7

Positive Effects of Sound

7.1 Introduction

While most of the effects mentioned up to this point have been negative, there are many positive effects associated with sound. Music has been known throughout history to promote positive effects on people, and entire industries have been established around music psychology and sound therapies meant to assist with the treatments of human ailments. Much research has been performed in this field, but there is also a significant amount of anecdotal information. This is explored in this chapter, along with the importance of natural sounds, leading to a discussion of the concept of soundscapes. The chapter concludes with a discussion of how sound is used to influence people and, although this aspect of sound is included in the discussion of positive effects, it is debatable whether this use of sound is positive or negative.

7.2 Music Psychology

While the word "noise" can be traced to the definitively negative Latin word *nausea*, the word "music" stems from the pleasurable effects related to the Greek Muses. Although the psychological effects related to music have been documented throughout history, the science associated with those effects has been formally documented since the 19th century, most notably beginning with Hermann Helmholtz's *On the Sensations of Tone as a Physiological Basis for the Theory of Music* (first published in 1862, translated from the original German into English and republished in 1954 [1]). Since that time and continuing to the present day, research has been attempting to answer the questions about how and why music affects people so profoundly, while there is no doubt that it does. For thorough discussions on the current state of research in this area, the reader is referred to such texts

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as the *Handbook of Music Psychology* [2] and the *Handbook of Music and Emotion* [3]. The discussion in this book is limited to the actual effects.

Music's main benefit (or detriment) is the emotional connection created with the individual listener. Until recent times, the emotional connection between music and listeners has been (for the most part) related to the tonal and rhythmic qualities of the music. The exception to this is religious or cultural music that has been associated with emotional experiences due to its association with the spiritual realm through repetition and the inherent beliefs associated with it. Lyrics in contemporary music have added a new dimension to that emotional connection by adding specific meaning to songs and enhancing that connection with people dealing with their own related struggles. This results in subjective responses to music that are a function of personal experiences, making it difficult, if not impossible, to determine general rules or trends for these responses.

The loudness of music, or any sound, can elicit an emotional response. As discussed in earlier chapters, elevated sound levels are most often associated with the negative effects of sound on people. However, certain acoustical environments generate arousal when sound levels are elevated, such as at concerts or rallies [4]. This arousal can be enhanced by generating vibratory sensations and even activating the vestibular system at high, low-frequency sound levels at night clubs and concerts, where typical sound levels have been measured to exceed the threshold of body vibrations in the 100–300 Hz range [5].

Whether or not lyrics are involved, cultural roots affect the types of music to which people become accustomed. Independent of these cultural influences, there are three basic emotions elicited by music – happiness, sadness, and fear. These emotions have been shown to be universal among humans through recent studies with isolated African Mafa tribe members, in which these people were exposed to Western music never heard before to elicit the same emotions as those elicited by the same music on Westerners who were familiar with the music [6]. Another study in the US involved exposing university students to different types of music that elicited the emotions of happiness, sadness, fear, and tension, while physiological measures of cardiac, vascular, dermal, and respiratory functions were monitored. Music associated with sad emotions produced the largest changes in heart rate, blood pressure, skin conductance, and temperature, while music associated with happiness produced the largest changes in respiration [7], clearly demonstrating the physiological changes induced by different types of music.

In a demonstration that the type of music affects emotional states, the same safety film showing industrial accidents was shown to three groups of people – one group being exposed to no music during the film, one group being exposed to non-descript music, and the third group being exposed to dissonant music typically used in horror films. Stress reactions were monitored in each of the subjects and those exposed to the nondescript music exhibited lower stress than those being exposed to no music, while those exposed to the horror film music during the same film exhibited higher stress reactions than those being exposed to no music [8], The amygdala in the brain appears to have the most influence on startle and fear reactions associated with sound [3]. It is one of the emotional centers of the brain, used, in particular, for recognition of danger. The amygdala also regulates memory, which makes it instrumental in associating memories with fears. Since the amygdala is always functioning, it is instrumental in waking us when a sound is associated with danger.

