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RESEARCH NOTE

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Sonic branding: A narrative review at the intersection of art and science

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Abstract

The field of sonic branding/marketing has grown rapidly in recent years, as has commercial interest in more science-based approaches to the practice, particularly as more brands and agencies look for qualitative and quantitative evidence to support the efficacy of sonic branding. In this research note, we explore the ways in which the design and execution (i.e., the "art") of sonic branding initiatives can be informed by overlapping approaches and techniques drawn from the sciences, namely psychoacoustics, semiotics, music/auditory cognition, and crossmodal research. We explore whether the rapid growth of generative AI may represent the next major evolution in the design, creation, and assessment of sonic assets, where science and art are used to train AI tools that could one day augment (and potentially disrupt) the work of human sound designers and composers. These developments notwithstanding, it is argued that sonic branding will likely remain as much an art as a science, though basing one's approach on the emerging scientific literature ought to at least tilt the odds of success in the creative's favor.

KEYWORDS

AI, audio branding, crossmodal correspondences, marketing, psychoacoustics, semantic differential technique, sonic branding, sonic logo, sound design

1 | INTRODUCTION

The field of sonic branding has grown exponentially in recent years (e.g., Jackson, 2003; Kemp et al., 2023; Unger, 2017; and see Keller & Spence, 2023, for a recent review). Spehr (2009, p. 27) defines sonic (or sound) branding as: "The process of forming an emotional connection between transmitter and receiver through sound, an associative anchor of recognition, communication of messages, image transfer and image consolidations." Consequently, the discipline of sonic branding can, at least according to Vidal-Mestre (2017, p. 57), be considered as a "set of strategically planned sound stimuli that serve as an intangible and expressive variable for a brand, enhancing its identification and differentiation and reinforcing its permanence in the minds of consumers thanks to its emotional aspect." Broadly-speaking, the aim of sonic branding is to present to the consumer's ears what visual branding offers their eyes: A way to recognize a brand through associations with specifically sonic triggers.

Over the years, a plethora of terms have emerged to describe the practice of branding with audio, whether in whole, or in part. The more general term covering all aspects of a brand's audio identity is described as sound branding (Graakjær & Bonde, 2018; Groves, 2011), sonic branding (Gustafsson, 2015; Hein, 2006), or audio branding (Müller & Kirchgeorg, 2011; Vidal-Mestre et al., 2022). In turn, the distinct sonic assets that are used to create a holistic

sonic identity are also referred to by a variety of monikers. These include the sonic logo (a short sequence of notes, sound effects, and/or vocalizations that, when heard, helps to bring a brand top-of-mind for those consumers who hear it), which can also be referred to as audio logos, sound logos, "mogos" (i.e., music logos), and "sogos" (i.e., sound logos; Kim, 2020; Krishnan et al., 2012; Scott et al., 2022; Techawachirakul et al., 2023b), as well as brand themes, brand voices, functional sounds, soundscapes, and even distinctive product sounds (Keller & Spence, 2023). These sonic assets can be used individually, or in combination, to help establish a sonic brand identity.

The recent growth of interest in sonic branding (Taylor, 2023a, 2023b) has been driven by market research suggesting that the use of distinctive sonic assets has a direct impact on brand salience and profitability. For instance, a 2020 study by the market research company Ipsos (Sheridan, 2020) found that audio assets were, on average, 3.44 times more effective than visual assets in producing a high performing advertisement, and that sonic brand cues (i.e., sonic logos) were the most effective of all the distinctive brand assets measured, being 8.53 times more likely to appear in high performing ads and thus bring the brand to top of mind. UK audio research company SoundOut researched the return on investment on sonic logos in the United Kingdom and the United States, finding that brands that have recognizable sonic identities can see an average 5% increase in their perceived value, and a similar increase among consumers in terms of purchase intent (De Lucia, 2022).[1] Sonic Agency DLMDD, in a study that was conducted in cooperation with market research firm YouGov, found that 20% of young adults were more inclined to buy a product from a brand with a sonic identity as compared to those without, and one in three young adults feel more positive towards those brands that have a distinctive sonic identity (McCullough, 2023). Mastercard and GfK Global reported that within 12 months of the launch of their sonic brand identity, 77% of their consumers believed that the new sonic identity made the brand more trustworthy (BrandMusiq, 2022; Cozine, 2020; Khamis & Keogh, 2021), whereas Tostidos reported a 38% increase in brand recall, a 13% increase in brand score, and a 70% increase in overall appeal after the launch of their sonic logo, based on market research conducted by audio testing company Veritonic (Made Music Studio, 2022; see also Cakim, 2023).

The recognition of the consumer appeal of the "experience economy," where brands and products are experienced through consumer participation or connection (Eglīte, 2021; Pine & Gilmore, 2011; Poulsson & Kale, 2004; Sundbo, 2013) has given rise to a move away from mono-sensorial branding (which typically favors the visual) in favor of a more multisensory approach to marketing (e.g., Hilton, 2015; Hultén, 2011; Hultén et al., 2009; Knoeferle & Spence, 2021; Krishna, 2012, 2013; Lindstrom, 2005a, 2005b; Sagha et al., 2022). According to a recent Dentsu study ("Dentsu Attention Economy Podcast and Radio Studies", conducted by Lumen Research; see Dentsu, 2023), audio attention and brand equity outperform visual media (i.e., online video, display, and social), suggesting that audio provides a bigger bang for a brand's advertising bucks. Such findings, particularly if they're replicated, would suggest that we may start to see a shifts in media planning. More specifically, the hope is that, by shifting money to audio, brands may be able to optimize their media spend and grab more attention as well. The mantra that one often hears in this space revolves around connecting, both rationally and emotionally, with as many of the consumers' senses, that is, sensory touchpoints, as possible (Neff, 2000; see also Fulberg, 2003). In exploring the multisensory dimensions of brand experience, companies have been inspired to consider how sound, and specifically sonic branding, might help them to amplify the consumer's auditory/sonic experience of their preferred brands.[2] Although sensory marketing started with B2C (i.e., business-to-consumer), there has been a growing realization that it may also have a role to play in B2B (i.e., business-to-business) communications as well. In addition, the rise of "audio only" or "audio first" consumer touchpoints, such as radio advertising, digital audio advertising, smart speakers (Pickup, 2017), audio aspects of retail environments, and digital audio interfaces, has forced many brands with already-strong visual identities to consider how they can be recognized in a world in which brands can be heard, but are not necessarily seen (though, of course, the size of the brand and the available touchpoints will undoubtedly inform a brand's approach to sonic branding; see Anon, 2018). Given the increased interest in sonic branding, there is clearly an opportunity to bring scientific methods and insights to bear on the art of creating and implementing sonic identities (McGuire & Crawford, 2023).

1.1 | Research note online: Aims and objectives

While focused predominately on sonic logos, this research note extends beyond such sonic assets to include retail sound (i.e., the background music that is played in retail environments),[3] as well as the significance/relevance of product sound research, as studied by those working in the field of psychoacoustics and, as a result, contributes to the literature on sonic branding by critically evaluating a variety of scientific methods that have been used to inform an understanding of the meaning and design of sonic assets. These range from the applicability of the semantic differential technique and the related literature on crossmodal correspondences, through to the potential use of generative AI in the development and/or assessment of sonic assets. For a systematic review approach to the field of audio branding, see Vidal-Mestre et al. (2022).

[1]The distinction of "recognizable sonic identities" is critical, as SoundOut also discovered that if consumers were unable to make a connection between the sonic logo and the brand, there was actually a 7.7% reduction in perceived value.

[2]Although the world of scent branding has grown significantly in recent years (e.g., Minsky et al., 2018), it is worth bearing in mind that sonic branding offers far more opportunities for frequency and reach to connect with consumers than various of the other forms of sensory branding, whether it be tactile (Spence & Gallace, 2011), olfactory, or even gustatory in nature (Farinella, 2009).

[3]In certain cases, retail music might even be considered a part of a retail brand's sonic identity, as in the case of Abercrombie & Fitch's sonically distinctive retail playlists (cf. Elliott, 2014; Graakjær, 2012).

2 | SCIENTIFIC APPROACHES TO SONIC BRAND DESIGN

Although sonic branding has traditionally been based on the intuitions/skills of the musical creative/professional/agency (e.g., Beckerman & Gray, 2014; Groves, 2009, 2011; Minskey & Fahey, 2017; Treasure, 2007), science can provide a more objective framework to assist practitioners in the design of distinctive sonic assets (see Keller & Spence, 2023, for a recent review). Consider, for example, the semantic differential technique, or advances in our understanding of the crossmodal correspondences (Spence, 2011, 2012a), both of which can potentially provide insights concerning the associations people (consumers) have with the basic qualities (or sensory features) of sound and how those qualities might help align consumer perception with brand intent. Tangentially, researchers in the fields of sonic semiotics (Reybrouck, 2017) and music/auditory cognition (e.g., Di Stefano et al., 2024) have assessed the moods/emotions that are associated with short musical phrases/clips (Fritz et al., 2009), as well as the meanings and narratives that people tend to associate with longer pieces of music (e.g., Margulis et al., 2022; Rigg, 1937; Trainor & Trehub, 1992). Such findings can then be used to inform more intentional approaches to the design of distinctive sonic assets which, in turn, would appear to be more likely to produce desired outcomes, particularly in regard to evoking memories, emotions and desired brand associations.

Below we look at the relevance of research literatures often described under the header of sonic semiotics, music/auditory cognition, and psychoacoustics to sonic branding. These are similar, somewhat overlapping areas, but also, importantly, somewhat distinct: One might, for example, separate the semantic "meaning" attributed to the sonic stimulus from a deliberately designed interpretation of the perceptual qualities as associated with specific sonic attributes (see Table 1).

2.1 | The semantic differential technique

The semantic differential technique provides a framework for the assessment of affective connotations of any concept (e.g., brand identity). This is accomplished through the use of polar adjectival scales (e.g., Good–Bad; Active–Passive; Strong–Weak; see Osgood et al., 1957; Oyama et al., 1998; Snider & Osgood, 1969), traditionally applied across three key dimensions: Evaluation, Potency, and Activity (Osgood, 1964; Tzeng & May, 1975).[4] Applied to sound, the semantic differential technique has been used to study musical perception (Accurso, 1967; Holbrook & Huber, 1979; Millet et al., 2021; Miller, 2021; Nordenstreng, 1968),[5] as well as the more psychacoustical aspects of sound design (i.e., tied more closely to the sound of objects/product interactions; e.g., Palù et al., 2017; Schäffer et al., 2023). The semantic differential approach promises a practical approach for those attempting the connotative fit of specific psychoacoustic designs (e.g., Chouard & Hempel, 1999; Kang & Zhang, 2010) or brand signs (e.g., logos; see Schaefer & Rotte, 2010) with actual (and/or desirable/aspirational) product or brand attributes.[6] The assessment of connotative meaning that is associated with the semantic differential approach has also been applied to the "meaning" of brand names (Motoki et al., 2021; Motoki, Park, et al., 2022; see also Motoki et al., 2020), as well as to the optimization of the perceptual qualities of product sounds, as in Palù et al.'s (2017) study evaluating the rolling sounds associated with office chairs (thus, perhaps, blurring the boundary with psychoacoustic approaches to auditory design).

Müllensiefen, (2016; see also Müllensiefen, 2021) developed another semantic differential approach to the study of emotion/music/brand mapping. Using an initial list of 39 attributes (as proposed by Asmus, 1985), these researchers collected 700 individual ratings from 185 participants regarding the perceived affect of 16 musical pieces. After an initial factor analysis, the attribute list was reduced down to a total of 15 adjectives that were further loaded against three factors: vibrant, dark, and tranquil. Ultimately, by considering a description of both a brand and a piece of music against these factors, the tool provides an objective measure of the distance between a brand profile and a particular soundtrack, aiding in determining the degree to which a soundtrack fits the brand it represents. Such a technique promises to help those wishing to analyze the congruency between distinctive audio assets and brand personality.

Although the administration of the semantic differential instrument is simple enough, the interpretation of the results (especially in the context of musical meaning) is a very different matter, as discussed at length by Miller (2021; see also Heise, 1969). Saitis et al. (2020) have suggested a paradigm shift for the field of timbral semantics, advocating for a movement beyond the traditional semantic differential method used to collect behavioral data, and towards the study of crossmodal correspondences between timbral dimensions and other sensory modalities. Indeed, one might worry whether the three traditional dimensions of the semantic differential technique are sufficiently granular to capture all the nuances/varieties of emotion that have been proposed (Cowen & Keltner, 2017). Relevant here, in their semantic differential analysis of sound symbolism, Sidhu et al. (2022) suggested an additional semantic factor to evaluation, potency, and activity when assessing the shapes that people associate with speech sounds, namely "novelty" (cf. Bentler & LaVoie, 1972, for an early suggestion of a fourth dimension described as "familiarity"; and Greenberg & Jenkins, 1966). That said, it currently remains an open question as

[4]Note that in certain research literatures, these are sometimes labeled as Pleasure, Arousal, and Dominance (PAD; e.g., in the area of environmental psychology; see Mehrabian & Russell, 1974).

