer circle, Potential Horizons, represents the possibility space for all of the potential horizons of meaning that could exist for the player based on what is heard. The outer boundary of this framework represents the absence of sound heard. Potential horizons are dependent on three critical factors, represented in boxes placed on the border of the outer circle: the actions taken by the player in the game (Player Actions), the game's state at the time of the experience (Game State), and the degree of synchretic pairing of sound and image that is embedded in the game's design (Degree of Synchresis). The notion of player actions is analogous to Collins's (2008) discussion of interactive sound that is triggered as a result of the game players' interaction with the game. The idea of game state is also taken from Collins's framework, since it is important in describing changing conditions that mark different aspects of gameplay, and thus results in what she describes as adaptive audio. I do not include Collins's description of nondynamic audio for sound that is not impacted by player actions, since the experiences from these sounds are included both in the explanation of synchretic pairing and are also reflected in other areas of the framework. The third factor in the outer circle, Degree of Synchresis, is also included in this area because of the importance that the participants placed on audiovisual pairing across all three games studied. Degree of Synchresis reflects the extent to which there is a plausible pairing of sound and visuals within the game's design. The three factors, Player Actions, Game State, and Degree of Synchresis, mediate participant experiences of sound as they play games and are dependent upon the players' actions, their progress through game states, and the degree to which players interpret synchretic pairing of sound and visuals. Although these three factors may vary based on an individual's own experience and perspective, it is important to note that removing the ability for players to hear sounds when they interact with a game, failing to provide sound to denote game state, or having minimal synchresis present in a game can dramatically reduce the number of potential horizons of meaning that can be derived as a result of experiences of sound.

While the outer circle of this framework represents the potential horizons of meaning that could emerge from play, the inner circle represents components that were presented using embedded game sound. These components are represented as boxes placed on the border of the inner circle: Game Interface, Game Characters, Game Narrative, Game Environment, and Game Phase. All of these components, except Game Phase, were extracted from the shared essential meanings found in common across all three games in this study. The fifth component, Game Phase, was added because it was an essential meaning derived specifically from the analysis of the strategy game. This game contained a structure that organized play through a series of phases within a given round. This box has a dotted outline since this component did not emerge as a shared essential meaning. All five components of gameplay thus reflect the ways in which sound is embedded in each of the games' designs in this study. The inner circle represents player experiences with sound as played games, and as such is situated within the overall possibility space of the potential horizons of meaning. This framework is designed to visually summarize the relationship of game components and mediating factors that defined the possible horizonal space for this study and which, through play, ultimately led to these participants' thick descriptions of sound in educational games. As researchers are able to study sound, more may be learned about how sound and visuals convey information, and in what ways can people find value in the use of sound in educational games. Such understandings will enable the educational game community to explore how to design immersive game-based learning environments that are both engaging and motivating.

References

Belinkie, M. (1999). *Video game music: Not just kid stuff*. Retrieved from http://www.vgmusic.com/vgpaper.shtml

Bishop, M. J., & Cates, W. M. (2001). Theoretical foundations for sound's use in multimedia instruction to enhance learning. *Educational Technology Research and Development*, 49(3), 5–22. doi:10.1007/bf02504912

Bishop, M. J., Amankwatia, T. B., & Cates, W. M. (2008). Sound's use in instructional software to enhance learning: A theory-to-practice content analysis. *Educational Technology Research and Development*, *56*, 467–486. doi: 10.1007/s11423-006-9032-3

Chion, M. (1994). *Sound on screen* (C. Gorbman, Trans.). New York, NY: Columbia University Press.

Cilesiz, S. (2009). Educational computer use in leisure contexts: A phenomenological study of adolescents' experiences at Internet cafés. *American Educational Research Journal*, 46(1), 232–274.

Cilesiz, S. (2010). A phenomenological approach to experiences with technology: Current state, promise, and future directions for research. *Educational Technology Research and Development*, 59(4), 487–510. doi:10.1007/s11423-010-9173-2

Collins, K. (2008). *Game sound: An introduction to the history, theory, and practice of video game music and sound design.* Cambridge, MA: The MIT Press.

Dahlberg, K., Dahlberg, H., & Nystrom, M. (2008). *Reflective lifeworld research* (2nd ed.). Lund, Sweden: Studentlitteratur AB.

Gaver, W. (1993). What in the world do we hear? An ecological approach to auditory event perception. *Ecological Psychology*, 5(1), 1–29.