Music in general can have the effect of either distraction or enhancement in task performance, depending on the specific task and personal preference. For example, reaction times during driving can be affected by music. A study in Australia showed that reaction times were enhanced by listening to moderate levels of music but were degraded when listening to higher levels [9]. In this case, 1990s heavy metal dance music was being played in the mid-50s on the dBA scale at the listener for the moderate condition and in the mid-80s on the dBA scale for the higher-level condition. This may not be a universal conclusion, however, as the subjects were university students and subjects of different ages and different music types were not included. Another confounding factor for these studies is personality type. A UK study involving university students evaluated task performance of introverts and extraverts while being exposed to silence, music, and typical office noise [10]. Although task performance for both personality types was negatively affected by music and noise, introverts were more affected than extraverts in each category of exposure. This study also used high-tempo music so, although these results are significant, they can't be generalized to all types of music.

Music types can affect behaviors under different circumstances. This can be used to influence consumer behaviors in different environments, as will be discussed later in this chapter, but general music environments tend to be more conducive to specific types of behaviors. For example, it has been shown in a French study that loud music (88 vs. 72 dB at the center of the room) in bars leads to increased alcohol consumption and faster drinking rates [11].

Other environments heavily influenced by music are exercise facilities. The arousal potential of a generic piece of music (to minimize subjective aspects of the music perception) is based on its tempo and level. A UK study using university students supports the widely held notion that music listened to at higher sound levels and higher tempo (producing higher arousal rates) is preferred for exercising activities, while lower tempo and sound levels are preferred for relaxation [12]. The conditions used in this study included the same generic music samples modified to 80 beats/min and 60 dB at the listener for low arousal and 140 beats/min and 80 dB at the listener for the high arousal. There is general agreement that music accompanying exercise results in increased exertion, a reduction in the rate of perceived exertion, and enhancement of affective states at high levels of work intensity [13].

Although music has many confirmed and widely accepted beneficial effects on people, some effects have been identified in isolated research studies that have not been supported by further research. An extreme example of this is what became to be known as the Mozart effect, stemming from a small California study published in 1993 which morphed into a mass-media educational movement. The original study involved 36 college students who took standardized intelligence tests under three different conditions – after listening to 10 minutes of Mozart's sonata for two pianos in D major, after 10 minutes of listening to a relaxation tape, and after 10 minutes of silence. The results showed an equivalent of eight- to nine-point intelligence quotient (IQ) score increases after listening to the Mozart piece compared with scores under the other conditions; however, the effect only lasted for 10–15 minutes following the exposure [14]. The premise behind this study was extrapolated by the communications media to the general idea that listening to classical music enhances intelligence, a premise that has since then been debated by scientists worldwide. Music therapy work by French physician Alfred Tomatis, reported in his autobiography [15] and

publicized through a book trademarking the name of the effect [16], affected curricula worldwide and established an industry of books and audio programs touted to increase intelligence by listening to music. The premise was diffused by 1999 with the publication of studies that clarified these results [17], including comments by the authors of the original 1993 study stating that they never claimed that listening to classical music enhances intelligence and that the effects were limited to spatial-temporal tasks involving mental imagery and temporal ordering. A summary of how this phenomenon began, thrived, and disappeared was published shortly thereafter [18]. This by no means diminishes the potential benefits of music and sound therapies, but merely shows an example of how these benefits can be misinterpreted. Sound therapies, when performed by trained, experienced professionals, can provide highly beneficial results.

7.3 Sound Therapies

Over the past century, music has been associated with variations in the following physiological responses through numerous research studies [2]:

- Heart and pulse rate
- Skin response and temperature
- Respiration rate
- Blood pressure
- Muscular tension/posture
- Blood volume
- Stomach contraction
- Pupillary reflex
- Blood oxygen level
- Hormone secretion.

In this regard, music has been proven through numerous studies to relieve stress [19]. The principle of entrainment can also have a significant effect on one's reaction to music. Entrainment is the process by which energy in one object is projected onto another to the point where the second object is synchronized with the energy of the first. This phenomenon occurs in nature when schools of fish or flocks of geese move in organized patterns. It also occurs in acoustics, manifested through external symptoms of moving with the rhythm of music to internal symptoms of variations in bodily functions and thought patterns. Entrainment is not associated with mechanical resonance. Resonance is a mechanical reaction to physical characteristics associated with sound exposure. Entrainment may have some mechanical components, especially in its manifestations, but it is not frequency-specific as it is not related to the mechanical structure of the object. Entrainment, especially with regard to sound, can also have an emotional component which transcends anything related to mechanical resonance.