[5]Note that much of this research has only appeared in unpublished theses and dissertations thus far (see Miller, 2021).

[6]See Kawachi et al. (2011) for an attempt to identify the neural substrates associated with the three key dimensions typically identified by the semantic differential technique.

TABLE 1 Summary of the various approaches to sound design assessment reviewed in present research note.

Approach	Description	Researchers applying this approach
Semantic differential technique	The use of semantic differential rating scales to measure the connotative meaning of a variety of concepts related to sound at a multidimensional level.	Accurso (1967) Nordenstreng (1968) Holbrook and Huber (1979) Chouard and Hempel (1999) Kang and Zhang (2010) Baker et al. (2016) Palù et al. (2017) Miller (2021) Sidhu et al. (2022) Schäffer et al. (2023)
Sonic semiotics	Application of semiotic techniques to uncover the meaning, signs, and/or symbols associated with certain sounds	Hrushovski (1981) Windsor (2004) Jekosch (2005) Arning and Gordon (2006) Bonde and Hansen (2013) Newton (2015) Reybrouck (2017) Di Stefano et al. (2024) Borgohain et al. (2023)
Crossmodal correspondences	Matching of distinct sonic parameters (pitch, tempo, timbre, dynamics, articulation, and so on) with features, attributes, and/or dimensions of other sensory modalities	Adeli et al. (2014) Hagtvedt and Brasel (2016) Getz and Kubovy (2018) Motoki et al. (2019) Wallmark (2019) Mahdavi et al. (2020) Saitis et al. (2020) Sunaga et al. (2021) Motoki, Takahashi, et al. (2022) Reymore (2022) Puligadda and VanBergen (2023) Zacharakis et al. (2023) Techawachiarakul et al. (2023a) Mesz et al. (2023b)
Psychoacoustics	Use of scientific principles of sound perception and audiology to understand psychological responses to sound	Lageat et al. (2003) Churchill et al. (2004) Spence and Zampini (2007) Knöferle (2012) Wang et al. (2013) Sanz-Segura and Manchado-Pérez (2017) de Villers et al. (2018) Spence et al. (2019) Takada et al. (2019) Kato and Yokote (2023) Lesko and Nguyen (2023) Yeoh et al. (2023)
Music/auditory cognition	Application of methods of cognitive science (i.e., behavioral, computational, and neurological) to understand the mental process involved in auditory cognition, from perception of speech, music and natural sounds to emotion, memory, attention, and production of auditory events	Hu (2010) Juslin and Lindström (2011) Parise and Spence (2012) Wazir and Wazir (2015) Fernández-Sotos et al. (2016) Bridger (2017) Iyer and Aggarwal (2019) Vandana et al. (2019) Mas (2019) Aryani et al. (2020)

(Continues)

TABLE 1 (Continued)

Approach	Description	Researchers applying this approach
		Kim and Kim (2021) Mas et al. (2021) McCrae (2021) Scott et al. (2022) Wang et al. (2022) Bosshard and Walla (2023) Techawachirakul et al. (2023b) Zoghaib et al. (2023)
AI	Use of LLMs and GenAI to analyze, test, and/or create music, soundscapes, and voices	Miranda (1995) Bruckert et al. (2010) Tenenbaum et al. (2011) Mesz et al. (2012) Bedingfield (2023) Efthymiou et al. (2023) Kanter (2023) Li et al. (2024)

Abbreviations: GenAI, Generative AI; LLMs, Large Language Models.

to whether this recently-identified "fourth dimension" is relevant when categorizing sonic logos and other sonic brand assets.

2.2 | Sonic semiotics

There is a long history of music research that has considered the meaning and associations that are evoked in listeners by specific musical parameters (e.g., Borgohain et al., 2023; Di Stefano et al., 2024; Margulis et al., 2022; Rigg, 1937; Trainor & Trehub, 1992; Watt & Quinn, 2007). The findings of this research support the view that music and soundscapes can be deliberately constructed to convey specific meaning or intent to a listener. Here, the field of sonic semiotics (which can be defined as the study of auditory signs; Arning & Gordon, 2006)[7] may offer informative insights to those wanting to engage a kind of "sonic symbolism" (Hrushovski, 1981; Reybrouck, 2017; Windsor, 2004). For instance, consider how, at the luxury end of the car market, the indicators in the Bentley Continental GT car have been carefully crafted, such that when they are turned on one hears the "tick-toc" of a carriage clock rather than some cheap-sounding tinny noise. This particular sound (or sonic sign) was presumably deliberately chosen because of its association with (or signification of) history and heritage, culture and class (Spence, 2021b; see also McLeod, 2021). There may well be intriguing insights to be explored/developed here with the world of sonic branding (see Deaville et al., 2021, for a recent volume reviewing developments at this intersection between theory and practice). Indeed, this approach may be particularly helpful when considering low involvement processing, where brand associations stored in memory can drive intuitive brand decisions (see Heath, 2000, 2010).

In the context of semiotic frameworks, sonic branding seeks to operate as a kind of "textual" communication, layered with meaning, encoded not only with sonic associations, but also with cultural meanings as well (Arning & Gordon, 2006). Just as visual logos often incorporate symbols that speak to a brand's history, service category, and/or purpose (see Spence & Van Doorn, 2022), so too can sonic logos use audio representations of brand symbols, values, and associations (Jekosch, 2005; Newton, 2015; see also Millet et al., 2021). Exploring these associations may well offer designers insights into how they might better connect sonic associations with other visual and textual associations that symbolize the brand (Clemente et al., 2023). Bonde and Hansen's (2013) use of a reduced articulation form might provide a particularly helpful way in which to apply sonic semiotics to the design of sonic logos. Drawing on earlier work by Van Leeuwen (1999) that offered a "sonic grammar" based on a list of "sound modality cues," Bonde and Hansen were able to further reduce this list, resulting in an approach that not only allows for the creation of sonic logos that are distinctive, but also flexible enough to be used across multiple touchpoints and brand expressions while still maintaining strong brand associations.

2.3 | Music/auditory cognition

Volumes have been written on the relationship between music, sound, emotions, and mood, and how this research might be used to develop taxonomies of sound and emotion (Hu, 2010; Kim et al., 2010; Vandana et al., 2019), including the impact of the design of sonic assets on the listener's emotions and brand perception (Bonde & Hansen, 2013; Mas, 2019; Mas et al., 2021; Scott et al., 2022). As music and sound have the power to evoke emotions and memories,

[7]More generally, semiotics refers to the study of the meaning of signs (Barthes, 1977; Chandler, 2017; Danesi, 2013; Mick, 1986; Plasschaert, 1995).

they can be used to create emotional connections with brands which can, in turn, increase brand salience and recall (Iyer & Aggarwal, 2019; Scott et al., 2022; Wazir & Wazir, 2015). Studies drawn from the fields of music/auditory cognition have revealed how specific auditory elements, such as timbre, pitch, and rhythm, can all influence brand perception (Mas, 2019; Mas et al., 2021; Techawachirakul et al., 2023b; Zoghaib et al., 2023; see also Motoki, Pathak, et al., 2022; Motoki, Park, et al., 2023). This knowledge can be particularly helpful in adapting brand themes and soundscapes so as to help evoke, or prime, specific emotions in a listener. Importantly, researchers working in the field of music cognition tend to operate under the assumption that specific musical forms were deliberately introduced by the composer to convey a particular extra-musical meaning.

One approach to mapping emotions to specific musical parameters is via the use of a circumplex model of affect, whereby emotions are mapped against two specific dimensions, with the examples of valence and arousal (Russell, 1980), tension and energy (Thayer, 1989), approach and withdrawal (Lang et al., 1998) to name but a few (see Posner et al., 2005, for a review).[8] Musical valence/arousal dimensions lend themselves particularly well to sound mapping. Arousal is considered to be a function of tempo, dynamics, pitch and articulation, while musical valence is a function of modality, harmony, and timbre (Fernández-Sotos et al., 2016; Juslin & Lindström, 2011; McCrae, 2021; Wang et al., 2022; see also Aryani et al., 2020). In theory, by manipulating the specific musical parameters that are associated with arousal and valence, composers and sound designers can more confidently target the specific emotions that they wish to evoke.

Recent advances in the neurosciences, particularly in the field of neuromarketing research, might provide further insights into underlying mechanisms that drive strong associations between brands and sonic assets, the implication being that neuro testing methodologies might reveal effects at a subconscious level that may be undetected when using self-reported, explicit measures (though see Spence, 2020b). Implicit Association Tests and Implicit Response Tests (IRT) are commonly used to measure these nonconscious attitudes and associations with stimuli (see Greenwald et al., 1998; Parise & Spence, 2012, and Bridger, 2017, in the auditory domain), along with the use of electroencephalography (EEG), the later comparing the amount of left/right frontal EEG activity to localized effects of processing positive/negative associations (Davidson et al., 1979). Bosshard and Walla (2023) found that they were able to use EEG to demonstrate changes in brand perception resulting from the pairing of brand names with positive/negative sonic stimuli, with brands more susceptible to the effects of negative conditioning than positive conditioning. These changes were not apparent when self-reported explicit measures were used. In the field, testing companies are already using IRT to measure intuitive responses to sonic logos and brand themes, teasing out not only implicit measures of attraction to sonic logos, but also degrees of congruency/fit with brand attributes (Bridger, 2023).

[8]Note that in some sense this approach starts to approximate the semantic differential approach mentioned earlier.

2.4 | Psychoacoustics and product sound design

Sonic branding, as a whole, is "other than the sum of its parts." By that, we mean that a brand's sonic identity is a combination of sonic experiences that can occur at multiple points of interaction with the brand (e.g., Keller & Spence, 2023; Singh, 2014), rather than defined by any single audio asset. Here, functional sounds, or even the sound of the product (interaction) itself, can be considered as a part of the sonic taxonomy that comprises a holistic sonic experience of the brand, and ipso facto, its sonic branding. Automotive manufacturers have long used sound in the design of their products to great effect, and the research shows that everything from the sound of a vehicle's door closing, to the sounds created to accompany the experience of driving an electric vehicle, to sound effects associated with the car, can impact product attractiveness and purchase decisions (Kato & Yokote, 2023; Takada et al., 2019; Yeoh et al., 2023). Indeed, car manufacturers have long worked on the psychoacoustic design of the sound of the car engine (as heard by the driver; Wang et al., 2013). Psychoacoustics have also played a role in the design of the sonic properties of everything from the car horn (How a car's horn says: "Buy me," 2005) and the sound of the door closing, to the sound made by the dashboard when the potential customer wraps it with their knuckles in the car showroom when considering that new purchase (Montignies et al., 2010). That said, in some instances, the psychoacoustic manipulation of automotive sounds have resulted in a backlash from those who feel tricked when they come to realize that the product (e.g., engine) sound has been "engineered in" (e.g., Ungoed-Thomas, 2016; see also Harwell, 2015).

Although the design of product sounds can draw on some of the other scientific approaches to sonic branding that have been mentioned previously, their design can be complicated by other variables like product specifications, safety regulations, and physical design. Such restraints are typically not a factor in the design of other distinctive audio assets, such as sonic logos, which are constrained only by the range of sounds that people are able to hear (or not hear; as in the case of the Coca-Cola Drum silent ad; Anon, 2019). Product sound design is a much more limited field of acoustic research in terms of the sonic solutions that are currently available to the designer/creative. A knowledge of psychoacoustics is essential to product development when sound optimization is part of the design criteria (e.g., Alexander, 2021; Almiron et al., 2021; Lesko & Nguyen, 2023; Spence, 2021a; Spence & Zampini, 2006, 2007), whether modifying the physical properties of product interaction sounds themselves (Guy, 2019; Hull, 2023; Lageat et al., 2003; Sanz-Segura & Manchado-Pérez, 2017), or the modification of a pre-existing sound that exists as part of a physical interaction with the product (e.g., consider only the modification of the Lynx/Axe deodorant can sound to better convey the forcefulness/powerfulness associated with the brand; Spence & Zampini, 2007).

Psychoacoustics, as a field, has even extended its analysis to the perceptual qualities of a range of household appliances, such as the sound of everything from kettles (Churchill et al., 2004) to vacuum cleaners (Wolkomir, 1996) and coffee machines (Knöferle, 2012). However, in contrast to the other approaches that have been

discussed so far, the focus here is very much on the perceptual description of the product (interaction) sounds rather than on their high-level sematic associations/meaning that they may have (e.g., the focus in Churchill et al.'s study was on the sharpness, roughness, and fluctuation strength of the kettle boiling sounds). Psychacousticians, therefore, tend to focus their efforts on functional sound, sound quality, and fixing problematic qualities of product sound, rather than necessarily assessing the "extra-noise" (analogous to the extra-musical noise) or semantic associations studied by the other approaches to sound design.

The application of soundscapes, or the creation of immersive experiences in retail environments, can both be considered as a part of a brand's sonic identity "ecosystem." Here, too, the application of psychoacoustic principles (e.g., the Haas effect, frequency masking, dynamics, acousmatic sound, and so on; see Robinson, 2022, for a review) are an important part of the design of retail spaces and how the consumer experiences them, which in turn can have an impact on the perception of the brand more generally (de Villers et al., 2018).[9] There is also a large body of marketing and psychology research investigating the particular associations with specific styles of music (think French, Italian, or classical), rather than with more granular sonic elements, such as timbre (e.g., Flynn et al., 2022; Spence et al., 2019; Yeoh & Spence, 2023; Yeoh et al., 2023).

