Vorderer, P. & Bryant, J. (2006). Playing Video Games: Motives, Responses, and Consequences. Mahwah, N.J.: Lawernce Erlbaum Associates Publishers.

PLAYING VIDEO GAMES

Motives, Responses, and Consequences

Edited by

Peter Vorderer
University of Southern California

Jennings Bryant
University of Alabama

LEA
LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS
2006 Mahwah, New Jersey London

Contents

CHAPTER

17

The Role of Music in Video Games

Sean M. Zehnder and Scott D. Lipscomb
Northwestern University

The role of music in video games has come a long way from the "hollow ringing sound" (Winter, 2004) of *Pong* (Atari, 1975), to the symphonic orchestral scores of games like *Medal of Honor: Frontline* (*MOH: Frontline;* Electronic Arts, 2002) and the highly customizable hip-hop playlists of others like *Tony Hawk's Underground* (Activision, 2003). While we recognize that there are a wide variety of definitions of the term, we use "video games" to refer primarily to console and computer gaming. With the introduction of the latest round of game console competitors in 2000, the Sony Playstation 2 (PS2), the Microsoft Xbox, and the Nintendo GameCube, interactive gaming took large strides forward in both video and audio capabilities. MP3 compression, CD-ROM and DVD technology, as well as faster processors and larger storage devices have enabled audio in games to approach the audio-visual quality of film and television. That music plays an important role in the overall experience of video gaming is widely accepted, although there have been very few experimental or theoretical studies of the role of music in the perception of video game stimuli.

This chapter explores the contribution of music to the gaming experience from a variety of perspectives. As there are very few studies of music in video games available, we begin by reviewing literature on the role of music in the perception of film,[1] from which we draw vocabulary and a theoretical framework for the later analysis of music in video games. Next, this chapter outlines an experimental study conducted by the authors on the perception of music in the game *The Lord of the Rings: The Two Towers* (Electronic Arts, 2002). Finally, the authors propose specific areas for future research studying the role of music in this rapidly evolving medium.

LITERATURE REVIEW

The Perception of Music in Film

Almost since its inception, cinematic imagery has been accompanied by musical sound. Early presentations of films by the Lumière Brothers in the 1890s, for example, typically incorporated a piano accompaniment. Silent films of the early Hollywood film era were accompanied by a variety of musical instruments from solo piano or organ to larger ensembles, depending on venue. Originally intended simply to cover the noisy sounds of the projection equipment (Cavalcanti, 1985), the impact of including a musical score as a means of enhancing and expanding on the psychological drama of the audio-visual experience—certainly a much more significant role—was soon realized. In fact, the film score has become so integral to the cinematic experience that a movie without a musical score (e.g., *The Birds*, 1963; *Diary of a Chambermaid*, 1964), interestingly, creates tension and a sense of urgency, causing audience members to seek out other sounds (e.g., ambient noises) to fulfill the functions typically performed by the music (Lipscomb & Tolchinsky, 2005).

The number of empirical investigations into the role of the musical soundtrack has increased dramatically since the late 1980s. Early studies (Tannenbaum, 1956; Thayer & Levenson, 1983) revealed that adding a musical soundtrack enhanced the viewers' experience. Marshall and Cohen (1988) demonstrated that information provided by a musical soundtrack could affect the judgments of personality attributes assigned by research participants to each of three geometric shapes presented as "characters" in an animated film.

In 1996, an entire issue of the journal *Psychomusicology* was devoted to the "Psychology of Film Music," including both experimental and theoretical work. Thompson, Russo, and Sinclair (1996) showed that a musical score can influence the perceived closure in filmed events, concluding that the role played by music was implicit. A study by Bolivar, Cohen, and Fentress (1996) revealed that both referential and temporal aspects are important to the interpretation of an audio-visual combination. In this context, the perceived "friendliness" or "aggressiveness" of characters in the audio-visual combinations were accurately predicted based on ratings for the independent visual and audio components. Lipscomb and Kendall (1996), using excerpts from *Star Trek IV: The Voyage Home* (1986), found that the majority of research participants were able to select the composer's intended musical score for each scene from a selection of musical excerpts taken from various parts of the same movie. In addition, subject responses to a series of verbal response scales revealed highly significant differences in the ratings, depending on which musical score was paired with a given visual scene. In the context of this experimental investigation, though the authors are cautious about stating the fact too emphatically, the musical score appeared to exert *more* influence on subject ratings than the visual images. Using both verbal rating scales and open-ended questions, a study by Bullerjahn and Güldenring (1996) revealed that the musical score polarizes the emotional content of a cinematic excerpt and significantly influences understanding of the dramatic plot. Results of a study by Sirius and Clarke (1996) revealed that the relationship between simple computer-generated visual images and music was additive, that is, "music that scores highly on the evaluative dimension simply raises the evaluative scores for an audiovisual combination in which the particular music is featured, no matter what the visual material is" (p. 130). Using excerpts from 20 commercially released laserdisc recordings, Iwamiya (1996) found that, when considering matched audio-visual combinations (i.e., combined in the manner intended by the producer of the recording), the auditory component systematically influences the visual component, but the visual component did not exert such influence on the audio.

Significant research in this area has continued to the present day. Boltz and her colleagues (Boltz, 1992, 2001; Boltz, Shulkind, & Kantra, 1991) have confirmed the important role played

by music and its placement within a dramatic sequence in relation to memory, especially in determining perceived duration of a scene and which specific aspects of a scene will be remembered after an initial viewing. Applying an empirical approach to a related artform, Krumhansl and Schenk (1997) investigated the relationship between Balanchine's dance choreography and the music by which it was inspired, Mozart's *Divertimento No. 15*. Vitouch (2001) asked participants, after seeing a brief film excerpt with one of two contrasting musical soundtracks, to provide a written prediction of how the plot would continue. Results revealed that anticipations of future events are "systematically influenced" by the accompanying musical sound (p. 70).

As a result of this collection of empirical studies, it is an undeniable fact that music plays a significant role in the motion picture experience. It is the belief of the present authors that the musical soundtrack plays a similarly important role in the context of video games.

Music as Communication

The essence of all music is communication, whether it is personal expression, spiritual messages, political persuasion, or commercial appeal (Sonnenschein, 2001, p. 101). According to Lipscomb and Tolchinsky (2005), "Music is a culturally-defined perceptual artifact, existing in the mind of enculturated listeners (Hood, 1982; Lomax, 1962; Merriam, 1964; Nettl, 1983) (p. 384). In order to be successful, communication must involve shared implicit as well as explicit knowledge structures (Kendall & Carterette, 1990). Many studies have investigated various aspects of musical communication as a form of expression (Bengtsson & Gabrielsson, 1983; Clarke, 1988; Clynes, 1983; Gabrielsson, 1988; Seashore, 1967/1938; Senju & Ohgushi, 1987; Sundberg, 1988; Sundberg, Frydén, & Askenfelt, 1983). A three-component communication model was proposed by Campbell and Heller (1980), including simply a composer, performer, and listener. It was upon this previous model that Kendall and Carterette (1990) expanded, elaborating upon and clearly defining the constituent parts and elucidating the specific interrelationships that exist.