Gershon, W. S. (2017). Sound curriculum: Sonic studies in educational theory, method, and practice. New York, NY: Routledge. doi:10.4324/9781315533131

Gibbons, W. (2009). Blip, bloop, Bach? Some uses of classical music on the Nintendo entertainment system. *Music and the Moving Image*, 2(1), 40–52.

Giorgi, A. (1997). The theory, practice, and evaluation of the phenomenological method as a qualitative research procedure. *Journal of Phenomenological Psychology*, 28(2), 235–260.

Giorgi, A. P., & Giorgi, B. M. (2003). The descriptive phenomenological psychological method. In P. M. Camic, J. E. Rhodes, & L. Yardley (Eds.), *Qualitative research in psychology: Expanding perspectives in methodology and design* (pp. 243–273. Washington, DC: American Psychological Association. https://doi.org/10.1037/10595-013

Ihde, D. (2007). *Listening and voice: Phenomenologies of sound.* Albany: State University of New York.

Jorgensen, K. (2008). Left in the dark: Playing computer games with the sound turned off. In K. Collins (Ed.), *From Pac-Man to pop music: Interactive audio in games and new media* (pp. 163–176). Burlington, VT: Ashgate.

Kostolny, J., & Bohacik, J. (2017, October). *Digital games in education and their development.* Presented at the 15th International Conference on Emerging eLearning Technologies and Applications (ICETA), Stary Smokovec, Slovakia. doi:10.1109/ICETA.2017.8102494

Kraemer, D. J. M., Macrae, C. N., Green, A. E., & Kelley, W. M. (2005). Sound of silence activates auditory cortex. *Nature*, 434, 158.

Mann, B. (2008). The evolution of multimedia sound. *Computers & Education*, 50(4), 1157–1173.

Merleau-Ponty, M. (2002). *Phenomenology of perception* [Kindle ed.]. New York, NY: Routledge.

Miller, C., Veletsianos, G., & Doering, A. (2008). Curriculum at forty below: A phenomenological inquiry of an educator/explorer's experience with adventure learning in the Arctic. *Distance Education*, 29(3), 253–267. doi:10.1080/01587910802395789

Moustakas, C. (1994). *Phenomenological research methods.* Thousand Oaks, CA: Sage.

Neuhoff, J. G. (2011). Perception, cognition and action in auditory display. In T. Hermann, A. Hunt, & J. G. Neuhoff (Eds.), *The sonification handbook* (pp. 63–85). Berlin, Germany: Logos.

Nintendo EAD. (1998). *The legend of Zelda: Ocarina of time* [Video game]. Kyoto, Japan: Nintendo.

Petri, G., & Gresse von Wangenheim, C. (2017). How games for computing education are evaluated? A systematic literature review. *Computers & Education*, 107, 68–90. doi:10.1016/j.compedu.2017.01.004

Ricoeur, P., Ballard, E. G., Embree, L., & Carr, D. (2007). *Husserl: An analysis of his phenomenology*. Evanston, IL: Northwestern University Press. doi:10.5195/JFFP.2017.800

Rosenblum, J. (2014). *What is it like to experience sound, while playing educational games?* (Unpublished doctoral dissertation). University of Texas, Austin, TX.

Rosenblum, J., & Hughes, J. E. (2017). Digital recording technologies in phenomenological investigations. *Journal of Ethnographic & Qualitative Research*, 12(1), 29–49.

Schafer, R. M. (1993). *The soundscape: Our sonic environment and the tuning of the world* [Kindle ed]. Rochester, VT: Inner Traditions/Bear & Company.

Toprac, P., & Abdel-Meguid, A. (2011). Causing fear, suspense, and anxiety using sound design in computer games. In M. Grimshaw (Ed.), *Game sound technology and player interaction: Concepts and developments* (pp. 176–191). Hershey, PA: Information Science Reference.

Voisin, J., Bidet-Caulet, A. l., Bertrand, O., & Fonlupt, P. (2006). Listening in silence activates auditory areas: A functional magnetic resonance imaging study. *The Journal of Neuroscience*, 26(1), 273–278. doi:10.1523/JNEUROSCI.2967-05.2006

Whalen, Z. (2004). Play along – An approach to videogame music. *Game Studies: The International Journal of Computer Game Research*, 4(1). Retrieved from http://gamestudies.org/0401/whalen/

Wharton, A., & Collins, K. (2011). Subjective measures of the influence of music customization on the video gameplay experience: A pilot study. *Game Studies: The International Journal of Computer Game Research*, 11(2). Retrieved from http://gamestudies.org/1102/articles/wharton_collins

Zatorre, R., & Halpern, A. (2005). Mental concerts: Musical imagery and auditory cortex. *Neuron*, 47, 9–12.