3 | CROSSMODAL CORRESPONDENCES: ANALYSIS AND SONIC DESIGN IMPLICATIONS

Separate, but linked, to the semantic differential approach, a growing body of literature has emerged over the last decade or so on crossmodal correspondences (Spence, 2011, 2012a), defined as the sometimes surprising yet consensual connections between features, attributes, and/or dimensions in different sensory modalities. Scientific journals are increasingly publishing research documenting how well (i.e., "consensually"; Koriat, 2008) this or that sonic property or dimension (e.g., such as timbre, pitch, roughness, and so on) corresponds crossmodally to a particular sensory attribute, such as shape (i.e., curvilinearity), visual lightness, elevation, or even taste qualities (e.g., Adeli et al., 2014; Hagtvedt & Brasel, 2016; Mesz et al., 2023a, 2023b; Motoki, Takahashi, et al., 2022; Reymore, 2022; Saitis et al., 2020; Wallmark, 2019). The associations between sound and taste have been widely documented, and brands are increasingly adapting these associations for use in their advertising campaigns and experiential activations (Spence et al., 2021), or at least that is the impression. For other research on the sonic properties and matching to sound and taste qualities beyond taste, there is a growing interest in assessing the crossmodal correspondences that have been documented between scent and sound features (e.g., Mahdavi et al., 2020; Zacharakis et al., 2023; see Spence et al., submitted).

Of particular interest in the context of the present review is the recent publication in marketing journals of a number of studies on crossmodal correspondences between auditory features and various product or brand attributes (i.e., rather than simple sensory attributes as assessed by the majority of the laboratory-based research that has been published on crossmodal correspondences to date; see Sunaga et al., 2021, submitted), or more conceptual qualities such as gender (e.g., Techawachirakul et al., 2023b) or healthfulness (Techawachirakul et al., 2022; see also Joshi & Kronrod, 2020; Park et al., 2021). For instance, Lowe and Haws (2017) reported on research suggesting that the pitch of a speaker's voice as well as the pitch of a musical excerpt significantly changed consumers' beliefs about relevant product attributes. In one example, lower-pitched voices or music were shown to result in the perception that a sandwich that was advertised was larger than when it was seen in the same ad accompanied by higher-pitched voice or music instead. Unfortunately, however, it should be noted that this specific result has proved hard to replicate (see Tran & Getz, 2023).

Nevertheless, other results in this area do appear more promising (perhaps suggesting that the pitch-size crossmodal correspondence may be more subject to top-down influences than various of the other crossmodal correspondences involving sonic elements that have been identified to date; see Getz & Kubovy, 2018). For example, in a study entitled 'Sweet voice: The influence of crossmodal correspondences between taste and vocal pitch on advertising effectiveness', Motoki et al. (2019) demonstrated that participants who listened to higher-pitched (rather than lower-pitched) voiceover ads expressed higher taste expectations and buying intention for sweet and sour foods. More recently, Melzner and Raghubir (2023) investigated how the roughness/smoothness of sonic logos would influence the perceptions of ruggedness/sophistication in brand personality. Similarly, Puligadda and VanBergen (2023) demonstrated that the timbre of a brand's sound logo enhanced the perceived sophistication (vs. ruggedness) of its personality (where a piano was associated more with sophistication and a synth bass was associated more with ruggedness). What is more, the congruency between the instrumentation of a sound logo and the design of a visual logo were shown to enhance perceptions of a brand's personality and result in a more favorable evaluation of the brand.[10] Meanwhile, Techawachirakul et al. (2023a) reported that the North American participants whom they tested associated sound logos played by 'masculine' instruments (i.e., alto saxophone, trombone, trumpet, and tuba timbres) with meat-based foods, in contrast to sound logos played by 'feminine' instrumental timbres (i.e., clarinet, flute,

[9]The importance of psychoacoustics and sound design for online shopping and VR environments is of increasing interest as consumers move towards "virtual" shopping experiences (Fiore & Kelly, 2007; Xi & Hamari, 2021).

[10]Sogos created using feminine instruments that connote positive valence are matched with sincerity dimension. Similarly, sogos created using masculine instruments that connote potency are matched with ruggedness, and this relationship is mediated by the perception of low pitch. Further, creating sogos with instruments that match a brand's personality evokes congruence of brand attributes.

oboe, and violin timbres), which were associated more with plant-based foods.

However, the latest research on the influence of musical parameters on the perception of an advertised product has highlighted the necessity for the consumers' attention to be explicitly drawn to its sonic qualities (such as pitch, tempo, & timbre; see Tran & Getz, 2023). Here, a discussion on the interplay between crossmodal correspondences and emotions is relevant, particularly when discussing the use of the semantic differential approach (see Spence, 2020a, for a review). At the same time, however, it is worth stressing that a number of the emotional dimensions/attributes used in the laboratory research on crossmodal correspondences would appear to go well beyond the basic seven universally recognized emotions, that were first identified by Paul Ekman (see Barrett, 2017; and once again, see Spence, 2020a, for a review of this literature as concerns the emotional-mediation of crossmodal correspondences). As has been mentioned previously, it is uncertain whether the various combinations of the three dimensions (namely evaluation, potency, and arousal) necessarily provide a sufficient degree of granularity with which to distinguish the full range of brand associations/identities (see also Tzeng & May, 1975). That said, the research shows that crossmodally corresponding combinations of sensory stimuli tend to be easier to learn (e.g., Imai et al., 2008, 2015) and may be processed more fluently (e.g., Reber & Schwarz, 2001; see also Brunel et al., 2015; Miron, 1961).

3.1 | Limitations with the use of crossmodal correspondences research in sonic branding

Although scientific developments regarding crossmodal correspondences are undoubtedly positive and promising for the emerging field of sonic (or sound) branding, it is important to note that there are several limitations to the approach that have seemingly been largely neglected by the more academically-minded researchers working in this area. First, crossmodal correspondences research, no matter whether of the basic or more applied kind, only ever reveals the best of the options made available to the participants in the studies concerned (although this may be a general limitation that applies regardless of the specific experimental approach that is adopted). Much of the research that has been published to date typically only probes a limited subset of sensory stimuli (e.g., sound qualities; cf. Motoki, Saito, et al., 2022; Parise et al., 2014). As such, one can never know whether the timbre of the Indian santur might turn out to be the ideal match for the spicy note associated with food and drink (see Klaverstijn, 2021), if no one had included the sound of this specific timbre/instrument in their research previously (see Wang et al., 2017). To that end, more systematic approaches to documenting the crossmodal associations of musical sounds and other product interaction sounds are now starting to become available (e.g., see Guedes et al., 2023; Rodríguez et al., 2023).

Second, simply showing in the laboratory (or as is increasingly the case, in an online study) that there happens to be a correspondence between, for example, auditory pitch and elevation, doesn't necessarily imply that this particular correspondence will be top-of-mind (i.e., dominant) in the mind of the consumer in any real world setting (Motoki et al., 2023). In fact, the strength of the association will, at least in part, likely depend on the context in which the various stimuli happen to be presented. To illustrate the point, consider how multiple studies demonstrate that the dimension of auditory pitch can correspond with any number of varying sensory dimensions, including size (assessed visually or haptically), elevation, brightness, and many others (see Spence, 2011, for a review), or the many contextually-determined associations that may be primed by seeing the color red (this notion linked to "color in context" theory; Elliot & Maier, 2012). Note, once again, that this limitation is not restricted to crossmodal correspondences, but extends to other online types of research technique as well.

Additionally, it would appear to be the relative pitch of a sound that matters most (i.e., rather than the absolute pitch), at least in the context of crossmodal correspondences where auditory pitch is considered as a corresponding dimension (Spence, 2019).[11] On the other hand, timbral (i.e., categorical) sound correspondences would appear to be more absolute, due in part to the fact that relative correspondences presumably require a prothetic (i.e., magnitude-based) stimulus dimension (see Spence, 2011; Spence & Di Stefano, 2023; Stevens, 1957). It may also be worth noting here that the majority of crossmodal correspondences research that has been published to date has tended to focus on instrumental, rather than vocal, timbres (Faure et al., 1996; Simner et al., 2010).[12] This is perhaps because the former are simply easier to annotate/describe in research papers (Spence, 2023).

The third limitation is that congruency (defined as how well stimuli match along a relevant sensory, affective, or conceptual dimension; Techawachirakul et al., 2023b), while important (see Lowe & Haws, 2017; Oakes & Abolhasani, 2021) is, of course, only one of the measurable parameters critical to the successful design of distinctive sonic assets. Over-and-above the desire to maximize processing fluency (e.g., Reber & Schwarz, 2001) and the congruency with key brand attributes (e.g., Sunaga et al., 2021; see also Errajaa et al., 2021; cf. Miyamoto et al., 2023),[13] distinctive sonic assets should also be liked (i.e., they should be hedonically appealing), as well as auditorily distinctive and memorable (cf. as in the case of "earworms"; Anglada-Tort et al., 2022; Floridou et al., 2012; Jakubowski et al., 2017). Indeed, the latest research from Kemp et al. (2023) suggests that the pleasant emotion that is associated with, and elicited by, a successful sonic logo, may be precisely what mediates between the presence of the sonic logo and the consumers' engagement with the brand. In particular, these researchers

[11]Note that this is just one of the ways in which crossmodal correspondences differ from synesthesia, which is, by contrast, an absolute mapping between inducer and concurrent (Deroy & Spence, 2013).

[12]Note that the major acoustic components of timbre, include the onset (attack time), spectral centroid (brightness), and modulation (roughness) (Marozeau et al., 2003; McAdams et al., 1995).

[13]Although note that, on rare occasion, there may also be an opportunity to work creatively with sensory incongruency; see Eklund & Helmefalk, 2022; Piqueras-Fiszman & Spence, 2012; Sundar & Noseworthy, 2016a, 2016b).

conducted two studies, the first of which demonstrated that when people find themselves in a decision context that provokes anxiety and uncertainty, the presence of a sonic logo elicits positive emotions which, in turn, may help to stimulate discovery and engagement with the brand. Meanwhile, the results of a second study revealed that the presence of a sonic logo engendered positive emotions in those individuals who were high in emotion-based decision-making even after having been presented with negative information about the target brand.

3.2 | Limitations regarding hedonic appeal and congruency

The importance of hedonic appeal can be illustrated by way of analogy with research from the world of "sonic seasoning," the name given to the creation of bespoke soundscapes based on the crossmodal correspondences between sound and taste/flavor associations. Although a combination of science and creativity can effectively deliver soundtracks that are increasingly well-matched to a given taste quality (Wang et al., 2015; see Spence et al., 2019, for a review), that doesn't necessarily mean that the resulting sonic seasonings are pleasant to listen to. Research from Reinoso-Carvalho and his colleagues (Reinoso-Carvalho et al., 2020a, 2020b) has shown that hedonic "sensation transference" effects tend to be more pronounced than the gustatory effects of sonic seasoning. In other words, the effect of music liking on taste liking appears to be more apparent than the effects of sonic seasoning on the perceived intensity of the relevant taste attribute. Hence, should such observations be generalizable to real-world design, ensuring that a musical track is liked may well turn out to be more important than generating a track that happens to match the crossmodal associations captured by the sonic seasoning itself (see Spence, 2021a). Likewise, sonic appeal as a parameter in the design of distinctive sonic assets may ultimately be just as important as brand fit (i.e., congruency). More research is then undoubtedly needed to determine the generalizability of Reinoso-Carvalho and colleagues' claim. In theory at least, it should be possible to achieve both (i.e., to develop a soundscape or music track/jingle[14] that is both hedonically liked and congruent with whatever attributes are most important; Rodríguez et al., 2023). That said, as has been noted already, it should be noted that research on sonic branding demonstrates the crucial role of positive emotion elicited by the presence of a sonic logo (e.g., see Galan, 2009; Kemp et al., 2023).

One final consideration here is in regard to an issue raised by researchers concerning the importance of congruency between the auditory and visual logo (cf. Salgado-Montejo et al., 2014). Although this question relates to the topic of crossmodal correspondences, it also applies to the other approaches mentioned above (e.g., the Semantic differential technique, sonic semiotics, and so on). Given these caveats/concerns, it soon becomes clear that much of the art and science related to the design of sonic assets is unlikely to make it far beyond the research laboratory and/or experiential event. Nevertheless, we would argue that it is still advantageous for sound designers to keep abreast of the rapidly expanding literature on crossmodal correspondences. They may well also find the semantic differential technique useful, at the very least when it comes to reassuring their clients that a given sonic solution "fits the bill."

4 | AI AND SONIC BRANDING

Beyond psychology and cognitive neuroscience (Mas et al., 2021), there has been a growing interest in what AI might offer the field of sonic branding (Suchman, 2024). Given the speed at which generative AI is developing currently, it would seem plausible that AI could one day soon help facilitate the analysis, testing, and creation of sonic logos in a variety ways (e.g., Bedingfield, 2023).