In video games, as in other audio-visual media, music serves as one important component of the spectrum of sound that includes the musical score, ambient sound, dialogue, sound effects, and even silence. As Peterson (2004) argued, "Game production today is serious business, and a major part of that appeal is great audio." In games such as *MOH: Frontline*, music plays a significant part in creating a sense of immersion in the game. *MOH: Frontline* places the player in the perspective of an Allied soldier taking part in the storming of the beach at Normandy during World War II. Bullets and explosions seem to wiz past the player's head while searching for a commanding officer. *MOH: Frontline* includes an original symphonic score composed by Michael Giacchino that was performed by a live orchestra and chorus, and recorded and mixed for Dolby 5.1 surround sound. In one online review, North (2003) described a variety of contributions of the *MOH: Frontline* score, including: heightened moments of suspense, accentuation of the "horrors of war" (by the use of an adult chorus), and bittersweet passages that "brighten the beauties of war." Upon a closer look, this review suggests that a musical score can contribute to both narrative (i.e., suspense) and meta-narrative (i.e., perception of horror or beauty) aspects of the video game experience.

There is good reason to believe that composers instinctively draw on their prior experience with films when composing for video games. Don Veca, audio director for *Lord of the Rings: the Return of the King* (EA Games, 2003), argued, "We're getting to the point where we're supposed to sound like a movie (quoted in Jackson, 2004a, p. 52). Reesman (2004) argued that the two media (film and video games) require a composer to work in "grand themes and short snippets." It is striking, in fact, that many interviews with game composers include some comparison to the creative process of scoring a film (Lennertz, 2004; Sanger, 2004;

Hyde-Smith, 2004b). Music can reflect the inner feelings of a character or the outward state of the setting, and in both cases it can choose to "comment on" either state through the audiovisual contrast, one of the audio-visual relationships discussed below.

Types of Listening

A key technique in the analysis of the role of music in video games is the differentiation of various types of listening. Chion (1994) outlined three main types of listening: reduced, causal, and semantic. *Reduced* listening emphasizes the sound itself and the source or meaning of the audio. *Causal* listening refers to listening to a sound to be able to identify its cause, while *semantic* listening focuses on code systems in the audio (i.e., spoken language) that symbolize ideas, actions, or things. In the case of video game music, reduced listening would emphasize the mood of the music, causal would highlight the actions that trigger certain sounds/loops, and semantic listening would focus on the lyrical or genre-related (i.e., hip-hop vs. symphonic classical) connotations of the audio.

Some scholars have argued that the strength of a musical contribution to multimodal communication lies in its ability to convey meanings that are incommunicable via words alone. Richard Wagner claimed of 19th-century music drama, that "as a pure organ of the feeling, [music] speaks out of the very thing which word speech in itself can not speak out. . . that which, looked at from the standpoint of our human intellect, is *the unspeakable*" (Wagner, 1849/1964, p. 217). Suzanne K. Langer (1942) argued, "Music has all the earmarks of a true symbolism, except one: the existence of an *assigned connotation*" (p. 240). Royal Brown (1988) argued that it is this "unconsummatedness" of music that accounts for the predominance of the orchestral film score. As Lipscomb and Tolchinsky (2005) suggested, in order for a film to make the greatest possible impact, it is necessary for there to be an interaction between at least three modes of signification: verbal dialogue, cinematic images, and the musical score.

Gorbman (1987) proposed three methods by which music can "signify" in the context of a narrative film. *Purely musical signification* results from the highly coded syntactical relationships inherent in the association of one musical tone with another, that is, patterns of tension and release provide a sense of organization and meaning to the musical sound, apart from any extramusical association that might exist (e.g., Hanslick's [1891/1986] "absolute music"). *Cultural musical codes* are exemplified by music that has come to be associated with a certain mood or state of mind (e.g., Meyer's [1956] "referentialism"). *Cinematic codes* influence musical meaning merely due to the placement of musical sound within the cinematic context; for example, opening credits, end title music, and recurring musical themes that come to represent characters or situations within the film.

Audio-Visual Relationships

The emotional response to music and a musical soundtrack's obvious ability to establish an appropriate mood are important to the process of music communication, whether in the context of film or video games. However, there are other effective ways in which music can communicate information to the listener that are equally important. Peirce (1931–1935, vol. 2) provided a classification of three types of signs used in the communication process, differentiated by the manner in which they represent their referent. Dowling and Harwood (1986) provided the following useful explication of this delineation:

> An *index* represents its referent by having been associated with it in the past, as lightning and thunder with a storm. An icon represents through formal similarity to the referent, as

> a wiring diagram represents a circuit. *Symbols* represent by being embedded in a formal system, such as language. (p. 203; italics added)

Within a musical context, both iconic and indexical signs may be considered referential means of musical communication. *Icons* provide perhaps the most concrete means of transmitting musical meaning, emulating the physiognomic structure of physical motion (Davies, 1978; Rosar, 1996). This type of signification is utilized frequently in animated cartoons. Inevitably, as a character falls toward certain destruction, the musical score will incorporate a descending melodic line or glissando.

Two instructive examples of indexical meaning can be found in Hal B. Wallis' classic film *Casablanca* (1942; musical score by Max Steiner). During the opening titles, the initial phrase of music was based on a scale consisting of semitones and augmented seconds that serves as an *index*, "pointing to" the foreign locale. Indexical meaning is utilized in the musical score throughout this film as a means of differentiating between the French citizens from the German soldiers occupying the city. A minor key rendition of "Die Wacht am Rhein," a German folk song, becomes associated with the German antagonists, while "La Marseilles" came to represent the French protagonists. Both of these musical themes are used to effectively express the tensions between these two groups during a confrontation that occurs in Rick's bar as the sound of the soldiers singing the German folk song is gradually drowned out by the refrain of the French national anthem.

Symbolic signification relies solely on the relationship between musical sounds for meaning, including such audio-visual arts as modern dance, ballet, and ice skating. In this context, the various bodily movements and musical sounds take on significance purely because of the syntactical relationship of one sound or movement to another. This relationship is directly affected by the interaction between the two modalities (i.e., sight and sound) and the alignment of their accent structures. Within the context of a motion picture or video game, varying degrees of *iconic*, *indexical*, and *symbolic* signs are used to communicate to the listener the composer's intended musical message.

REVIEW OF MUSIC IN VIDEO GAMES

With the rapid pace of technological development in the video game industry, there have been great improvements in both the audio tools for designers and composers and the possibilities for storage and playback. Twenty years ago, composers of music for games were limited to simple beeps or synthesized sound (Jackson, 2004b), 8-bit central processing units (at best!), and minimal storage space. Today composers for video games often use state-of-the-art tools and instruments to extremely high-quality soundtracks, rivaling the production quality and musical sources typical of cinema. In fact, the primary technological hurdle remaining in the arena of music for games involves the implementation of interactive music engines, within which musical tracks and loops are activated and layered "on-the-fly" based on the actions of the player in the gamespace. Designers now have the freedom to pick and choose what aspects of the audio they would like to allow the user to control—from custom playlists to the volume levels of dialogue and the customization of surround sound. Today, designers can choose whether or not they would like to license extant music performed by recording artists or to hire a composer to create a unique score for the game. In the following section, we consider the evolution of console sound technologies and the evolving role of sound within the gaming experience.