The ability of sound energy to manipulate organisms and treat illnesses has been widely documented, both anecdotally and through research programs. Cells have been photographed

to be manipulated by exposure to music [20] and medical doctors have documented numerous cases of illness recoveries from sound therapies involving music, voice, and tones [21–23]. As many of these treatments are more anecdotal than scientific in their publications, the reader is referred to these sources with that understanding.

The use of music in treating physical and mental illnesses has been documented for thousands of years. Music therapy has developed into a credible profession since the mid-20th century with the establishment of the American Music Therapy Association (AMTA) in the US, offering a board-certification program from which there are currently over 5,000 members, and later in Italy with the establishment of the World Federation of Music Therapy. A thorough history of the profession of music therapists can be found in the AMTA's latest overview [24]. As noise has been associated with stress-related dis-eases, music is associated with the eases of relieving stress by activating the same systems in the body to result in positive effects. This assumes that the music is pleasing to the individual, however, since taste in music is purely subjective and music can be interpreted as noise depending on the person and circumstance.

Music therapists' work has been documented to ease most physical and mental afflictions, but the key word is "ease" rather than cure. A recent study of cardiac rehabilitation patients showed clear physical (with respect to blood pressure) and psychological benefits from the stress reduction associated with music therapy when it accompanied outpatient rehabilitation exercises [25]. A recent review of 26 studies involving 1,369 participants found a general trend that sedative music could have a beneficial effect for people with coronary heart disease, in terms of lowering systolic blood pressure and heart rate, and also for reducing anxiety for heart attack patients in hospitals [26].

With regard to pain, there are mixed results. A recent review of 51 studies involving 3,663 participants found that listening to pleasing music relieves pain intensity and reduced medication requirements, but the magnitude of that effect is small [27]. Another review of 14 studies shows positive results in pain management, in that music pieces selected by the subject may promote healing through repair mechanisms in the brain with fewer side-effects than those associated with medications [28].

Significant research has also been performed relating music therapy to cancer treatment. A recent review of 30 studies involving 1,891 participants reported positive effects mostly for relieving anxiety and improving mood for cancer patients [29]. Another study review found qualitative improvements for cancer patients in general, with live music by a qualified music therapist being more effective than recorded music [30]. One key aspect of music for patients besides the qualitative improvements is distraction from side-effects, reducing symptom severity for many. There is also some evidence of music therapy boosting the immune system and promoting neurological blocking mechanisms for pain [31]. These are clear examples of the positive psychological effects associated with sound.

7.4 Natural Sources/Soundscapes

The natural environment has long been treasured for its restorative effects from the complexities of urban living [32]. Although urban environments have been considered as being inherently noisy and rural environments inherently quiet, the types of sound

sources in these different environments do more to dictate the subjective experience than the actual sound pressure level exposures. It is a valid statement that urban areas have a greater potential to be louder than rural areas because of the many dominant sound sources unique to those environments, but the perceived qualities of those environments are highly subjective.

Some claim that silence is required for a peaceful environment while complete silence can be frightening in many conditions. Although it is generally recognized that an environment in which equivalent noise level ($L_{eq(24)}$) values are less than 45 dBA are acceptable, when speaking in terms of a desire for quiet, the implied aural goal is for "calm" conditions in which noise is not dominant, as defined by the European Environment Agency in their *Good Practice Guide on Quiet Areas* [33].

Each environment has its own soundscape, a term coined by Canadian composer R. Murray Schafer in his 1977 book introducing the subject [34]. The term "soundscape" describes the aural environment associated with a region. It does not imply quiet; it is associated with background sounds inherent to an area. Sound sources not typical for an area are unacceptable components of the soundscape and the goal of a soundscape designer is to preserve the desired aural environment of the community.

The quality of natural quiet has been removed from many areas over the past century with the expansion of transportation networks, with the air travel industry making the most difference, as illustrated in Figure 6.1. Natural quiet in Figure 6.1 is defined by areas not influenced by transportation noise, but true natural quiet is associated with areas devoid of any anthropogenic sound sources. Undisturbed natural environments are being preserved in the US by the National Park Service (NPS), but even they are struggling with man-made sound sources threatening those soundscapes. Trains, buses, cars, motorcycles, snowmobiles, jet skis, military training flights, tourist helicopters, and resource extraction (such as oil, gas, mineral, and timber) negatively affect the soundscape of these areas and efforts continue to reduce activities associated with these sources in protected lands [35,36].