In regard to analysis and testing, AI might help in the identification and modeling of relevant crossmodal correspondences from analysis of largescale data resources (see Rosi et al., 2023, discussed below). For example, semantic distance analysis can potentially be used to identify associations between concepts or even to potentially discover novel crossmodal correspondences (see Tenenbaum et al., 2011). Indeed, researchers turning to Large Language Models might deliver evidence of crossmodal correspondences that thus far have required more laborious traditional data collection with human participants (e.g., see Velasco et al., 2023). Rather than asking a group of participants in a laboratory or online setting to either name or pick the sound or color that they most strongly associate with sweetness, a researcher might arrive at the same answer by prompting a generative AI tool such as Chat-GPT to describe/list the sonic seasonings associated with the perception of a "sweet color," the answer being delivered in a fraction of the time and cost that traditional research practices require (see Woods et al., 2015).

Additionally, the emergence of "synthetic data" might offer ways to quickly test prototypes of distinctive sonic assets without the need for human panelists in testing scenarios. Consider, for instance, the research of Li et al. (2024). These researchers were able to construct a perceptual brand map using GPT4 to collect target attributes and brands via the internet, without human involvement. After counting, ranking, and comparing these brands and attributes, AI was used to create a multidimensional map reflecting the relative positioning of brands based on their perceived attributes. For comparison, Li et al. (2024) also collected quantitative similarity ratings from 530 human participants and used that data to create a similar multidimensional perceptual map. They demonstrated a 90% similarity between the AI generated map (i.e., synthetic data) and the human generated map.

[14]Note that a jingle is different from a sonic logo. The former tends to be a short popular music motif whereas the latter tends to have been deliberately constructed to serve as part of the brand's sonic identity. A jingle is a short song or tune that is used in advertising and for other commercial uses. Jingles are relevant to this Research Note in that they are considered as a form of sound branding. A jingle contains one or more 'hooks' and meanings that explicitly promote the product or service being advertised, usually through the use of advertising slogan(s).

According to Li et al. (2024, p. 2), these findings suggest that: "with an even larger training corpus applied to generative language models, AI-based market research will be applicable to answer more nuanced question based on demographic variables or contextual variation that would be prohibitively expensive or infeasible with human respondents." It would seem possible that in the not-too-distant future such approaches may become increasingly relevant when mapping associations between brand attributes and sonic attributes, predicting brand fit without the time and expense associated with using human panelists to achieve similar results.

Given the above, it's not hard to imagine an AI tool that would allow for the input of music, soundscapes, sound design, and other audio samples, which could be quickly analyzed to suggest the probability of congruent associations between the audio signal and the targeted associations (be it emotional, crossmodal, semiotic, contextual, and so on). Kanter's *Needscope AI for Music* (Kantar, 2023) is a recently developed AI tool that uses machine learning to help understand the emotion in auditory assets, and how well they match brand profiles. The tool considers a series of four drivers for brands and music across an *x*/*y* matrix (e.g., extroverted/introverted, affiliative/extraordinary, inclusive/independent, uplift/revive) against a set of six emotive spaces (e.g., joyful, rebellious, warm, powerful, peaceful, cultured). The output of the analysis provides insight into how well sonic attributes "fit" brand positioning across multiple touchpoints. Similarly, AI tools (e.g., machine learning and large language models) could be used to quickly identify the shared mental representations that underlie metaphorical sound concepts (Rosi et al., 2023). In the latter study, the researchers investigated four metaphorical sound concepts, namely brightness, warmth, roundness, and roughness, amongst a sample of sound engineers, conductors, and nonexperts (cf. Rosi, Houix, et al., 2022). The 24 participants who took part in the study rated a corpus of orchestral instrument sounds ($N = 520$) using a technique known as Best–Worst Scaling (see Rosi, Ravillion, et al., 2022). This data-driven method was used to sort the sound corpus for each metaphorical sound concept and population. These population ratings were then compared, and machine learning algorithms were used to uncover the acoustic 'portraits' associated with each concept. Note how such AI-generated perceptual maps could potentially be used to analyze how closely a particular prototype of a sonic asset would align with a desired metaphorical association.

Beyond analysis and testing, AI might also help in the actual creation of music, engineered to meet specific connotative goals (Miranda, 1995; see also Mesz et al., 2012). For example, AI could ingest the "sonic DNA" of a brand (e.g., the melody/motif of a brand theme, guidelines for tone and timbre) and then quickly generate working prototypes of music and soundscapes, based on predetermined criteria (e.g., emotional, crossmodal, contextual, semiotic, and so on), but all infused with the brand's sonic audiomark. Sound designers and composers could then build on these prototypes or use them as inspiration in their own designs, and/or brands might incorporate them directly into their advertising and marketing (see Allan, 2007, 2008).

Sonic assets generated by AI are particularly appealing when copyrights are considered (although there is an on-going debate about who owns AI generated creative content; see McKendrick, 2022). Copyright/licensing considerations have been an ongoing concern for music tracks incorporated into branded content (e.g., Scherer, 2021), and the creation and/or use of music, soundscapes, and voices can be costly. AI-generated audio assets could be much more affordable, with the ensuring copyright potentially owned and controlled by the brand. That said, it is hard to imagine that AI-generated music will ever have the same huge commercial appeal/success of those classic tracks that have been linked to some of the world's most iconic/successful marketing/branding. Here, one can think of tracks such as "I'd Like To Teach The World To Sing (In Perfect Harmony)," used by Coca-Cola in the 1970s (Pendergast, 2013; cf. Graakjær, 2021); "I Heard It Through The Grapevine" by Marvin Gaye, used in Levi's 501 Laundrette advert with the model Nick Kamen (1985); United Airlines adoption of George Gershwin's "Rhapsody in Blue" in the 1980s (Kemp et al., 2023); Or British Airways, "The Pearl Fishers," see also Keller & Spence, 2023). However, as artists are already beginning to collaborate with AI in interesting new ways (e.g., Chow, 2020), it seems likely that AI-generated music will soon become a part of popular culture, and more appealing to brands and advertisers as a result.

Finally, AI voice synthesis offers yet another opportunity to integrate AI technology into the design and creation of sonic identities. Although voices are seldom discussed, they should nonetheless be considered in the inventory of sonic assets that are available to brands. Like any other distinctive sonic asset, brand voices can be used to communicate values, create connections, and establish recognition and recall (Gardner, 2005; Kamins & Gupta, 1994; Simner et al., 2010; Spence, 2023).[15] Used consistently over time, a brand voice can function in a similar fashion to an audio logo, where the sound of a particular voice can evoke memories/associations with an associated brand. The use of digital assistants and smart speakers represents yet another sonic touch point available to brands. Here, the use of a branded voice not only serves to identify the brand to users, but can also build familiarity, trust, and emotional connections (Poushneh, 2021a, 2021b; Wienrich et al., 2023).

Additionally, AI generated voices and/or voice clones can be easily modified to speak in another language or with another dialect, while maintaining the essence of the personality of the original. Efthymiou et al. (2023) demonstrated that manipulating the vocal tract length (i.e., timbre) of a synthetic voice had an impact on perceptions of congruency toward stereotypically masculine and feminine products, which in turn improved click-through rates and lowered costs per click. AI technology may also aid in combining or morphing voices in unique ways, and at least one study suggests that

[15]Brand voices may be human/celebrity driven (e.g., Dennis Haysbert for Allstate, James Earl Jones for CNN, Josh Lucas for The Home Depot) or character driven (e.g., the Geico Gecko, the AFLAC duck, Mayhem for AllState). It may be worth noting that, in the case of celebrity voices, there's always a danger of the "vampire effect," whereby the celebrity talent overshadows the brand, in which case consumers may remember the talent, but not the brand (see Chan & Chau, 2023).

vocal attractiveness can be enhanced by averaging multiple voices together (Bruckert et al., 2010).

In all of these instances, AI-generated voices may offer some benefits, namely the ability for brands to create a unique voice that can be owned in the same way brands might own any other distinctive sonic asset, and one that is free from the ongoing licensing costs or talent fees that might otherwise be incurred with the use of a human voice actor. In those instances where brands have already established equity through the use of a human voice actor, AI voice clones may offer advantages for cost controls and scale. There is already a precedent for the use of voice clones, with some actors negotiating rights to their use (Edwards, 2022; Yandoli, 2023).

4.1 | Limitations regarding the use of AI

Despite the potential advantages AI may afford for cost and scale, more research is needed to understand the limits of AI integration into creative workflows, both in the application and the implication of their use. Bias against AI generated content, particularly music and voice, may have a negative impact on brand perception (Caputo, 2018), and ethical concerns around the use of voice clones and voice assistants need to be addressed (Seymour et al., 2023). Currently, questions regarding copyright infringement abound, as well as concerns regarding the economic impact of AI on voice talent and content creators (Desai, 2023; Federal Trade Commission, 2023), prompting potential government regulation of AI generated content that could limit the contexts in which AI might be used, or the need to disclose its use to consumers (Lapowsky, 2023; Satariano, 2023; cf. Califano & Spence, 2024). As the use of AI voices/influencers becomes more common, the question of whether these AI generated spokespersons are trusted equally in all sensory domains is one worth exploring further (e.g., see Fu et al., 2024; Hasan et al., 2021; Koles et al., 2024).

Although many of these concerns apply to a much broader use of AI than the narrow focus outlined in this Research Note, it's easy to understand their implications for the creation and application of AI-generated music, voice, and soundscapes in the field of sonic branding. Beyond these concerns, there is currently little evidence that AI-generated music, sound design, and/or sonic assets will necessarily offer better outcomes where non-AI approaches to art/science creative collaboration fail (cf. Martin, 2023). Despite all the possibilities and potential, until commercially successful examples of AI-/science-inspired sonic designs start to emerge into the marketplace, all the theoretical possibility may come to nought. Future research will hopefully address these questions as the applications and implications of AI use continue to emerge.

5 | CONCLUSIONS

Previously, sonic identity practitioners, with few exceptions, have been guided more by the art of sonic branding than by the science (see Keller & Spence, 2023, for a recent review), drawing on their skills as composers, sound designers, and artists, and making creative choices based on their experience and expertise gained from practicing their craft. However, there has always been an appeal to science inherent in more intentional approaches to the design of sonic identities. As the field of sonic branding has matured over the past decade, there has been a growing interest in more science-based approaches, driven in no small part by brands and agencies looking for qualitative and quantitative proof of the efficacy of sonic branding.

Ultimately, sound business decisions require ensuring a brand's return on their audio investments (Keller, 2018; see also Krishnan & Kellaris, 2021; Krishnan et al., 2012). Although this narrative review has focused more on sound science rather than sound art, the suggestion that emerges from this Research Note is that it is a combination of the two that leads to sound decisions, both literally and figuratively. At present, there are robust empirical frameworks for aligning sound with the connotative meaning of a product or brand (e.g., the semantic differential technique; Snider & Osgood, 1969). Meanwhile, the application of insights from the fields of semiotics, music/auditory cognition, and psychoacoustics can help inform the design and evaluation of distinctive sonic assets, potentially providing a way to predict their success. Here, too, an emerging body of evidence and theoretical framework for aligning music-sensory/conceptual associations (one that importantly doesn't rely on synesthesia; e.g., Haverkamp, 2014)[16] provides additional insight into sound choices that might better fit a multisensory expression of the brand, whether that be in regard to sonic assets, or the development of experiential marketing initiatives (e.g., see Spence et al., 2021), both of which can shape consumer perceptions of the brand.

Looking to the future, the use of generative AI may very well represent the ultimate synthesis of science and art, whereby the input of data and content from both could result in tools that augment the creative process in efficient, scalable, and cost-effective ways (Van Esch & Stewart Black, 2021; see also Ameen et al., 2022). One might imagine a future in which AI could dynamically adjust the sonic expression of a brand to fit a listening environment or context, personalizing the advertising experience of a consumer (Maroely & Munichor, 2023; Suchman, 2024), or the potential for genetic algorithms to participate in the creation of sonic assets built on the crossmodal correspondences (cf. Wright & Ward, 2013). It has also been suggested that computational models may soon be able to predict perceived musical expression in branding scenarios (Lepa et al., 2020).

5.1 | "The proof is in the pudding"

Returning to the art of sonic branding, a review of the most successful sonic logos and jingles that have been heard over the years

[16]Which as the first author has argued elsewhere has seemingly distracted the creatives working in many fields for far too long now (Spence, 2012b, 2015).

(e.g., Walter Werzowa's, "Intel Inside"; Kaufman, 1999; see also Graakjær, 2019; and Pendergast, 2013, on Pepsi's early success with jingles in the States), begs the question as to whether or not any scientific, technological (e.g., generative AI), or artistic approach to their creation could generate or predict commercial success on a regular basis. Indeed, even some of the individuals responsible for creating these famous sonic assets may find it difficult to repeat their success, and it would seem foolhardy to guarantee it. That said, one should not forget the important role that repetition plays in building up liking for music (Madison & Schiölde, 2017). In the end, sonic branding may remain as much an art as a science (or at most, a scientifically supported/inspired endeavor). Nevertheless, it is our belief that basing one's approach to sonic branding on the emerging scientific literature ought to at least tilt the odds of success in the creative's favor (Keller & Spence, 2023), more so than relying solely on subjective aesthetics. Time, and research, will tell.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no data sets were generated or analyzed during the current study.