The Co-Evolution of Music-Related Technologies and Implementations

Implementations of interactive music have developed alongside music-related technologies. Belinkie (1999) described the tone of the musical sounds in the original Nintendo Entertainment System as "hardly better than that of pure sine waves," largely due to the small amount of available storage space and 7-bit playback that could only handle four simultaneous sounds. Introduced to video game consoles by Sega in 1992, most major video game consoles turned to CD-ROM media soon thereafter due to its large storage capacity, high reliability, and comparatively low cost of production. Jackson (2004a) wrote, "Everyone agrees that it was the eventual widespread adoption of the CD-ROM format for video games that allowed for the rapid improvement of game audio." Nine years later, Sony Playstation 2 introduced the first video game console to use a proprietary DVD format along with mpeg-2 standard for video compression—offering a sevenfold increase in the amount of storage capacity of a single disc compared to a CD-ROM. This dramatic increase in storage space allowed video game producers to integrate extremely high-quality audio and video recordings in video games, to the point where, today, many games include the same DVD-quality audio and video of their cinematic counterparts.

Hyde-Smith (2004b) suggested that the improvement of game audio has contributed to a shift in public perception of gaming—from the domain of geeks to mass appeal. He wrote:

> I remember when I did *The Lost World*. We used a live orchestra and as soon as you said the word "videogame" people were just uninterested because in their mind videogame music was just annoying kid stuff. But I've seen a big change since then.

Indeed, there can be striking differences between the synthetic sound of MIDI and the sound of an orchestral recording, not the least of which is that audiences have grown accustomed to the quality of sound in other entertainment media such as television and film. In fact, scholarship on the perception of music in film indicates that as audio-visual stimuli become more complex, there is a shift in the cognitive role of music from one of association to one of highlighting key aspects of the visual domain (Boltz, 2001; Lipscomb, 2005). In other words, though in the past music might have primarily served to encode the game with additional associational meaning, contemporary designers have the added possibility of using music to heighten specific aspects or emotional qualities of the visual experience.

Genres Use Music and Other Aural Components Differently

To glean a better understanding of the recent history of audio in video games, data were collected on a representative sample of video games from the years 1985–2004 ($n = 159$), across a variety of platforms and genres.[2] Each game was coded for the presence/absence of the ability of the user to control various aspects of the game's sound, including: the playlist, volume-level of the sound effects, volume-level of the music, volume-level of the in-game voice/dialogue, the presence/absence of popular or familiar music, the ability to switch between stereo and mono-aural modes, and the presence/absence of surround sound controls.

Because video games are routinely categorized into genres in a similar fashion to television and film, we considered it important to look at whether and how music is used differently between these genres. In order to do so, each video game was assigned to one of five genre categories: Action/Adventure, Racing/Driving, Sports, Role-Playing Games (RPG), and Simulation/Strategy (see Appendix). The role and functions of music within each genre were assessed. Analysis of these data, using a multivariate analysis of variance, revealed a significant main

TABLE 17.1
Post-Hoc Comparisons of Means (only statistically significant differences are shown)

Sound Option	*Comparison (Means)*	
Sound FX	Racing/Driving (.917)	RPG (.250)
	Simulation (.845)	RPG (.250)
	Racing Driving (.917)	Action/Adventure (.376)
	Simulation (.845)	Action/Adventure (.376)
Music Vol.	Racing/Driving (.917)	RPG (.312)
	Simulation (.845)	RPG (.312)
	Racing/Driving (.917)	Action/Adventure (.495)
	Racing/Driving (.917)	Simulation (.845)
Pop/Recognizable Music	Racing/Driving (.333)	Action/Adventure (0.0)
	Sports (.254)	Action/Adventure (0.0)
Stereo/Mono	Action/Adventure (.507)	Sports (.126)

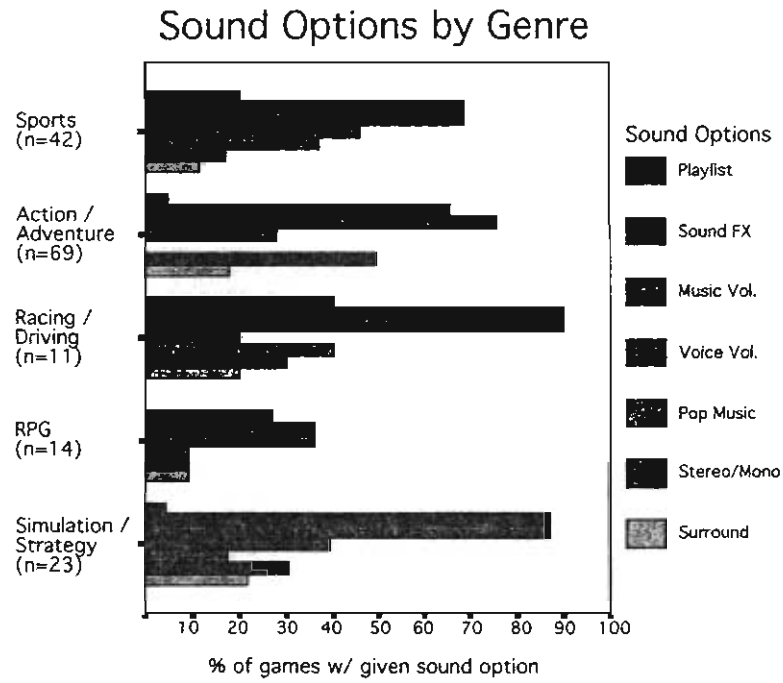

FIG. 17.1. Comparision of sound options in video games, grouped by genre.

effect for genre ($F = 2.784; df = 4; p = .031$). Table 17.1 depicts the pairwise comparisons of means by genre ($n = 5$) and sound option ($n = 7$) that are statistically significant ($p <= .05$).

As reflected in Table 17.1, the Racing/Driving and Simulation genres have significantly higher percentage of games that allow the player to control the volume of sound effects and music than the RPG and Action/Adventure genres. Also, our findings suggest that Action/Adventure games have lower incidence of popular or familiar music than the Racing/Driving or Sports genres, as well as a higher incidence of Stereo/Mono control than sports games (see Figure 17.1).

That there is variation in the implementations of sound across video game genres is not wholly surprising. As independent game composer Darryl Duncan explained:

> "Clearly if it is a medieval role playing type game, it would often call for dark dramatic orchestra based music. If the game is a Car racing game then the music would need to be more fast paced and 'driving' like Techno or Rave." (quoted in Belinkie, 1999)

What is more unexpected in our findings, however, is that genres of video games are not only differentiated by the type of music, but also through a degree of control given the player over their game experience: expressivity/customizability versus a controlled/narrated experience.

Perceptual Constraints

Along with technological constraints, composers for video games also face significant cognitive constraints on the amount of music and other sound that can be implemented effectively in a video game. For example, Stephen Rippy, composer of *Age of Mythology* (Microsoft Game Studios, 2002), stated, "You're dealing with a couple of dozen little characters on the screen at once, so it's finding a balance between hearing general mayhem and being able to identify what you're selecting and, 'Is this thing responding to what I'm telling it to do?' " (quoted in Jackson, 2004b). In order to balance what music plays when and at what levels, video game designers will have to incorporate interactive music engines that dynamically adapt the musical track to cues from the actions of the player in real-time. Additionally, the wider use of music situated in the game world will require the interactive music game engines to support the real-time spatialization of musical sound sources to complement implementations of point of view in 3-D video games.