In *Voices of the Wild*, Bernie Krause introduces the field of soundscape ecology, which divides soundscape components into three categories – geophony (natural sources), biophony (sounds from living organisms), and anthropophony (sounds generated by humans) [37]. A concern among soundscape ecologists is that humans are causing changes to soundscapes that are minimizing the availability of natural soundscapes for all species, a point that is illustrated in Figure 6.1 in Chapter 6 for the US.

As background sound pressure levels in some of these areas are below 20 dBA [38,39], preserving the natural quiet has its challenges. The NPS includes soundscape management in their management policies to address these issues by taking action to minimize impacts to the natural soundscapes on NPS properties [40]. To illustrate the value of preserving natural quiet in these settings, visitors to a national park in Spain were recently surveyed about the soundscape and they exhibited a willingness to pay an entrance fee to fund a noise reduction program at the park intended to minimize unnatural sounds [41].

Natural sounds have been shown to promote faster recovery from psychological stress than man-made sounds such as traffic and building ventilation system noise. A recent Swedish study showed that this was true even for lower levels of man-made sounds

(by as much as 10 dBA on average; specifically, 50 dBA L_{eq} of bird and fountain sounds resulted in faster recoveries than 40 dBA L_{eq} of man-made ventilation system sound exposure) compared with those of natural sounds [42]. This restorative effect of natural sounds has been recognized by urban planners with their introduction of the quiet-side concept into urban residences, for which a side of the building is facing away from major community noise sources (such as traffic) to create an environment in which the background noise levels are 10–20 dBA quieter than on the side of the building facing the dominant sources. Quiet courtyards can provide quality environments for rest and relaxation, but only in areas with moderate background sound levels. It has been found that when outdoor noise levels exceed an $L_{eq(24)}$ of 60 dBA on the exposed side of the building, the perceived beneficial effect of the quiet side diminishes [43]. The maximum benefit of quiet-side designs occurs when quiet-side background levels are less than an $L_{eq(24)}$ of 48 dBA [44].

It must be considered that the pleasant sounds of birds during the day, insects at night, flowing water through creeks, and ocean waves on beaches can generate sounds into the 50s and 60s on the dBA scale. The qualification of "quiet" must therefore be defined in terms of a minimum of non-natural sounds, rather than an absolute decibel limit. Sounds must also be put into context. The continuous rhythmic sounds of crickets, cicadas, and katydids can be soothing, while the sound of a single mosquito or bee at a lesser sound level and similar frequency range can have the opposite reaction. Placing numerical limits on the soundscape can be impractical as the soundscape concept is based on the inclusion of inherent sounds. The goal is not the absence of sound but the absence of unwanted sound sources that mask or alter the desired acoustic environment.

The urban soundscape is much more complicated than the natural soundscape. Sounds associated with the urban experience form the lifeblood of a city, complete with notable soundmarks (analogous to landmarks) in each area. Soundmarks can be passive or active, with passive soundmarks intentionally added to an area (e.g. fountains and church bells) and active soundmarks generated from human and animal activities. These aspects need to be balanced to result in a pleasant environment. A recent Italian survey showed that the aural environment in historic areas banned from traffic did not turn out to be as pleasant as expected, because isolated sound events were more intrusive with the quieter background [45]. A recent soundscape survey of an historic district in China emphasizes yet another important point, that the acceptability of specific sound sources is subjective and the satisfaction of an aural environment also depends on non-acoustic factors, such as the age of the listener, weather conditions, cultural identity, vitality, sanitation, and landscaping [46]. A natural component to the soundscape is always welcome in any environment, especially through the introduction of birdsong, but preferences tend to change with the age of the individual, leaning towards exclusively natural sounds with increasing age [47].

As mentioned, quiet does not necessarily imply satisfaction with an aural environment. The many typical aural characteristics of an urban environment embody an aspect of the attractiveness of these types of areas. There is therefore no set of acoustic guidelines for ideal soundscapes. The ideal soundscape for any area is unique to that area, driven by the desires of the local population at the time. Soundscapes should therefore be fluid and be dictated by the current inhabitants.

7.5 Using Sound to Influence People

All of the information mentioned thus far supports the premise that sound affects people in physiological and psychological ways; however, these effects have, for the most part, been conscious. Accounts of the influence of sound on people have been passed on throughout history, from the haunting chants of the Sirens in Homer's *Odyssey* in the 8th century BC to religious chants still practiced to this day, sound has been used to influence people's behavior at a local level for thousands of years. The advent of electroacoustic systems in the 20th century created the new potential to influence people with sound on a mass level.