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REFERENCES

Accurso, R. (1967). *The development and application of a semantic differential for sounds* [Unpublished masters thesis]. University of Illinois at Urbana/Champaign.

Adeli, M., Rouat, J., & Molotchnikoff, S. (2014). Audiovisual correspondence between musical timbre and visual shapes. *Frontiers in Human Neuroscience*, *8*, 352. https://doi.org/10.3389/fnhum.2014.00352

Alexander, L. (2021). From a Lamborghini's roar to a Moët's pop: How sound became one of luxury's most powerful tools. *Robb Report*. Retrieved October 15, 2021, from https://robbreport.com/lifestyle/news/sound-of-luxury-1234636968/

Allan, D. (2007). Sound advertising: A review of the experimental evidence on the effects of music in commercials on attention, memory, attitudes, and purchase intention. *Journal of Media Psychology*, *12*(3), 1–35.

Allan, D. (2008). A content analysis of music placement in prime-time television advertising. *Journal of Advertising Research*, *48*(3), 404–417.

Almiron, P., Escobar, F. B., Pathak, A., Spence, C., & Velasco, C. (2021). Searching for the sound of premium beer. *Food Quality & Preference*, *80*, 104088. https://doi.org/10.1016/j.foodqual.2020.104088

Ameen, N., Sharma, G. D., Tarba, S., Rao, A., & Chopra, R. (2022). Toward advancing theory on creativity in marketing and artificial intelligence. *Psychology & Marketing*, *39*, 1802–1825. https://doi.org/10.1002/mar.21699

Anglada-Tort, M., Schofield, K., Trahan, T., & Müllensiefen, D. (2022). I've heard that brand before: The role of music recognition on consumer choice. *International Journal of Advertising*, *41*(8), 1567–1587. https://doi.org/10.1080/02650487.2022.2060568

Anon. (2019). Coca-Cola: Try not to hear this by David. *The Drum*. Retrieved April 2019, from https://www.thedrum.com/creative-works/project/david-coca-cola-try-not-hear

Anon. (2018). I don't care about my brand's sound – No, really. *Marketing Week*. Retrieved August 31, 2018, from https://www.marketingweek.com/adelphoi-music-audio-branding/

Arning, C., & Gordon, A. (2006). Sonic semiotics. The role of music in marketing communications, *ESOMAR Annual Conference, London: Congress 2006 – Foresight – The predictive power of research* (pp. 1–18). Academia.

Aryani, A., Isbilen, E. S., & Christiansen, M. H. (2020). Affective arousal links sound to meaning. *Psychological Science*, *31*(8), 978–986. https://doi.org/10.1177/0956797620927967

Asmus, E. P. (1985). The development of a multidimensional instrument for the measurement of affective responses to music. *Psychology of Music*, *13*(1), 19–30. https://doi.org/10.1177/0305735685131002

Baker, D. J., Trahan, T., & Müllensiefen, D. (2016). Matching music to brand personality: A semantic differential tool for measuring emotional space, *Proceedings of the 14 International Conference on Music Perception and Cognition* (pp. 269–271). ICMPC14.

Barrett, L. F. (2017). *How emotions are made: The secret life of the brain*. Macmillan.

Barthes, R. (1977). *Elements of semiology*. Hill & Wang.

Beckerman, J., & Gray, T. (2014). *The sonic boom: How sound transforms the way we think, feel, and buy*. Houghton Mifflin Harcourt.

Bedingfield, W. (2023). Musicians, machines, and the AI-powered future of sound. *Wired*, Retrieved March 16, 2023, from https://www.wired.co.uk/article/generative-ai-music

Bentler, P. M., & LaVoie, A. L. (1972). An extension of semantic space. *Journal of Verbal Learning and Verbal Behavior*, *11*, 174–182.

Bonde, A., & Hansen, A. G. (2013). Audio logo recognition, reduced articulation and coding orientation: Rudiments of quantitative research integrating branding theory, social semiotics and music psychology. *SoundEffects-An Interdisciplinary Journal of Sound and Sound Experience*, *3*(1–2), 112–135. https://doi.org/10.7146/se.v3i1-2.15644

Borgohain, J., Behera, R. R., Patnaik, P., & Suar, D. (2023). Visual mental imagery evoked in Indian classical music: A listener-oriented study. *Music & Science*, *6*, 1–28. https://doi.org/10.1177/20592043231206255

Bosshard, S., & Walla, P. (2023). Sonic influence on initially neutral brands: Using EEG to unveil the secrets of audio evaluative conditioning. *Brain Sciences*, *13*(10), 1393.

BrandMusiq (2022, May 28). MasterCard case study: The making of MasterCard's global sonic identity [Video]. https://www.youtube.com/watch?v=bSIN694crNY

Bridger, D. (2017). *Neuro design: Neuromarketing insights to boost engagement and profitability*. Kogan Page.

Bridger, D. (2023). Testing the power of sonic logos. *CloudArmy*. Retrieved June 28, 2023, from https://cloud.army/resources/blog/testing-the-power-of-sonic-logos

Bruckert, L., Bestelmeyer, P., Latinus, M., Rouger, J., Charest, I., Rousselet, G. A., Kawahara, H., & Belin, P. (2010). Vocal attractiveness increases by averaging. *Current Biology*, *20*(2), 116–120. https://doi.org/10.1016/j.cub.2009.11.034

Brunel, L., Carvalho, P. F., & Goldstone, R. L. (2015). It does belong together: Cross-modal correspondences influence cross-modal integration during perceptual learning. *Frontiers in Psychology*, *6*, 358. https://doi.org/10.3389/fpsyg.2015.00358

Cakim, I. (2023). New research confirms audio outperforms TV and digital. *Audacy*. Retrieved August 1, 2023, from https://audacyinc.com/insights/new-research-confirms-audio-outperforms-tv-and-digital/

Califano, G., & Spence, C. (2024). Assessing the visual appeal of real/AI-generated food images. *Food Quality and Preference*, *116*, 105149. https://doi.org/10.1016/j.foodqual.2024.105149

Caputo, A. (2018). A study on the perception of algorithmic composition music, *Proceedings of the National Conference on Undergraduate Research 2018*. University of Central Oklahoma.

Chan, T. H., & Chau, B. K. H. (2023). Mitigating the vampire effect of using celebrity in advertising: An eye-tracking approach. *Journal of Current Issues & Research in Advertising*, *44*(4), 453–472. https://doi.org/10.1080/10641734.2023.2209848

Chandler, D. (2017). *Semiotics: The basics*. Taylor & Francis.

Chouard, N., & Hempel, T. (1999). A semantic differential design especially developed for the evaluation of interior car sounds. *The Journal of the Acoustical Society of America*, *105*, 1280.

Chow, A. R. (2020). Musicians using AI to create otherwise impossible new songs. *Time*. https://time.com/5774723/ai-music/

Churchill, C., Maluski, S., & Cox, T. (2004). Simplified sound quality assessment for UK manufacturers, *33rd International Congress and Exposition on Noise Control Engineering* (pp. 1–7).

Clemente, A., Friberg, A., & Holzapfel, A. (2023). Relations between perceived affect and liking for melodies and visual designs. *Emotion (Washington, D.C.)*, *23*(6), 1584–1605. https://doi.org/10.1037/EMO0001141

Cowen, A. S., & Keltner, D. (2017). Self-report captures 27 distinct categories of emotion bridged by continuous gradients. *Proceedings of the National Academy of Sciences*, *114*(38), E7900–E7909. https://doi.org/10.1073/pnas.1702247114.

Cozine, E. (2020). Mastercard unveils its first-ever music single, delivering latest evolution of its sonic brand identity for the next decade. *Mastercard Press Release*. Retrieved January 7, 2020, from https://www.mastercard.com/news/press/2020/january/mastercard-unveils-its-first-ever-music-single-delivering-latest-evolution-of-its-sonic-brand-identity-for-the-next-decade/

Danesi, M. (2013). Semiotizing a product into a brand. *Social Semiotics*, *23*, 464–476. https://doi.org/10.1080/10350330.2013.799003

Davidson, R. J., Schwartz, G. E., Saron, C., Bennett, J., & Goleman, D. J. (1979). Frontal versus parietal EEG asymmetry during positive and negative affect. *Psychophysiology*, *16*, 202–203.

Deaville, J. A., Tan, S. & Rodman, R. W., (Eds.). (2021). *The Oxford handbook of music and advertising*. Oxford University Press.

De Lucia, M. (2022). Do sonic logos actually work? *Brandingmag*. Retrieved January 14, 2022, from https://www.brandingmag.com/2022/01/14/do-sonic-logos-actually-work/.

Dentsu. (2023). *Dentsu partners with six top audio destinations to measure attention in advertising in first-of-its-kind study with lumen research*. Dentsu. Retrieved March 3, 2024, from https://www.dentsu.com/us/en/media-and-investors/dentsu-partners-with-six-top-audio-destinations

Deroy, O., & Spence, C. (2013). Why we are not all synesthetes (not even weakly so. *Psychonomic Bulletin & Review*, *20*, 643–664. https://doi.org/10.3758/s13423-013-0387-2

Desai, A. (2023). *Notes from the FTC's creative economy and generative AI roundtable*. International Association of Privacy Professionals (IAPP). https://iapp.org/news/a/notes-from-the-ftcs-creative-economy-and-generative-ai-roundtablex/

Di Stefano, N., Ansani, A., Schiavio, A., & Spence, C. (2024). Prokofiev was (almost) right: A cross-cultural investigation of auditory-conceptual associations in Peter and the Wolf. *Psychonomic Bulletin & Review*. https://doi.org/10.3758/s13423-023-02435-7

Edwards, B. (2022). Darth Vader's voice will be AI-generated from now on. *Ars Technica*. https://arstechnica.com/information-technology/2022/09/james-earl-jones-signed-darth-vader-voice-rights-to-disney-for-ai-use/

Efthymiou, F., Hildebrand, C., de Bellis, E., & Hampton, W. H. (2023). The power of AI-generated voices: How digital vocal tract length shapes product congruency and ad performance. *Journal of Interactive Marketing*. https://doi.org/10.1177/10949968231194905

Eglīte, Ž. (2021). The role of senses, emotions and the principles of the experience economy in the creative industries. *Culture Crossroads*, *19*(1), 230–242. https://doi.org/10.55877/cc.vol19.25

Eklund, A. A., & Helmefalk, M. (2022). Congruency or incongruency: A theoretical framework and opportunities for future research avenues. *Journal of Product & Brand Management*, *31*(4), 606–621. https://doi.org/10.1108/JPBM-03-2020-2795

Elliot, A. J., & Maier, M. A. (2012). Color-in-context theory. In P. Devine, & A. Plant (Eds.), *Advances in experimental social psychology* (Vol. 45, pp. 61–125). Elsevier. https://doi.org/10.1016/B978-0-12-394286-9.00002-0

Elliott, A. F. (2014). Lights up, sound down, clothes on: Abercrombie & Fitch tones down its nightclub-themed stores in a bid to win back disinterested teens. *Daily Mail Online*. Retrieved May 23, 2014, from https://www.dailymail.co.uk/femail/article-2637492/Lights-sound-clothes-Abercrombie-Fitch-tones-nightclub-themed-stores-bid-win-disinterested-teens.html

Errajaa, K., Legohérel, P., Daucé, B., & Bilgihan, A. (2021). Scent marketing: Linking the scent congruence with brand image. *International Journal of Contemporary Hospitality Management*, *33*(2), 402–427. https://doi.org/10.1108/IJCHM-06-2020-0637

Farinella, D. J. (2009). Companies seek signature sound. *Variety*. Retrieved December 4, 2009, from https://variety.com/2009/digital/news/companies-seek-signature-sound-1118012189/Faure1996

Faure, A., McAdams, S., & Nosulenko, V. (1996). Verbal correlates of perceptual dimensions of timbre, *4th International Conference on Music Perception and Cognition* (pp. 79–84).

Federal Trade Commission. (2023). Creative economy and generative AI - transcript. *FTC Creative Economy and Generative AI Roundtable Transcript*. Retrieved October 4, 2023, from https://www.ftc.gov/system/files/ftc_gov/pdf/creative-economy-and-generative-ai-transcript-october-4-2023.pdf

Fernández-Sotos, A., Fernández-Caballero, A., & Latorre, J. M. (2016). Influence of tempo and rhythmic unit in musical emotion regulation. *Frontiers in Computational Neuroscience*, *10*, 80. https://doi.org/10.3389/fncom.2016.00080

Fiore, S. G., & Kelly, S. (2007). Surveying the use of sound in online stores: Practices, possibilities and pitfalls for user experience. *International Journal of Retail & Distribution Management*, *35*(7), 600–611. https://doi.org/10.1108/09590550710755967

Floridou, G. A., Williamson, V. J., & Müllensiefen, D. (2012). Contracting earworms: The role of personality and musicality. In E. Cambouropoulos, C. Tsougras, P. Mavromatis, & K. Pastiadis (Eds.), *Proceedings of the 12th International Conference on Music Perception and Cognition and the 8th Triennial Conference of the European Society for the Cognitive Sciences of Music* (pp. 302–309).