One of the most apparent medium-specific constraints on the implementation of music in video games is that of designing music that is engaging, while not becoming intolerable after a significant amount of repetition. Many games, after all, require the user to replay levels many times while they master the skills and gather information to complete tasks and overcome obstacles. "The true test of game music is whether a player can still stand a simple theme after hearing it repeated for an hour or more," Belinkie (1999) wrote. In an environment where audio cues are given by triggers based on the player's progress through a scene or challenge, the length of time that a certain track will be looping is variable. "A kid plays his favorite game for 40 hours," Sanger (2004) wrote, "hears that hour over and over, and by the fourth hour, he's sick of the music." (p. 409) Some repetition can be helpful in establishing musical motifs, but too much can become extremely annoying.

APPLIED MEDIA AESTHETICS AND SOUND DESIGN FOR VIDEO GAMES

Adapting to technical and perceptual challenges has occupied video game composers and programmers throughout the medium's short history, and will likely continue to do so as constant innovation plays such an important role in the industry. The following section explores implementations of basic cinematic sound design techniques in video games. We contend that video game scores and incidental music serve crucial functions in the technical, aesthetic, and emotional experience of the player. In particular, music in video games can serve to enhance

a sense of presence, cue narrative or plot changes, act as an emotional signifier, enhance the sense of aesthetic continuity, and cultivate the thematic unity of a video game.

Heightened Sense of Immersion

Music also serves an important role in the cultivation of the sense of perceptual or psychological presence in the video game. *Perceptual immersion* refers to a sense of having one's perceptual system submerged in a virtual environment (Biocca & Delaney, 1995), while *psychological immersion* refers to the degree to which the user feels involved in or engaged with stimuli from the virtual environment (Lee, 2004; Palmer, 1995). Tamborini and Skalski provide an overview of the components and consequences of presence in video games in their chapter "The Role of Presence" in this book.

Diegesis refers to the world of the characters and story within the film; everything that happens to the characters and in the environment portrayed on screen. In some cases, nondiegetic music (music, such as an orchestral score, that is not considered to be audible by the characters themselves) functions as an interpretive element, guiding the listener toward a certain feeling, subjectively beyond the visual elements (Sonnenschein, 2001, p. 154). As a diegetic example, music can be present as if occurring somewhere in the world of the game, such as a car radio in *Grand Theft Auto: Vice City* (Rockstar Games, 2002) or a small portable radio as in *Star Wars: Knights of the Republic* (LucasArts, 2003). In fact, in the latter example, the music is spatialized, meaning it adapts the volume-levels in the left and right stereo channels depending on the player's distance and orientation to the radio. Although they include diegetic music, *Grand Theft Auto III* (Rockstar Games, 2001) and *Grand Theft Auto: Vice City* do not have to contend with the implementation of spatial dynamics as the music plays while the player is sitting in a car. In fact, the *Grand Theft Auto: Vice City* soundtrack is not only an important part of the game play, but it has also created a profitable cross-media synergy through the commercial release of soundtrack CDs for each of the game's eight radio stations. Although it is too early to tell if this model will prove profitable for other video games or the music industry, the idea of a business model that incorporates proprietary technologies, older music properties, and cross-media synergies must be tantalizing to those in the music business who are reeling from the impact of peer-to-peer file sharing on their corporate earnings.

Narrative

Another important role of music is as a contributor to the narrative of a video game. More specifically, music can both assist in the unfolding of events in time (i.e., plot) and infuse the game experience with a heightened sense of importance, tension, or emotion.

One contribution of music to plot is as a marker of environmental changes. In games like *Final Fantasy X* (Square Electronic Arts, 2001), a change in the soundtrack is often triggered to coincide with the appearance of an enemy or triggered by a spatially located threshold to signal a change of scene. The *Lord of the Rings:The Two Towers* (EA Games, 2002) takes this one step farther by punctuating periods of silence with music cued by the sudden attack of a group of enemies (for a good example, see the marsh sequence near the end of "the Gates of Moria" level). This controlled use of silence is another important technique in sound design for video games. As Hyde-Smith (2004b) suggested, "It's actually more effective if you don't have it all the time because when it arrives it has more weight."

Music can serve as a sort of punctuation. In the "Otherworld" scene from *Final Fantasy X*, for example, the screen fades rapidly to white at the same time we hear the sound of a door slamming or the heavy metal rock music abruptly coming to an end, punctuating the end of one scene and the beginning of the next. Alternatively, sound effects and music can also be used

to smooth over gaps or imperfections in the visual and sound effect layers of the experience, helping to ensure that the player is not distracted by technical irregularities/interruptions of the medium.

An extremely common archetype in both film and video games, the *hero's journey* begins with the introduction of a character who must undergo a series of trials or difficulties, often involving a descent into hell (at least metaphorically) in order to come to a revelation and return to the ordinary world (Zehnder & Calvert, 2004). This trope is easily adapted to the classic Aristotelian model of narrative typified by a rising action (desis), climax (peripeteia), and unwinding (denouement). Correspondingly, there is a long tradition in musical composition of developing themes—in the context of the common sonata form movement—that are first presented (exposition), brought into tension (development), and recapitulated (resolved) in the end (Sonnenschein, 2001).

However, the narrative structure of video games also creates a unique set of difficulties for the exposition, development, and recapitulation of leitmotifs. A *leitmotif* is a musical theme that becomes associated with a character, object, emotion, or idea within the game or motion picture. Film scores are replete with examples of such themes, for example, the "Fellowship" theme, the "Shire theme," and the "Ring" theme, to name a few of the themes composed by Howard Shore and used consistently throughout *The Lord of the Rings* trilogy. For example, in many *Action/Adventure* games, there are a few scenes that set the stage and provide the character with a narrative and navigable plane that, on completion and arrival at the goal of the journey, provide a final challenge with a "boss" or extremely powerful enemy that stands as a final obstacle before the protagonist, and the scene's denouement. Often, the music follows a narrative arc similar to the scene, where tension builds as the player makes progress navigating toward the goal, and finally reaching its climax. At this point, there is an abrupt change in the soundtrack that serves as a marker of the climax within the narrative arc. There are certainly consistencies in the musical theme that signify the new challenge as part of the preceding series of events. However, it is typical for the intensity of the piece—in rhythm and volume, for example—to signify a salient moment. This is one way in which music can simultaneously serve the purpose of marking an environmental change while also retaining important characteristics of the narrative trajectory.

Emotional Signifier

Another important role for music in video games is as an emotional signifier, or as exemplified by the quotes from of Wagner (1964) and Langer (1942) cited previously, to infuse the experience with "unconsummated symbolism." Bill Brown, composer of *Return to Castle Wolfenstein: Tides of War* (Activision Publishing, Inc., 2003), described this use of music in the following passage:

> I try to serve the subtext of what's going on in each area of the game. So I said, "Well, this is obviously a very sad thing going on, why don't we play it totally opposite and make this a really heart-wrenching piece?" It took a little bit of convincing but we finally did it and I think it worked well, while all this chaos is going on and you're trying to survive the level. We were already going to have tons of explosives and the action music would only be competing with that. I think it's a little bit more suspenseful if at times, it's the opposite. (Hyde-Smith, 2004a)

In this example, Brown described how the presence of music that contrasts the visual activity of the scene sometimes acts as a better complement to the experience as a whole. In fact, such music can heighten the sense of suspense by providing contrapuntal contrast.