This idea was first introduced by Brigadier General George Owen Squier in the US, with the introduction of electronic mood music in the 1930s. Squier was a pioneer in the telecommunications industry and, later in life, after retiring from a distinguished career in the American Army, he applied his experience to develop a mass communication music service. He presented his patents to the North American Company, which created Wired Radio, Inc. in 1922 to distribute news and dance music for a monthly fee to homes and small businesses. Before his death in 1934, Squier changed the name of the company to Muzak (from a combination of music and Kodak) to give it more of a memorable name. At that point, the Muzak Corporation was researching the effects of sound on people with regard to mood, and the mass production of mood music was expanded into every aspect of commercial life. The idea was to provide aural wallpaper to commercial establishments and workplaces, with nondescript music that created a pleasurable environment in which the music blended in with the atmosphere without creating any distractions. It is, as R. Murray Schafer wrote, "music that is not to be listened to [34]." The story behind Muzak has been chronicled by Joseph Lanza in *Elevator Music* [48], for those interested in more related information.

The premise behind the success of the Muzak Corporation has been researched extensively since the 1930s, and it has been extrapolated into the marketing of products and services on a global level. The general musical characteristics of mode, tempo, pitch, rhythm, harmony, and volume can be varied to produce specific emotional responses [49]. These have been used historically in television and cinema, and have more recently been introduced into the general sales communities. It was initially called "elevator music," because elevators were new inventions in tall buildings at the time and the music was introduced to ease the fears of those using these new devices to quickly ascend and descend between floors.

Another powerful aspect of influential sound is the impact of the lack of it. Silence in an advertisement can have a profound effect, especially when the advertisement includes visual information, such as on television or in the theater. Depending on the context, silence can attract attention to evoke emotions such as intrigue, curiosity, and contemplativeness [50]. Silence can also influence discomfort in an environment. An experiment with 100 students showed that waiting times were underestimated significantly more in conditions where there was music as compared with conditions where there was silence, and three to four times more students left the experiment early after waiting in silence compared with those waiting with music [51]. This was independent of the type of music, suggesting that people are willing to wait longer in conditions with background music than in conditions with

silence. Although the distracting nature of music clearly plays a significant role in this, the pleasantness and familiarity with the music also plays a role. This was confirmed in a British study showing that listening to music that people liked or that fit the conditions resulted in longer waiting times on telephone calls [52].

A discussion on the subject of sound's influence on people cannot be complete without mentioning subliminal messaging. Since the 1950s, visual and auditory messages have been added to advertisements with the intention of influencing buying decisions. The exposure of these tactics initially resulted in outrage and fear of unwelcomed manipulations and brainwashing that were not limited to advertising. For the most part, the influential power of these messages was found to be limited, especially in the 1980s after subliminal self-help audio recordings that flooded the market, advertised to improve every aspect of the listener's life, were proved to be ineffective [53].

Since that time, research has revealed more subtle but powerful methods to influence people's buying decisions. A host of studies have showed how music can affect consumer behaviors in different environments. Examples of this premise have been published with regard to retail and occupational environments, with effects based more on emotional response than on brand recognition or purchase intent [54]. Music evoking sad emotions has been shown to influence greeting card purchases more than music evoking happy emotions or no music [55].

Several studies on wine purchases noted that the type of background music in the stores influenced the price of wines sold rather than the volume of sales. One US study showed that patrons tended to buy more expensive bottles of wine when classical music was being played in the store than when top-40 music was being played [56]. In a separate UK study, French and German wines were displayed in a store side by side and patrons bought more of the French wine while French music was playing in the background and more of the German wine while German music was playing in the background [57,58]. This supports the premise of having the music fit the products being sold to maximize sales.

Another aspect of music in shopping environments is time perception. A US study in a clothing store noted that the only effect of varying music in the store was the perception of shopping time. In this case, two types of music were played in the store – background instrumental and foreground original music – in addition to no music for periods of time. Shoppers under 25 years of age reported that they spent more time than expected in the store when exposed to background music and those 25 and older reported the same thing when exposed to foreground original music [59]. A more recent US study by the same researchers revealed that people spent more time shopping in an environment in which unfamiliar music was being played in the background than in environments in which familiar music was being played [60]. This was reported to be associated with the differences attributable to emotional responses related to the music. As people tend to buy more when they spend more time at an establishment, this supports the premise that playing unfamiliar, rather than familiar, music may result in more sales.