Flynn, E., Whyte, L., Krause, A. E., North, A. C., Areni, C., & Sheridan, L. (2022). Attribute accessibility, normative influence, and the effect of classical and country music on willingness to pay for social identity and utilitarian products. *Psychology of Music*, *50*(1), 3–16. https://doi.org/10.1177/0305735620976927

Fritz, T., Jentschke, S., Gosselin, N., Sammler, D., Peretz, I., Turner, R., Friederici, A. D., & Koelsch, S. (2009). Universal recognition of three basic emotions in music. *Current Biology*, *19*(7), 573–576. https://doi.org/10.1016/j.cub.2009.02.058

Fu, S., Wu, Y., Du, Q., Li, C., & Fan, W. (2024). The secret of voice: How acoustic characteristics affect video creators' performance on Bilibili. *Decision Support Systems*, *179*, 114167. https://doi.org/10.1016/j.dss.2023.114167

Fulberg, P. (2003). Using sonic branding in the retail environment: An easy and effective way to create consumer brand loyalty while enhancing the in-store experience. *Journal of Consumer Behaviour*, *3*(2), 193–198. https://doi.org/10.1002/cb.132

Galan, J.-P. (2009). Music and responses to advertising: The effects of musical characteristics, likeability and congruency. *Recherche et*

Applications en Marketing (English Edition), *24*(4), 3–22. https://doi.org/10.1177/205157070902400401

Gardner, N. (2005). Celebrity voice-overs: That not-too familiar voice could be selling you something. UW News. https://www.washington.edu/news/2005/12/20/celebrity-voice-overs-that-not-too-familiar-voice-could-be-selling-you-something/

Getz, L. M., & Kubovy, M. (2018). Questioning the automaticity of audiovisual correspondences. *Cognition*, *175*, 101–108.

Graakjær, N. J. (2012). Dance in the store: On the use and production of music in Abercrombie & Fitch. *Critical Discourse Studies*, *9*(4), 393–406. https://doi.org/10.1080/17405904.2012.713208

Graakjær, N. J. (2019). Sounding out I'm lovin' it – A multimodal discourse analysis of the sonic logo in commercials for McDonald's 2003–2018. *Critical Discourse Studies*, *16*(5), 569–582. https://doi.org/10.1080/17405904.2019.1624184

Graakjær, N. J. (2021). The sounds of Coca-Cola: On "cola-nization" of sound and music. In J. Deaville, S.-L. Tan, & R. Rodman (Eds.), *The Oxford handbook of music and advertising* (1st Ed., pp. 397–413). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190691240.013.18

Graakjær, N. J., & Bonde, A. (2018). Non-musical sound branding – A conceptualization and research overview. *European Journal of Marketing*, *52*(7/8), 1505–1525. https://doi.org/10.1108/EJM-09-2017-0609

Greenberg, J. H., & Jenkins, J. J. (1966). Studies in the psychological correlates of the sound system of American English. *WORD*, *22*, 207–242.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, *74*(6), 1464–1480. https://doi.org/10.1037/0022-3514.74.6.1464

Groves, J. (2009). A short history of sound branding. In K. Bronner, & R. Hirt (Eds.), *Audio branding brands, sound and communication* (pp. 62–75). Reinhard Fischer.

Groves, J. (2011). *Commusication: From Pavlov's dog to sound branding*. Oak Tree Press.

Guedes, D., Vaz Garrido, M., Lamy, E., Pereira Cavalheiro, B., & Prada, M. (2023). Crossmodal interactions between audition and taste: A systematic review and narrative synthesis. *Food Quality and Preference*, *107*, 104856. https://doi.org/10.1016/j.foodqual.2023.104856

Gustafsson, C. (2015). Sonic branding: A consumer-oriented literature review. *Journal of Brand Management*, *22*(1), 20–37. https://doi.org/10.1057/bm.2015.5

Guy, J. (2019). EU requires carmakers to add fake engine noises to electric cars. *CNN*. Retrieved July 1, 2019, from https://edition.cnn.com/2019/07/01/business/electric-vehicles-warning-noises-scli-intl-gbr/index.html

Hagtvedt, H., & Brasel, S. A. (2016). Crossmodal communication: Sound frequency influences consumer responses to color lightness. *Journal of Marketing Research*, *53*(4), 551–562. https://doi.org/10.1509/jmr.14.0414

Harwell, D. (2015). America's best-selling cars and trucks are built on lies: The rise of fake engine noise. *The Washington Post*. Retrieved January 21, 2015, from https://www.washingtonpost.com/business/economy/americas-best-selling-cars-and-trucks-are-built-on-lies-the-rise-of-fake-engine-noise/2015/01/21/6db09a10-a0ba-11e4-b146-577832eafcb4_story.html?noredirect=on&utm_term=.72837a32f5de

Hasan, R., Shams, R., & Rahman, M. (2021). Consumer trust and perceived risk for voice- controlled artificial intelligence: The case of Siri. *Journal of Business Research*, *131*, 591–597. https://doi.org/10.1016/j.jbusres.2020.12.012

Haverkamp, M. (2014). *Synesthetic design: Handbook for a multisensory approach*. Birkhäuser.

Heath, R. (2000). Low involvement processing – A new model of brands and advertising. *International Journal of Advertising*, *19*(3), 287–298. https://doi.org/10.1080/02650487.2000.11104802

Heath, R. (2010). *The hidden power of advertising: How low involvement processing influences the way we choose brands*. Admap Publications.

Hein, K. (2006). Sonic branding firms get increase in sales volume. *Brandweek*, *47*(14):8.

Heise, D. R. (1969). Some methodological issues in semantic differential research. *Psychological Bulletin*, *72*(6), 406–422. https://doi.org/10.1037/h0028448

Hilton, K. (2015). Psychology: The science of sensory marketing. *Harvard Business Review*, *March*, *28–31*. https://hbr.org/2015/03/the-science-of-sensory-marketing.

Holbrook, M. B., & Huber, J. (1979). Separating perceptual dimensions from affective overtones: An application to consumer aesthetics. *Journal of Consumer Research*, *5*(4), 272–283. https://www.jstor.org/stable/2488680

'How a car's horn says: "Buy me"' (2005, January 14). BBC News. http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk_news/wales/4174543.stm.

Hrushovski, B. (1981). The structure of semiotic objects. In W. Steiner (Ed.), *The sign in music and literature*. University of Texas Press.

Hu, X. (2010) Music and mood: Where theory and reality meet. *Proceedings of 2010 iConference*. http://hdl.handle.net/2142/14956.

Hull, R. (2023). Ferraris will still growl even when they run on batteries: Supercar legend files patent to boom electric drivetrain sounds out via external speakers. *This is Money*. Retrieved January 24, 2023. https://www.thisismoney.co.uk/money/electriccars/article-11670111/Ferrari-patent-reveals-supercars-growl-goes-electric.html

Hultén, B. (2011). Sensory marketing: The multi-sensory brand-experience concept. *European Business Review*, *23*(3), 256–273. https://doi.org/10.1108/09555341111130245

Hultén, B., Broweus, N., & van Dijk, M. (2009). *Sensory marketing*. Palgrave Macmillan.

Imai, M., Kita, S., Nagumo, M., & Okada, H. (2008). Sound symbolism facilitates early verb learning. *Cognition*, *109*(1), 54–65. https://doi.org/10.1016/j.cognition.2008.07.015.

Imai, M., Miyazaki, M., Yeung, H. H., Hidaka, S., Kantartzis, K., Okada, H., & Kita, S. (2015). Sound symbolism facilitates word learning in 14-month-olds. *PLoS One*, *10*(2), e0116494. https://doi.org/10.1371/journal.pone.0116494.

Iyer, S. P., & Aggarwal, A. (2019). The role of music in brand recall – A study of select two-wheeler advertisements. *International Journal of Management, Technology and Engineering*, *9*(1), 481–503

Jackson, D. (2003). Sonic branding: An essential guide to the art and science of sonic branding. Palgrave McMillan.

Jakubowski, K., Finkel, S., Stewart, L., & Müllensiefen, D. (2017). Dissecting an earworm: Melodic features and song popularity predict involuntary musical imagery. *Psychology of Aesthetics, Creativity, and the Arts*, *11*(2), 122–135. https://doi.org/10.1037/aca0000090

Jekosch, U. (2005). Assigning meaning to sounds – Semiotics in the context of product-sound design. In J. Blauert (Ed.), *Communication Acoustics* (pp. 211–226). Springer.

Joshi, P., & Kronrod, A. (2020). Sounds of green: How brand name sounds metaphorically convey environmental friendliness. *Journal of Advertising*, *49*(1), 61–77. https://doi.org/10.1080/00913367.2019.1696720

Juslin, P. N., & Lindström, E. (2011). Musical expression of emotions: Modelling listeners' judgements of composed and performed features. *Music Analysis*, *29*(1–3), 334–364. https://doi.org/10.1111/j.1468-2249.2011.00323.x

Kamins, M. A., & Gupta, K. (1994). Congruence between spokesperson and product type: A matchup hypothesis perspective. *Psychology & Marketing*, *11*(6), 569–586. https://doi.org/10.1002/mar.4220110605

Kang, J., & Zhang, M. (2010). Semantic differential analysis of the soundscape in urban open public spaces. *Building & Environment*, *45*, 150–157. https://doi.org/10.1016/j.buildenv.2009.05.014

Kantar. (2023). *From celebrity recognition to sonic branding - Kantar's AI cracks the code. Shape your brand future*. https://www.kantar.com/company-news/from-celebrity-recognition-to-sonic-branding-kantars-ai-cracks-the-code

Kato, T., & Yokote, R. (2023). Effect of driving sound of electric vehicle on product attractiveness. *Human-Centric Intelligent Systems*, *3*, 416–424. https://doi.org/10.1007/s44230-023-00030-6

Kaufman, L. (1999). The man who created Intel's audio 'signature'. *Los Angeles Times*. Retrieved October 20, 1999, from https://www.latimes.com/archives/la-xpm-1999-oct-20-fi-24321-story.html

Kawachi, Y., Kawabata, H., Kitamura, M. S., Shibata, M., Imaizumi, O., & Gyoba, J. (2011). Topographic distribution of brain activities corresponding to psychological structures underlying affective meanings: An fMRI study. *Japanese Psychological Research*, *53*(4), 361–371. https://doi.org/10.1111/j.1468-5884.2011.00485.x

Keller, S. (2018). Sound business: Improving your audio ROI. *The European Business Review*. Retrieved April 19, 2018, from https://www.europeanbusinessreview.com/sound-business-improving-your-audio-roi/

Keller, S., & Spence, C. (2023). Sounds like branding: Cognitive principles & crossmodal considerations for the design of successful sonic logos. *Expert Marketing Journal*, *11*, 91–117. https://marketing.expertjournals.com/23446773-1108

Kemp, E., Cho, Y.-N., Bui, M., & Kintzer, A. (2023). Music to the ears: The role of sonic branding in advertising. *International Journal of Advertising*, 1–21. https://doi.org/10.1080/02650487.2023.2273645

Khamis, S., & Keogh, B. (2021). Sonic branding and the aesthetic infrastructure of everyday consumption. *Popular Music*, *40*(2), 281–296. https://doi.org/10.1017/S0261143021000118

Kim, D. Y., & Kim, H.-Y. (2021). Trust me, trust me not: A nuanced view of influencer marketing on social media. *Journal of Business Research*, *134*, 223–232. https://doi.org/10.1016/j.jbusres.2021.05.024

Kim, S. G. (2020). Dissecting the sonic identity of brands: Timbre of sonic logo and brand perception. *Wharton Research Scholars*, *208*. https://repository.upenn.edu/wharton_research_scholars/208

Kim, Y., Schmidt, E., Migneco, R., Morton, B., Richardson, P., Scott, J., Speck, J., & Turnbull, D. (2010). Music emotion recognition: A state of the art review. *International Society of Music Information Retrieval Conference (ISMR 2010)*, *86*, 937–952.

Klaverstijn, T. (2021). A pinch of 'sonic seasoning' for your Black Bottle. https://wordsofwhisky.com/black-bottle-alchemy-series-sonic-seasoning/

Knoeferle, K., & Spence, C. (2021). Sound in the context of (multi-)sensory marketing. In J. A. Deaville, S. Tan, & R. W. Rodman (Eds.), *Oxford handbook of music and advertising* (pp. 833–856). Oxford University Press.

Knöferle, K. (2012). Using customer insights to improve product sound design. *Marketing Review St. Gallen*, *29*(2), 47–53.

Koles, B., Audrezet, A., Moulard, J. G., Ameen, N., & McKenna, B. (2024). The authentic virtual influencer: Authenticity manifestations in the metaverse. *Journal of Business Research*, *170*, 114325. https://doi.org/10.1016/j.jbusres.2023.114325

Koriat, A. (2008). Subjective confidence in one's answers: The consensuality principle. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *34*(4), 945–959. https://doi.org/10.1037/0278-7393.34.4.945

Krishna, A. (2012). An integrative review of sensory marketing: Engaging the senses to affect perception, judgment and behavior. *Journal of Consumer Psychology*, *22*(3), 332–351. https://doi.org/10.1016/j.jcps.2011.08.003

Krishna, A. (2013). *Customer sense: How the 5 senses influence buying behaviour*. Palgrave Macmillan.