Music can also infuse a scene or activity with the artist's critical perspective, although we contend that the division of labor in video game production militates against this to some degree. As Sonnenschein (2001) suggested: "Music can raise the literal to the symbolic, the ordinary to the poetic, and the particular to the universal. We feel the sense of belonging to all of mankind as we live the lives of those individuals on the screen" (p. 107). In order to enrich the experience of the World War II first-person shooter game he was producing, Steven Spielberg hired Michael Giacchino to compose an entirely orchestral score for the game *Medal of Honor* (EA Games, 1999). For this project, Giacchino composed "sad and sober pieces" that provide a powerful emotional signification throughout the continuing game series. Christopher Lennertz (2004), award-winning composer of *Medal of Honor: Rising Sun* (EA Games, 2003), asserted, "I also tend to be very visceral with my scores as well the action and tension will be on full tilt one minute then followed by a very sparse, subtle moment of plaintive drama. I think that *Medal of Honor* is the perfect canvas for that sort of thing."

EXPERIMENTAL STUDY OF THE IMPACT OF MUSIC ON IMMERSION

As stated at the outset of this chapter, there has been a surprising paucity of empirical research into the role of music in the context of gaming. Both players and, judging from all outward appearances, those involved in creating the games share the belief that the presence of music enhances the video game experience. However, our review of related literature revealed no experimental studies into this relationship. It is possible—perhaps even probable—that such research has been carried out by the companies that produce the video games, but the results—like the programming code for the games themselves—have remained proprietary. In an effort to initiate a much-needed investigation into this matter, the present authors designed and carried out an investigation into the role of music and its effect on the user's immersion in the gaming experience (Zehnder, Igoe, & Lipscomb, 2003), serving as a pilot study for the investigation reported herein. Though the purpose of this chapter is to inform the reader concerning the general role of music in video games, not to disseminate the results of experimental research, the latter is a vital—and currently absent—component in the advancement of knowledge in the field.[3]

Research Questions and Hypotheses

Several research questions were of interest: Do people perceive a game differently due to the presence of music? If so, what are the ways in which music can contribute to the aesthetic experience of the game? Does the presence of music act primarily as a complement to the visual components in that individuals who play the game with music have a similar, but more intense experience? In what ways does the audio-visual interaction contribute to the construction of narrative meaning (i.e., the player's interpretation of the scene)? We predicted that verbal responses provided by participants after exposure to one of three conditions (playing the game with music, playing the game without music, or *music-only*) would be significantly different. We also predicted that the presence of music would intensify the gaming experience, as explained below.

Method

Participants in the study included 76 university (63) and high school (13) students. This sample included 51 females and 25 males (see Table 17.2). Each subject completed a one page

TABLE 17.2
Number of Participants by Gender and School Group

		High School	*University*
Gender	Male	6	19
	Female	7	44

TABLE 17.3
Adjectives for Verbal Response Scales

Not at all Pleasant	Pleasant
Not at all Active	Active
Not at all High	High
Not at all Powerful	Powerful
Not at all Loud	Loud
Not at all Good	Good
Not at all Exciting	Exciting
Not at all Annoying	Annoying
Not at all Busy	Busy
Not at all Strange	Strange
Not at all Dangerous	Dangerous
Not at all Labored	Labored
Not at all Bright	Bright
Not at all Relaxed	Relaxed
Not at all Colorful	Colorful
Not at all Cold	Cold
Not at all Gentle	Gentle
Not at all Intense	Intense
Not at all Fast	Fast
Not at all Simple	Simple
Not at all Masculine	Masculine

pre-experimental survey, in which they provided general demographic information. After being randomly assigned to one of three conditions (with music, without music, or *music-only*), each participant played three segments from *The Lord of the Rings: The Two Towers* video game for the Sony PlayStation2 (Electronic Arts, 2002). Following each segment, participants responded to a series of 21 verbal response scales, providing information about the experience (see Table 17.3). Each subject responded by moving the button on a scrollbar to an appropriate location between two terms anchoring the left and right side of the scroll (e.g., not active–active). This response was recording by the computer software as a value between 0 and 100, based on the location of the scrollbar button. After the participant completed all 21 randomly presented rating scales, they were asked to complete a free-response form containing five questions related to their perception of the musical and/or visual components of the stimulus. The participant would then move on to the next segment of game play, until all three had been completed and their responses collected.

The Stimuli

Three scenes were selected from the *Lord of the Rings: The Two Towers* video game for the purposes of this study, labeled by the investigators as: (1) "Weather Top," (2) "Moria," and (3) "Amon Hen." In all three scenes the players control the character Aragorn.

Weather Top refers to the second level of the video game (the first level after the prologue) where the player's main objective is to protect the character Frodo from the Ringwraiths—menacing-looking characters dressed in dark cloaks that emit shrill screams. The setting is atop a high mountain ruin surrounded by forest at night. In this scene the player must repeatedly relight and wield a torch in order to fend off the Ringwraiths.

Moria refers to a late portion of the second level of the video game where the player must fight through a marsh while orcs attack from the water and as arrows are shot from the surrounding cliffs. Because each participant was only asked to play the later half of this level, an experimenter cued the stimulus (with the sound off) either before the session or while the subject was busy responding to the questionnaire, depending on the randomized scene-order assignment. The scene is very dark and appears to be set at night, and goes through periods of relative quiet, punctuated by the occasional attack from an orc hidden in the marsh. The amount of activity reaches a crescendo as the player approaches the end of the level.

Amon Hen refers to the seventh level of the video game where the players must fight their way down a forest path against the fierce Uruk-Hai fighters, a stronger and larger breed of orc. The scene is set in the daytime in a forest and includes a large number of enemies in close combat. Research participants were instructed to play until they successfully reached the far side of the first bridge spanning the forest trail.

Treatment

Because the game engine for *Lord of the Rings: The Two* Towers allows players the option of turning off the music, the stimuli for Groups 1 and 2 (*game with music* and *game without music*, respectively) required no modification for the purposes of this study. However, Group 3, the *music-only* condition, required the extraction of segments of the in-game musical soundtrack, which were recorded as three separate tracks on an audio CD. Because the game does not allow for the absence of nonmusical sound (without eliminating all sound), the creation of the *music-only* stimuli required that (a) the audio of each game segment be extracted multiple times, (b) edited to eliminate the nonmusical sounds, and (c) reconstructed, keeping the music as intact as possible.[4] The lengths of the music-only stimuli were 54, 86, and 85 seconds, respectively. In comparison, scenes chosen for the game playing conditions were targeted at roughly 120 seconds each.