The food service industry has had several research studies carried out to determine optimal background conditions for restaurants. In terms of general pitch perception associated with taste, a UK study yielded results showing that sweet and sour foods tend to be associated with higher-pitched sounds, implying that the taste of food may be influenced by the frequency content of background sounds [61].

Music tempo has been shown to be influential in terms of arousal and the length of time patrons spend in restaurants. One US study was set in a restaurant crowded on Friday and Saturday nights, in which the background music tempo was randomly varied by night, with 72 beats/min defining the upper limit of slow tempo music and 92 beats/min defining the lower limit for fast tempo music. The findings revealed that patrons exposed to slow tempo music stayed longer, ate the same amount of food, and consumed more alcoholic beverages than those exposed to fast tempo music [62]. An Australian study investigated the atmosphere created in a restaurant in which different types of music were being played. The results of this study showed that patrons were willing to spend more money in a restaurant when popular, jazz, and classical music were being played in the background [63]. This supports the results of an earlier UK study, which found that no music or easy listening music in the background significantly lowered the perceived value of food and services in the venue [64]. The premise of "fit" is also seen in restaurants, in that music viewed as fitting the environment of the restaurant promotes an expectation of spending more. Research has shown that the music being played in a dining facility can be directly correlated with a person's feeling about the establishment, in that if a person likes the music being played, then that person also likes the atmosphere of the establishment and is likely to return [65]. Yet another aspect that affects patron behavior is the loudness of the music. It has been found that softer music in restaurants results in patrons spending more money than they would in louder establishments [66]. It is also helpful to provide music in waiting areas to shorten the perceived waiting time and minimize patron irritation.

The supermarket is yet another shopping venue studied for the effects of background music on customer behaviors. As for restaurants, studies have shown that the tempo of the music tends to influence the time and money spent at the establishment, with slow tempos resulting in increased revenues [67]. A balance must be struck, however, to provide music that matches the tastes of the majority of patrons, with the understanding that some music genres may offend or irritate some patrons. Ethnic establishments playing ethnic music must tailor the tempo and loudness to the prevailing age group and tempo appropriate to the desired environment [68].

Research has shown that music plays a key role in identifying the image of a consumer establishment. Background music can establish an environment that is perceived as being upbeat or dynamic, aggressive or threatening, and sophisticated or intellectual [69]. Music found to induce pleasure and arousal has been shown to increase consumers' desire to participate in buyer–seller interactions under low and high conditions, but not under moderate conditions [70].

Although the effects of music in retail establishments are consistent, documented occupational effects are not. It is universally accepted that music affects time perception and often makes a job more pleasant, but productivity does not appear to be affected by any type of music, even though perception of increased productivity is often present [71]. This is the case regardless of the complexity of the tasks. Noise, on the other hand, has been associated with negative effects on productivity, as mentioned in Chapter 5.

These principles are now becoming adopted by the business community, with the current emphasis on branding. The branding of a sound signature is becoming just as important to a company's image, if not more so, than its physical logo, most notably with sonic brands

associated with companies such as Intel, AT&T, and T-Mobile. Just hearing the few notes associated with these companies immediately brings them to mind. The hope is that these sonic signatures will become earworms [23], which are sonic signatures or parts of songs that stay in our memories for extended periods of time. Also called stuck song syndrome and involuntary musical imagery, it is not completely understood why we lose conscious control of earworms repeating in our minds. What is known is that they mainly depend on an individual's state of mind and personal history, making the phenomenon completely subjective and difficult to generalize [72]. Although earworms have had suggested links with obsessive-compulsive disorder, there has been no proof of that as yet [73].

Sonic logos are carefully developed to be memorable and evoke the kinds of emotions associated with the company brand. For example, the roar of the lion in the MGM sonic logo clearly establishes the image of the company. These have become so important that sound trademarks, or sound marks have been registered with commissions for their legal protections. The first soundmark was the National Broadcasting Company's sequence of three chimes in 1950, followed by others as diverse as Tarzan's yell and the Looney Toons cartoon soundtrack. Full descriptions of the processes involved in developing sonic logos can be found in recent books such as *Sound Business* [74] and *Sonic Branding* [75].

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