Krishnan, V., & Kellaris, J. J. (2021). Hearing, remembering, and branding: Setting strategic directions for sonic branding research. In J. A. Deaville, S. Tan, & R. W. Rodman (Eds.), *The Oxford handbook of music and advertising* (pp. 674–696). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190691240.013.26

Krishnan, V., Kellaris, J. J., & Aurand, T. W. (2012). Sonic logos: Can sound influence willingness to pay? *Journal of Product & Brand Management*, *21*(4), 275–284. https://doi.org/10.1108/10610421211246685

Lageat, T., Czellar, S., & Laurent, G. (2003). Engineering hedonic attributes to generate perceptions of luxury: Consumer perception of an everyday sound. *Marketing Letters*, *14*, 97–109. https://doi.org/10.1023/A:1025462901401

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1998). Emotion, motivation, and anxiety: Brain mechanisms and psychophysiology. *Biological Psychiatry*, *44*(12), 1248–1263. https://doi.org/10.1016/s0006-3223(98)00275-3

Lapowsky, I. (2023). Everything to know about the government's efforts to regulate AI. *Fast Company*. https://www.fastcompany.com/90955937/everything-you-need-to-know-about-the-governments-efforts-to-regulate-ai

Lepa, S., Herzog, M., Steffens, J., Schoenrock, A., & Egermann, H. (2020). A computational model for predicting perceived musical expression in branding scenarios. *Journal of New Music Research*, *49*(4), 387–402. https://doi.org/10.1080/09298215.2020.1778041

Lesko, D. J., & Nguyen, V. (2023). Assessing the subjective response of consumer product acoustic stimuli in the presence of background variables. *Applied Acoustics*, *211*, 109508. https://doi.org/10.1016/j.apacoust.2023.109508

Li, P., Castelo, N., Katona, Z., & Sarvary, M. (2024). Determining the validity of large language models for automated perceptual analysis (December 6, 2023). Available at SSRN: https://ssrn.com/abstract=4241291 or; https://doi.org/10.2139/ssrn.4241291.

Lindstrom, M. (2005a). *Brand sense: How to build brands through touch, taste, smell, sight and sound*. Kogan Page.

Lindstrom, M. (2005b). Broad sensory branding. *Journal of Product and Brand Management*, *14*(2), 84–87. https://doi.org/10.1108/10610420510592554

Lowe, M. L., & Haws, K. L. (2017). Sounds big: The effects of acoustic pitch on product perceptions. *Journal of Marketing Research*, *54*(2), 331–346. https://doi.org/10.1509/jmr.14.0300

Made Music Studio (2022). *Tostitos sonic logo: Case study*. https://mademusicstudio.com/case-studies/tostitos/

Madison, G., & Schiölde, G. (2017). Repeated listening increases the liking for music regardless of its complexity: Implications for the appreciation and aesthetics of music. *Frontiers in Neuroscience*, *11*, 147. https://www.frontiersin.org/articles/10.3389/fnins.2017.00147

Mahdavi, M., Barbosa, B., Oliveira, Z., & Chkoniya, V. (2020). Sounds of scents: Olfactory-auditory correspondences in the online purchase experience for perfume. *Review of Business Management*, *22*(4), 836–853.

Margulis, E. H., Wong, P. C. M., Turnbull, C., Kubit, B. M., & McAuley, J. D. (2022). Narratives imagined in response to instrumental music reveal culture-bounded intersubjectivity. *Proceedings of the National Academy of Sciences*, *119*(4), e2110406119. https://doi.org/10.1073/pnas.2110406119

Maroely, R., & Munichor, N. (2023). Music to the individual consumer's ears: How and why does personalizing music in advertising enhance viewing duration and ad effectiveness? *International Journal of Advertising*, *42*(4), 682–712. https://doi.org/10.1080/02650487.2022.2106675

Marozeau, J., de Cheveigné, A., McAdams, S., & Winsberg, S. (2003). The dependency of timbre on fundamental frequency. *The Journal of the Acoustical Society of America*, *114*(5), 2946–2957. https://doi.org/10.1121/1.1618239

Martin, R. (2023). Sounding it out: The future of sound design in the wake of AI. *Shots*. Retrieved May 23, 2023, from https://shots.net/news/view/sounding-it-out-the-future-of-sound-design-in-the-wake-of-ai.

Mas, L. (2019). Sonic logos: An experimental design on sound features and brand personality. *Anuario electrónico de estudios en Comunicación Social "Disertaciones"*, *12*(2), 125–141. https://doi.org/10.12804/revistas.urosario.edu.co/disertaciones/a.6373

Mas, L., Bolls, P., Rodero, E., Barreda-Ángeles, M., & Churchill, A. (2021). The impact of the sonic logo's acoustic features on orienting responses, emotions and brand personality transmission. *Journal of Product & Brand Management*, *30*(5), 740–753. https://doi.org/10.1108/JPBM-05-2019-2370

McAdams, S., Winsberg, S., Donnadieu, S., De Soete, G., & Krimphoff, J. (1995). Perceptual scaling of synthesized musical timbres: Common dimensions, specificities, and latent subject classes. *Psychological Research*, *58*, 177–192. https://doi.org/10.1007/BF00419633

McCrae, R. R. (2021). Music lessons for the study of affect. *Frontiers in Psychology*, *12*, 760167. https://doi.org/10.3389/fpsyg.2021.760167.

McCullough, E. (2023). Millennials & Gen Z more likely to buy from brands with consistent sound. *DLMDD*. Retrieved January 5, 2023, from https://dlmdd.com/article/yougov-study-sound-equals-spend/

McGuire, L., & Crawford, A. (2023). Sonic branding will give 'voice' to new tech in 2023. *Adweek*. https://www.adweek.com/brand-marketing/sonic-branding-will-give-voice-to-new-tech-in-2023/.

McKendrick, J. (2022). Who ultimately owns content generated by ChatGPT and other AI platforms? *Forbes*. Retrieved December 21, 2022, from https://www.forbes.com/sites/joemckendrick/2022/12/21/who-ultimately-owns-content-generated-by-chatgpt-and-other-ai-platforms/?sh=63ec8bbc5423.

McLeod, K. (2021). Designing identities: Sound and music in automotive and appliance branding. In J. A. Deaville, S.-L. Tan, & R. W. Rodman (Eds.), *Oxford handbook of music and advertising* (pp. 186–202). Oxford University Press.

Mehrabian, A. R., & Russell, J. A. (1974). *An approach to environmental psychology*. MIT Press.

Melzner, J., & Raghubir, P. (2023). The sound of music: The effect of timbral sound quality in audio logos on brand personality perception. *Journal of Marketing Research*, *60*(5), 932–949. https://doi.org/10.1177/00222437221135188

Mesz, B., Sigman, M., & Trevisan, M. A. (2012). A composition algorithm based on crossmodal taste-music correspondences. *Frontiers in Human Neuroscience*, *6*(71), 1–6. https://doi.org/10.3389/fnhum.2012.00071

Mesz, B., Sakdavong, J.-C., Silén, S., & Hopia, A. (2023a). Aesthetic emotions in a mixed reality gastrosonic experience: An exploratory study. *Digital Creativity*, 1–16. https://doi.org/10.1080/14626268.2023.2287189

Mesz, B., Tedesco, S., Reinoso-Carvalho, F., Ter Horst, E., Molina, G., Gunn, L. H., & Küssner, M. B. (2023b). Marble melancholy: Using crossmodal correspondences of shapes, materials, and music to predict music-induced emotions. *Frontiers in Psychology*, *14*, 1168258. https://doi.org/10.3389/fpsyg.2023.1168258.

Mick, D. G. (1986). Consumer research and semiotics: Exploring the morphology of signs, symbols, and significance. *Journal of Consumer Research*, *13*, 196–213.

Miller, R. (2021). The semantic differential in the study of musical perception: A theoretical overview. *Visions of Research in Music Education*, *16*, 11. https://opencommons.uconn.edu/vrme/vol16/iss1/11

Millet, B., Chattah, J., & Ahn, S. (2021). Soundtrack design: The impact of music on visual attention and affective responses. *Applied Ergonomics*, *93*, 103301. https://doi.org/10.1016/j.apergo.2020.103301

Minskey, L., & Fahey, C. (2017). *Audio branding: Using sound to build your brand*. Kogan Page.

Minsky, L., Fahey, C., & Fabrigas, C. (2018). Inside the invisible but influential world of scent branding. *Harvard Business Review*. Retrieved April 11, 2018, from https://hbr.org/2018/04/inside-the-invisible-but-influential-world-of-scent-branding

Miranda, E. R. (1995). An artificial intelligence approach to sound design. *Computer Music Journal*, *19*(2), 59–75. https://doi.org/10.2307/3680600

Miron, M. S. (1961). A crosslinguistic investigation of phonetic symbolism. *The Journal of Abnormal and Social Psychology*, *62*, 623–630. https://doi.org/10.1037/h0045212

Miyamoto, K., Taniyama, Y., Hine, K., & Nakauchi, S. (2023). Congruency of color–sound crossmodal correspondence interacts with color and sound discrimination depending on color category. *i-Perception*, *14*(4), 1–32. https://doi.org/10.1177/20416695231196835

Montignies, F., Nosulenko, V., & Parizet, E. (2010). Empirical identification of perceptual criteria for customer-centred design. Focus on the sound of tapping on the dashboard when exploring a car. *International Journal of Industrial Ergonomics*, *40*, 592–603.

Motoki, K., Saito, T., & Velasco, C. (2022). Spontaneous crossmodal correspondences grounded in contexts. *Food Quality and Preference*, *100*, 104619. https://doi.org/10.1016/j.foodqual.2022.104619

Motoki, K., Pathak, A., & Spence, C. (2022). Tasting prosody: Crossmodal correspondences between voice quality and basic tastes. *Food Quality and Preference*, *100*, 104621. https://doi.org/10.1016/j.foodqual.2022.104621

Motoki, K., Marks, L. E., & Velasco, C. (2023). Reflections on cross-modal correspondences: Current understanding and issues for future research. *Multisensory Research*, *37*(1), 1–23. https://doi.org/10.1163/22134808-bja10114

Motoki, K., Park, J., Pathak, A., & Spence, C. (2021). Constructing healthy food names: On the sound symbolism of healthy food. *Food Quality and Preference*, *90*, 104157. https://doi.org/10.1016/j.foodqual.2020.104157

Motoki, K., Park, J., Pathak, A., & Spence, C. (2022). The connotative meanings of sound symbolism in brand names: A conceptual framework. *Journal of Business Research*, *150*, 365–373. https://doi.org/10.1016/j.jbusres.2022.06.013

Motoki, K., Takahashi, N., Velasco, C., & Spence, C. (2022). Is classical music sweeter than jazz? Crossmodal influences of background music and taste/flavour on healthy and indulgent food preferences. *Food Quality & Preference*, *96*, 104380. https://doi.org/10.1016/j.foodqual.2021.104380

Motoki, K., Park, J., Pathak, A., & Spence, C. (2023). Creating luxury brand names in the hospitality and tourism sector: The role of sound symbolism in destination branding. *Journal of Destination Marketing & Management*, *30*, 100815. https://doi.org/10.1016/j.jdmm.2023.100815

Motoki, K., Saito, T., Nouchi, R., Kawashima, R., & Sugiura, M. (2019). A sweet voice: The influence of crossmodal correspondences between taste and vocal pitch on advertising effectiveness. *Multisensory Research*, *32*(4–5), 401–427. https://doi.org/10.1163/22134808-20191365

Motoki, K., Saito, T., Park, J., Velasco, C., Spence, C., & Sugiura, M. (2020). Tasting names: Systematic investigations of taste-speech sounds associations. *Food Quality & Preference*, *80*, 103801. https://doi.org/10.1016/j.foodqual.2019.103801

Müllensiefen, D. (2021). Methods for testing the emotional effects of music in advertising and brand communications. In J. A. Deaville, S. Tan, & R. W. Rodman (Eds.), *The Oxford handbook of music and advertising* (pp. 697–719). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190691240.013.34

Müller, J., & Kirchgeorg, M. (2011). Audio branding in line with brand personality. In K. Bronner, R. Hirt, & C. Ringe (Eds.), *Audio branding academy yearbook 2010/2011* (pp. 189–203). Nomos.

Neff, J. (2000). Product scents hide absence of true innovation. *Advertising Age*. Retrived February 21, 2022, from http://adage.com/article/news/product-scents-hide-absence-true-innovation/59353/

Newton, A. M. (2015). Semiotics of music, semiotics of sound, and film: Toward a theory of acousticons [Doctoral dissertation, University of Texas at Austin]. https://repositories.lib.utexas.edu/bitstream/handle/2152/31592/NEWTON-DISSERTATION-2015.pdf.