Results

Interestingly, the study revealed no between-subjects differences in participant responses based on the main effects of gender (female–male), age level (high school–university), or experimental condition (with music, without music, or *music-only*), nor in the interaction between these factors. However, looking closely at the subject responses as a within-subjects factor reveals some interesting differences. Not surprisingly, research participants responded differently to the various verbal scales ($F_{(20,1280)} = 22.606$, $p < .0005$). Participants from high school responded differently to the various verbal scales than the university students ($F_{(20,1280)} = 1.760$, $p = .020$). Differences emerged in the verbal responses to each game segment ($F_{(40,2560)} = 1.464$, $p = .031$), gender influence on the verbal ratings of each game

segment ($F_{(40,2560)} = 1.657$, $p = .006$), and the influence of age level on the verbal ratings of each game segment ($F_{(40,2560)} = 1.622$, $p = .008$). Most important to the present study are the statistical conclusions that research participants responded differently to the verbal scales based on the experimental condition to which they were assigned ($F_{(40,1280)} = 1.522$, $p = .020$) and responded differently to the verbal scales for each scene based on the experimental condition to which they were assigned ($F_{(80,2560)} = 1.330$, $p = .028$). Therefore, though there were no significant differences between the responses of males and females, of high school and university students, or the music condition to which they were assigned, when we begin to look at more complex interactions between these factors and the verbal response scales, some interesting relationships can be identified. Most important, the ratings given to the various scales are significantly influenced by the presence or absence of music.

A detailed discussion of these empirical results is beyond the scope of the present chapter. However, it is worth noting that statistically significant differences clearly emerge as a result of the presence of music in the gaming environment. The results of this experimental investigation also suggest that gender differences and age level differences may provide fertile ground for future research into the role and functions of music in the context of video games.

AVENUES FOR FUTURE RESEARCH

It is our view that although the role of music in video games is generally respected by practitioners and fans, the foundation of scientific knowledge about its specific contribution to the perceptual salience of video games is, at present, virtually unexplored. There is a growing body of literature investigating the role of music in film, but very little experimental research into the role of music in the cultivation of a sense of immersion in the game. A significant portion of this chapter has been invested in establishing a critical vocabulary to support future research into the various roles that music plays in video games.

Of particular importance to video game designers and composers will likely be experimental research studies comparing human thresholds for discontinuity and latency in various formal features of video games, including the musical score. If, after all, music is often used to maintain a sense of continuity when visuals become jumpy or CPU load times create a momentary lag, then it would be useful to know the most effective types of music or implementation strategies that could maximize perceived continuity. Furthermore, in order to design effective interactive music engines, it would be helpful to have a better understanding of the factors influencing the cognition of musical loops and samples as accompaniment to repetitive game tasks.

There is also some important work to be done on the evolving relationship between the video game and music industries, especially with the diffusion of broadband Internet access and online gaming services. It is likely that, as more households connect to the Internet via broadband and video games are developed with more advanced online capabilities, the recording industry will increasingly seize upon the opportunity to license their content for real-time streaming and interactive sampling. Fledgling music licensing divisions like EA Trax will aggressively pursue exclusive licenses of popular music in order to maintain a creative advantage in an extremely volatile industry.

Furthermore, there is a need for historical and critical research on the co-evolution of hip-hop, rap, and video games—especially since it appears that the affinity for these styles of music cut across demographic boundaries, especially within the Sports and Action genres. As Kevin Liles of Def Jam Records explained, "Since the video game audience and hip hop demographics are clearly converging, the partnerships between our two brands is a powerful vehicle for our artists' and music" (quoted in *EA Partners With Major Music Labels and Artists on EA Trax*, 2004). Studies of this type would do well to build upon the body of research on music in

contemporary culture, including research on music in music videos (Hansen & Hansen, 2000), uses and gratifications of popular music among adolescents (Gantz et al., 1978), the relationship of sex and violence in music videos (Gow, 1990), as well as early studies of the cognitive effects of gangsta rap (Hansen, 1995) and rock music (Greenfield et al., 1987).

The future of interactive gaming will undoubtedly be accompanied by an exponential improvement in sound quality and increasing role for music in the overall experience. Driven by future innovations in sound compression, spatialization, and interactive implementation as well as the diffusion of broadband Internet access, music will continue not only to enhance the narrative and emotional qualities of gaming experience, but also provide opportunities for the rich experience of live music, presented virtually.

APPENDIX—GENRE SAMPLES FOR THE "MUSICAL CAPABILITIES BY GENRE" STUDY

The following 69 games were categorized in the *Action/Adventure* genre: *Super Mario Bros, Afterburner, Karnov, Castlevania III: Dracula's Curse, Crash Bandicoot, Resident Evil, Tomb Raider, Mortal Kombat: Trilogy, 007: Goldeneye, MegaMan X4, Skull Monkeys, Star Wars: Rogue Squadron, Tomb Raider II, 007: Tomorrow Never Dies, Silent Hill, Tomb Raider: The Last Revelation, Wu Tang: Shaolin Style, Quake II, Resident Evil 2, 007: Agent Under Fire, Dead or Alive 3, Halo: Combat Evolved, Oni, Silent Hill 2: Restless Dreams, Star Wars: Obi-Wan, Blinx: The Time Sweeper, Conflict: Desert Storm, Disney's Treasure Planet, Max Payne, Medal of Honor: Allied Assault, Medal of Honor: Frontline, Monster's Inc, Robotech: Battlecry, Socom: U.S. Navy Seals, Spider-Man, Spyro: Enter the Dragonfly, State of Emergency, Super Mario Sunshine, The Getaway, Metroid Prime, Tom Clancy's Splinter Cell, Unreal Championship, Sonic Mega Collection, Freedom Fighters, Max Payne 2: The Fall of Max Payne, Prince of Persia, The Hulk, The Legend of Zelda: The Wind Waker, Unreal II: The Awakening, X2: Wolverine's Revenge, Tao Feng: Fist of the Lotus, Soul Calibur II, XIII, Half-Life, Return to Castle Wolfenstein: Tides of War, Star Wars Jedi Knight: Jedi Academy, Delta Force 2, Rayman 2: The Great Escape, Tom Clancy's Rainbow Six: Rogue Spear, Outlaws, Nam, Get Medieval, Descent, Sonic the Hedgehog, Sonic the Hedgehog 2, Sonic the Hedgehog 3, Sonic and Knuckles, Sonic 3D Blast, Sonic Spinball.*

The following 11 games were categorized in the *Racing/Driving* genre: *Cruis'n USA, Twisted Metal 2, GTA2, Midnight Club, Jet Set Radio Future, Sega GT 2002, Wreckless: The Yakuza Missions, Grand Theft Auto: Vice City, Nascar Thunder 2004, Gran Turismo 3, Grand Theft Auto: 3.*

The following 14 games were categorized in the *RPG* genre: *Dragon Warrior, Faxanadu, Parasite Eve, The Legend of Zelda: Ocarina of Time, Threads of Fate, Final Fantasy X, Harry Potter and the Chamber of Secrets, Lord of the Rings: The Fellowship of the Ring, Lord of the Rings: The Two Towers, The Elder Scrolls III: Morrowind, Lord of the Rings: The Return of the King, Star Wars: Knights of the Old Republic, Diabolo II, Dark Stone.*

The following 23 games were categorized in the *Simulation/Strategy* genre: *Metal Gear Solid 2: Sons of Liberty, Britney's Dance Beat, Mario Party 4, Mary-Kate and Ashley: Sweet 16: Licensed to Drive, Warcraft III: Reign of Chaos, Command & Conquer: Generals, The Sims Bustin' Out, Socom II: US Navy Seals, The Sims, Civilization III, Disciples, CyberStorm 2, Jagged Alliance 2, The Operational Art of War, vol 1, Armored Fist 3, Starsiege: Tribes, SimCity 2000 SE, Starfleet Command: Neutral Zone, Police Quest: Swat 2, Homeworld, Pax Imperia: Eminent Domain, Wing Commander: Prophecy, Dr. Robotnik's Mean Bean Machine.*

The following 42 games were categorized in the *Sports* genre: *Duck Hunt, NHL 99, Cool Boarders 4, Knockout Kings 2000, Grind Session, NFL Blitz: 2001, Madden NFL 2001, Tony*

Hawk: Pro Skater 2, Madden NFL 002. Amped: Freestyle Snowboarding, BMX XXX. Madden 2003, FIFA Soccer 2003, WWW Raw, Dead or Alive: Extreme Beach Volleyball, Harry Potter: Quidditch World Cup, Madden 2004, NBA Live 2004, NBA Street Vol. 2, SSX 3, Def Jam: Vendetta, Tony Hawk's Underground, World Series Baseball 2K3, NBA Inside Drive 2004, WWF Smackdown: Justin Bring It, Tony Hawk Pro Skater 3, NHL 000, Tiger Woods PGA Tour, Prime Time Starring Deion Sanders, World Series Baseball, NHLPA Hockey '93, PGA Tour Golf II, Madden 95, John Madden Football '93, NBA Live 95, FIFA Soccer 97, College Football USA 97, John Madden Football '92, Coach K College Basketball, FIFA International Soccer, PGA European Tour, NHL 95.

NOTES

[1]For the purposes of this chapter, "film" is used as an umbrella term to describe all cinematic audio-visual media without drawing distinctions between various digital and analog formats.

[2]The number and percent of games by platform were the following: NES (n = 7; 4.4%), Nintendo 64 (n = 10; 6.3%), Sega Genesis (n = 21; 13.2%), Sony Playstation (n = 19; 11.9%), Sony Playstation 2 (n = 39; 24.5%), Nintendo GameCube (n = 8; 5.0%), Miscrosoft Xbox (n = 24; 15.1%), and PC/CDROM (n = 31; 19.5%).

[3]Results of the statistical analyses are presented in an abbreviated format, providing the essential information for those to whom such figures are useful. Any reader interested in more detailed results should contact the primary author via email (s-zehnder@northwestern.edu) for details.

[4]The signal path was from the Playstation 2 audio out directly into a Motu 828. The Motu was connected via firewire to a Mac G4 Powerbook, running Logic Audio Platinum 5. The editing of the segments was done by first eliminating any unwanted nonmusical sounds from each extraction, resulting in several layers of music files with gaps of silence. These files were then combined so as to "fill in the gaps" by pasting portions of each layer together at identical zero-crossings, resulting in one seamless audio file identical to the in-game sound excluding nonmusical sounds. As a player of the game, one author (SZ) determines that these excerpts were representative of music that would accompany the gaming experience.

REFERENCES

Belinkie, M. (1999). Video game music: Not just kid stuff. Special Report for VGMusic.com. Retrieved May 15, 2004, at http://www.vgmusic.com/vgpaper.shtml.

Bengtsson, I., & Gabrielsson, A. (1983). Analysis and synthesis of musical rhythm. In J. Sundberg (Ed.), *Studies of music performance* (pp. 27–60). Stockholm: Royal Swedish Academy of Music.

Biocca, F., & Delaney, B. (1995). Immersive virtual reality technology. In F. Biocca & M. Levy (Eds.), *Communication in the age of virtual reality* (pp. 57–124). Hillsdale, NJ: Lawrence Erlbaum Associates.

Bolivar, V. J., Cohen, A. J., & Fentress, J. C. (1996). Semantic and formal congruency in music and motion pictures: Effects on the interpretation of visual action. *Psychomusicology, 13*, 28–59.

Boltz, M. (1992). Temporal accent structure and the remembering of filmed narratives. *Journal of Experimental Psychology: Human Perception and Performance, 18*, 90–105.

Boltz, M. (2001). Musical soundtracks as a schematic influence on the cognitive processing of filmed events. *Music Perception, 18*(4), 427–454.

Boltz, M., Schulkind, M., & Kantra, S. (1991). Effects of background music on the remembering of filmed events. *Memory & Cognition, 19*, 593–606.

Brown, R. (1988). Film and classical music. In G. R. Edgerton (Ed.), *Film and the arts in symbiosis: A resource guide* (pp. 165—215). New York: Greenwood Press.

Bullerjahn, C., & Güldenring, M. (1996). An empirical investigation of effects of film music using qualitative content analysis. *Psychomusicology, 13*, 99–118.

Campbell, W., & Heller, J. (1980). An orientation for considering models of musical behavior. In D. Hodges (Ed.), *Handbook of music psychology* (pp. 29–36). Lawrence, KS: National Association for Music Therapy.

Cavalcanti, A. (1985). Sound in films. In E. Weis & J. Belton (Eds.), *Film sound: Theory and practice* (pp. 98–111). New York: Columbia University Press.

Chion, M. (1994). *Audio-Vision: Sound on screen* (C. Gorbman, Trans.). New York: Columbia University Press. (Original work published in 1990).

Clarke, E. (1988). Generative principles in music performance. In J. A. Sloboda (Ed.), *Generative processes in music* (pp. 1–26). Oxford, England: Clarendon.

Clynes, M. (1983). Expressive microstructure in music, linked to living qualities. In J. Sundberg (Ed.), *Studies of music performance* (pp. 76–181). Stockholm: Royal Swedish Academy of Music.

Dowling, W. J., & Harwood, D. L. (1986). *Music cognition*. Orlando, FL: Academic Press.

Davies, J. B. (1978). *The psychology of music*. Stanford, CA: Stanford University Press.

EA Partners With Major Music Labels and Artists on EA Trax. Music4Games.com. Retrieved March 24, 2004, at http://www.music4games.net/n_eatrax.html.

Gabrielsson, A. (1988). Timing in music performance and its relations to music experience. In J. A. Sloboda (Ed.), *Generative processes in music* (pp. 27–51). Oxford, England: Clarendon.

Gantz, W., Gartenberg, H. M., Pearson, M. L., & Schiller, S. O. (1978). Gratifications and expectations associated with pop music among adolescents. *Popular Music in Society, 6*, 81–89.

Giacchino, M. (2002). Medal of Honor: Frontline (Soundtrack). Electronic Arts, Inc.

Gorbman, C. (1987). *Unheard melodies: Narrative film music*. Bloomington: Indiana University Press.

Gow, J. (1990). The relationship between violent and sexual images and the popularity of music videos. *Popular Music and Society, 14*(4), pp. 1–10.

Greenfield, P. M., Bruzzone, L., Koyamatsu, K., Satuloff, W., Nixon, K., Brodie, M., & Kingsdale, D. (1987). What is rock music doing to the minds of our youth? A first experimental look at the effects of rock music lyrics and music videos. *Journal of Early Adolescents, 7*, 315–330.

Hansen, C. H. (1995). Predicting cognitive and behavioral effects of gangsta' rap. *Basic and Applied Social Psychology, February, 16*(1–2), 43–52.

Hansen, C., and Hansen, R. (2000). Music and music videos. In D. Zillmann & P. Vorderer (Eds.), *Media entertainment: The psychology of its appeal* (pp. 175–196). Mahwah, NJ: Lawrence Erlbaum Associates.

Hanslick, E. (1986). *On the musically beautiful: A contribution towards the revision of the aesthetics of music* (8th ed., G. Payzant, Trans.). Indianapolis, IN: Hackett Publishing. (Original work published in 1891).

Hood, M. (1982). *The ethnomusicologist*. Kent, OH: Kent State University Press.

Hyde-Smith, A. (2004a). Interview with Composer Bill Brown. *Music4Games.com*. Retrieved March 23, 2004, at http://www.music4games.net/f_billbrown.html.

Hyde-Smith, A. (2004b). Interview with Medal of Honor Composer Michael Giacchino. *Music4Games.com*. Retrieved March 23, 2004, at http://www.music4games.net/f_moh_mgiacchino.html.

Iwamiya, S. (1996). Interactions between auditory and visual processing when listening to music in an audio visual context: 1. Matching 2. audio quality. *Psychomusicology, 13*, 133–153.

Jackson, B. (2004a). Game sound: Audio at electronic Arts. *Mix*, March. Retrieved July 7, 2005, from http://mixonline.com/recording/interviews/audio_audio-electronic_arts/.

Jackson, B. (2004b). Game sound: Ensemble Studios on gods, trolls and minotaurs. *Mix*, at http://mixonline.com/recording/applications/audio-ensemble-studios-goods/.

Kendall, R. A., & Carterette, E. C. (1990). The communication of musical expression. *Music Perception 8 (2)*, 129–163.

Krumhansl, C. L., & Schenck, D. L. (1997). Can dance reflect the structural and expressive qualities of music? A perceptual experiment on Balanchine's choreography of Mozart's *Divertimento No. 15*. *Musicae Scientiae, 1*(1), 63–85.

Langer, S. K. (1942). *Philosophy in a new key: A study of symbolism of reason, rite, and art* (3rd ed.). Cambridge, MA: Harvard University Press.

Lee, K. M. (2004). Presence, explicated. *Communication Theory, 14*(1), February, 27–50.

Lennertz, C. (2004). Interview with New Medal of Honor Composer Christopher Lennertz. *Music4Games.com*. Retrieved March 23, 2004, at http://www.music4games.net/f_moh_christopherlennertz.html.

Lipscomb, S. D. (2005). The perception of audio-visual composites: Accent structure alignment of simple stimuli. *Selected Reports in Ethnomusicology, 11*, Winter, 37–67.

Lipscomb, S. D., & Kendall, R. A. (1996). Perceptual judgment of the relationship between musical and visual components in film. *Psychomusicology, 13*(1), 60–98.

Lipscomb, S. D., & Tolchinsky, D. E. (2005). The role of music communication in cinema. In D. Miell, R. MacDonald, & D. Hargreaves (Eds.), *Music communication*. Oxford, UK: Oxford University Press, 283–404.

Lomax, A. (1962). Song structure and social structure. *Ethnology, 1*, 425–451.

Marshall, S. K., & Cohen, A. J. (1988). Effects of musical soundtracks on attitudes toward animated geometric figures. *Music Perception, 6*, 95–112.

Merriam, A. P. (1964). *The anthropology of music*. Evanston, IL: Northwestern University Press.

Meyer, L. B. (1956). *Emotion and meaning in music*. Chicago: University of Chicago Press.

Nettl, B. (1983). *The study of ethnomusicology*. Urbana: University of Illinois Press.

North, A. (2003). Medal of Honor: Frontline (Soundtrack Review). Retrieved May 10, 2004, at http://www.film-tracks.com/titles/medal_honor3.html. Last modified: July 27, 2003.

Palmer, M. T. (1995). Interpersonal communication and virtual reality: Mediating interpersonal relationships. In F. Biocca & M. R. Levy (Eds.), *Communication in the age of virtual reality* (pp. 277–302). Hillsdale, NJ: Lawrence Erlbaum Association.

Peirce, C. S. (1931–1935). *Collected papers* (Vols. 1–6). C. Hartshorne & P. Weiss (Eds.). Cambridge, MA: Harvard University Press.

Peterson, G. (2004). From the editor: Not just a game! *Mix*, March. Retrieved 7/27/05, from http://mixonline.com/mag/audio-not-game/

Reesman, B. (2004). Music for games: Bob Daspit. *Mix*, March. Retrived 7/27/05, from http://mixonline.com/recording/interviews/audio-music-game/

Rosar, W. H. (1996). Film music and Heinz Werner's theory of physiognomic perception. *Psychomusicology, 13*, 154–165.

Sanger, G. A. (2004). *The fat man on game audio: Tasty morsels of sonic goodness*. Indianapolis, IN: New Riders.

Seashore, C. E. (1938). *Psychology of music*. New York: McGraw-Hill. (Reprinted, New York: Dover, 1967).

Senju, M., & Ohgushi, K. (1987). How are the player's ideas conveyed to the audience? *Music Perception, 4*, 311–323.

Sirius, G., & Clarke, E. F. (1996). The perception of audiovisual relationships: A preliminary study. *Psychomusicology, 13*, 119–132.

Sonnenschein, D. (2001). Sound design: The expressive power of music, voice, and sound effects in cinema. Studio City, CA: Michael Wiese Productions.

Stam, Robert (2000). *Film theory*. Oxford, England: Blackwell.

Sundberg, J. (1988). Computer synthesis of music performance. In J. A. Sloboda (Ed.), *Generative processes in music* (pp. 52–69). Oxford, England: Clarendon.

Sundberg, J., Frydén, L., & Askenfelt, A. (1983). What tells you the player is musical? An analysis-by-synthesis study of music performance. In J. Sundberb (Ed.), *Studies of music performance* (pp. 61–67). Stockholm: Royal Swedish Academy of Music.

Tannenbaum, P. H. (1956). Music background in the judgment of stage and television drama. *Audio-Visual Communications Review, 4*, 92–101.

Thayer, J. F., & Levenson, R. W. (1983). Effects of music on psychophysiological responses to a stressful film. *Psychomusicology, 3*, 44–54.

Thompson, W. F., Russo, F. A., & Sinclair, D. (1996). Effects of underscoring on the perception of closure in filmed events. *Psychomusicology, 13*, 9–27.

Vitouch, O. (2001). When your ear sets the stage: Musical context effects in film perception. *Psychology of Music, 29*, 70–83.

Wagner, R. (1964). *Wagner on music and drama*. New York: Da Capo Press, Inc.

Winter, David. Atari Pong—the first steps. Retrieved April 20, 2004, at http://www.pong-story.com/atpong1.htm.

Zehnder, S., & Calvert, S. (2004). Developmental differences in older and younger adolescents' understanding of heroic depictions. *Journal of Communication Inquiry*, April, 122–137.

Zehnder, S., Igoe, L., & Lipscomb, S. D. (2003). Immersion factor—sound: A study of the influence of sound on the perceptual salience of interactive games. Paper presented at the conference of the Society for Music Perception & Cognition. Las Vegas, NV, June 2003.