Nordenstreng, K. (1968). A comparison between the semantic differential and similarity analysis in the measurement of musical experience. *Scandinavian Journal of Psychology*, *9*, 89–96.

Oakes, S., & Abolhasani, M. (2021). Musical congruity in advertising: Established and emerging themes. In J. A. Deaville, S. Tan, & R. W. Rodman (Eds.), *The Oxford handbook of music and advertising* (pp. 674–696). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190691240.013.32

Osgood, C. E. (1964). Semantic differential technique in the comparative study of cultures. *American Anthropologist*, *66*(3), 171–200. https://doi.org/10.1525/aa.1964.66.3.02a00880

Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. (1957). *The measurement of meaning*. University of Illinois Press.

Oyama, T., Yamada, H., & Iwasawa, H. (1998). Synesthetic tendencies as the basis of sensory symbolism: A review of a series of experiments by means of semantic differential. *Psychologia*, *41*(3), 203–215.

Palù, D. D., Buiatti, E., Puglisi, G. E., Houix, O., Susini, P., De Giorgi, C., & Astolfi, A. (2017). The use of semantic differential scales in listening tests: A comparison between context and laboratory test conditions for the rolling sounds of office chairs. *Applied Acoustics*, *127*, 270–283. https://doi.org/10.1016/j.apacoust.2017.06.016

Parise, C. V., & Spence, C. (2012). Assessing the associations between brand packaging and brand attributes using an indirect performance measure. *Food Quality and Preference*, *24*(1), 17–23. https://doi.org/10.1016/j.foodqual.2011.08.004

Parise, C. V., Knorre, K., & Ernst, M. O. (2014). Natural auditory scene statistics shapes human spatial hearing. *Proceedings of the National Academy of Sciences*, *111*, 6104–6108. https://doi.org/10.1073/pnas.1322705111

Park, J., Motoki, K., Pathak, A., & Spence, C. (2021). A sound brand name: The role of voiced consonants in pharmaceutical branding. *Food Quality & Preference*, *90*, 104104. https://doi.org/10.1016/j.foodqual.2020.104104

Pendergast, M. (2013). *For God, country & Coca-Cola* (3rd Ed.). Basic Books.

Pickup, O. (2017). Shopping with voice tech challenges brands. *Raconteur*, *484*(November 15th), 3.

Pine, B. J., & Gilmore, J. H. (2011). *The experience economy*. Harvard Business Review Press.

Piqueras-Fiszman, B., & Spence, C. (2012). Sensory incongruity in the food and beverage sector: Art, science, and commercialization. *Petits Propos Culinaires*, *95*, 74–118.

Plasschaert, J. (1995). The meaning of colour on packaging – A methodology for qualitative research using semiotic principles and computer image manipulation. Decision making and research in action. *48th ESOMAR Marketing Research Congress* (pp. 217–232). Amsterdam, The Netherlands.

Posner, J., Russell, J. A., & Peterson, B. S. (2005). The circumplex model of affect: An integrative approach to affective neuroscience, cognitive development, and psychopathology. *Development and Psychopathology*, *17*(3), 715–734. https://doi.org/10.1017/S0954579405050340.

Poulsson, S. H. G., & Kale, S. H. (2004). The experience economy and commercial experiences. *The Marketing Review*, *4*(3), 267–277. https://doi.org/10.1362/1469347042223445

Poushneh, A. (2021a). Impact of auditory sense on trust and brand affect through auditory social interaction and control. *Journal of Retailing and Consumer Services*, *58*, 102281. https://doi.org/10.1016/j.jretconser.2020.102281

Poushneh, A. (2021b). Humanizing voice assistant: The impact of voice assistant personality on consumer's attitudes and behaviors. *Journal of Retailing and Consumer Services*, *58*, 102283. https://doi.org/10.1016/j.jretconser.2020.102283

Puligadda, S., & VanBergen, N. (2023). The influence of sound logo instruments on brand personality perceptions: An investigation of brand ruggedness and sophistication. *Journal of Business Research*, *156*, 113531. https://doi.org/10.1016/j.jbusres.2022.113531

Reber, R., & Schwarz, N. (2001). The hot fringes of consciousness: Perceptual fluency and affect. *Consciousness & Emotion*, *2*(2), 223–231. https://doi.org/10.1075/ce.2.2.03reb

Reinoso-Carvalho, F., Gunn, L. H., ter Horst, E., & Spence, C. (2020b). Blending emotions and crossmodality in sonic seasoning: Towards greater applicability in multisensory food experience design. *Foods*, *9*, 1876. https://www.mdpi.com/2304-8158/9/12/1876/pdf

Reinoso-Carvalho, F., Gunn, L., Molina, T., Narumi, T., Spence, C., Suzuki, Y., ter Horst, E., & Wagemans, J. (2020a). A sprinkle of emotions vs a pinch of crossmodality: Towards globally meaningful sonic seasoning strategies for tasting experiences. *Journal of Business Research*, *117*, 389–399. https://doi.org/10.1016/j.jbusres.2020.04.055

Reybrouck, M. (2017). *Music and semiotics: An experiential approach to musical sense-making*. InTech. https://doi.org/10.5772/67860

Reymore, L. (2022). Characterizing prototypical musical instrument timbres with timbre trait profiles. *Musicae Scientiae*, *26*(3), 648–674. https://doi.org/10.1177/10298649211001523

Rigg, M. (1937). An experiment to determine how accurately college students can interpret the intended meanings of musical compositions. *Journal of Experimental Psychology*, *21*, 223–229. https://doi.org/10.1037/h0056146

Robinson, G. (2022, October 15). *9* psychoacoustic sound design tricks to improve your music. *Get That Pro Sound*. https://getthatprosound.com/hacking-your-listeners-ears-9-psychoacoustic-sound-design-tricks-to-improve-your-music/

Rodríguez, B., Reyes, L. H., & Reinoso-Carvalho, F. (2023). Exploring crossmodal associations between sound and the chemical senses: A systematic review including interactive visualizations. *Multisensory Research*, *36*(8), 725–825. https://doi.org/10.1163/22134808-bja10107

Rosi, V., Houix, O., Misdariis, N., & Susini, P. (2022). Investigating the shared meaning of metaphorical sound attributes. *Music Perception*, *39*, 468–483. https://doi.org/10.1525/mp.2022.39.5.468

Rosi, V., Ravillion, A., Houix, O., & Susini, P. (2022). Best-worst scaling, an alternative method to assess perceptual sound qualities. *JASA Express Letters*, *2*, 064404. https://doi.org/10.1121/10.0011752

Rosi, V., Sarah, P. A., Houix, O., Misdariis, N., & Susini, P. (2023). Shared mental representations underlie metaphorical sound concepts. *Scientific Reports*, *13*(1), 5180. https://doi.org/10.1038/s41598-023-32214-2

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, *39*(6), 1161–1178. https://doi.org/10.1037/h0077714

Sagha, M. A., Seyyedamiri, N., Foroudi, P., & Akbari, M. (2022). The one thing you need to change is emotions: The effect of multi-sensory marketing on consumer behavior. *Sustainability*, *14*(4), 2334. https://doi.org/10.3390/su14042334

Saitis, C., Weinzierl, S., von Kriegstein, K., Ystad, S., & Cuskley, C. (2020). Timbre semantics through the lens of crossmodal correspondences: A new way of asking old questions. *Acoustical Science & Technology*, *41*(1), 365–368. https://doi.org/10.1250/ast.41.365

Salgado-Montejo, A., Velasco, C., Olier, J. S., Alvarado, J., & Spence, C. (2014). Love for logos: Evaluating the congruency between brand symbols and typefaces and their relation to emotional words. *Journal of Brand Management*, *21*(7–8), 635–649. https://doi.org/10.1057/bm.2014.29

Sanz-Segura, R., & Manchado-Pérez, E. (2017). Potential of application of psychoacoustics to user/product interaction design. *Proceedings of AM '17*. August 23–6, 2017, London, United Kingdom. https://doi.org/10.1145/3123514.3123554.

Satariano, A. (2023). Europeans take a major step toward regulating A.I. *The New York Times*. https://www.nytimes.com/2023/06/14/technology/europe-ai-regulation.html

Schaefer, M., & Rotte, M. (2010). Combining a semantic differential with fMRI to investigate brands as cultural symbols. *Social Cognitive and Affective Neuroscience*, *5*(2–3), 274–281. https://doi.org/10.1093/scan/nsp055

Schäffer, B., Pieren, R., Brink, M., & Schlittmeier, S. J. (2023). Development and application of a semantic differential for perception-based optimization of wind turbine and other broadband sounds. *Applied Acoustics*, *211*, 109493. https://doi.org/10.1016/j.apacoust.2023.109493

Scherer, D. A. (2021). Money for something: Music licensing in the 21st century. *Congressional Research Service*. R43984. Retrieved February 23, 2021, from https://sgp.fas.org/crs/misc/R43984.pdf

Scott, S. P., Sheinin, D., & Labrecque, L. I. (2022). Small sounds, big impact: Sonic logos and their effect. *Journal of Product & Brand Management*, *31*(7), 1091–1103. https://doi.org/10.1108/JPBM-06-2021-3507

Seymour, W., Zhan, Z., Coté, M., Such, J. (2023). A systematic review of ethical concerns with voice assistants. In *Proceedings of the 2023 AAAI/ACM Conference on AI, Ethics, and Society (AIES '23)* (pp. 131–145. Association for Computing Machinery. https://doi.org/10.1145/3600211.3604679

Sheridan, A. (2020). The power of you: Why distinctive brand assets are a driving source of creative effectiveness. *Ipsos Views*. https://www.ipsos.com/sites/default/files/2022-03/power-of-you-ipsos.pdf.

Sidhu, D. M., Vigliocco, G., & Pexman, P. M. (2022). Higher order factors of sound symbolism. *Journal of Memory and Language*, *125*, 104323. https://doi.org/10.1016/j.jml.2022.104323

Simner, J., Cuskley, C., & Kirby, S. (2010). What sound does that taste? Cross-modal mappings across gustation and audition. *Perception*, *39*(4), 553–569. https://doi.org/10.1068/p6591.

Singh, N. (2014). Sonic branding: An audible brand value. *Journal of Marketing and Communication*, *10*(2), 28–35.

Snider, J. G., & Osgood, C. E. (1969). *Semantic differential technique: A sourcebook*. Aldine Publishing.

Spehr, G. (2009). Audio branding - All new? In K. Bronner, & R. Hirt (Eds.), *Audio branding. Brands, sound and communication* (pp. 27–33). Nomos.

Spence, C. (2011). Crossmodal correspondences: A tutorial review. *Attention, Perception, & Psychophysics*, *73*(4), 971–995. https://doi.org/10.3758/s13414-010-0073-7

Spence, C. (2012a). Managing sensory expectations concerning products and brands: Capitalizing on the potential of sound and shape symbolism. *Journal of Consumer Psychology*, *22*(1), 37–54. https://doi.org/10.1016/j.jcps.2011.09.004

Spence, C. (2012b). Synaesthetic marketing: Cross sensory selling that exploits unusual neural cues is finally coming of age. *The Wired World in 2013*, (November), 104–107.

Spence, C. (2015). Book review: Synesthetic design: Handbook for a multisensory approach, written by michael haverkamp. *Multisensory Research*, *28*(3–4), 245–248. https://doi.org/10.1163/22134808-00002476

Spence, C. (2019). On the relative nature of (pitch-based) crossmodal correspondences. *Multisensory Research*, *32*(3), 235–265. https://doi.org/10.1163/22134808-20191407

Spence, C. (2020a). Assessing the role of emotional mediation in explaining crossmodal correspondences involving musical stimuli. *Multisensory Research*, *33*, 1–29. https://doi.org/10.1163/22134808-20191469

Spence, C. (2020b). On the ethics of neuromarketing & sensory marketing. In J. Trempe-Martineau, & E. Racine (Eds.), *Organizational neuroethics: Reflections on the contributions of neuroscience to management theories and business practice* (pp. 9–30). Springer Nature.

Spence, C. (2021a). Sonic seasoning and other multisensory influences on the coffee drinking experience. *Frontiers in Computer Science*, *3*, 644054. https://doi.org/10.3389/fcomp.2021.644054.

Spence, C. (2021b). *Sensehacking: How to use the power of your senses for happier, heathier living*. Viking Penguin.

Spence, C. (2023). The science of voice branding. In L. Minsky, S. Westwater, S. Westwater, & C. Fahey (Eds.), *Voice marketing: Harnessing the power of conversational AI to drive customer engagement* (pp. 52–55). Kogan Page.

Spence, C., & Zampini, M. (2006). Auditory contributions to multisensory product perception. *Acta Acustica United with Acustica*, *92*(6), 1009–1025.

Spence, C., & Zampini, M. (2007). Affective design: Modulating the pleasantness and forcefulness of aerosol sprays by manipulating aerosol spraying sounds. *CoDesign*, *3*(sup1), 107–121. https://doi.org/10.1080/15710880701362679

Spence, C., & Gallace, A. (2011). Multisensory design: Reaching out to touch the consumer. *Psychology & Marketing*, *28*(3), 267–308. https://doi.org/10.1002/mar.20392

Spence, C., & Van Doorn, G. (2022). Visual communication via the design of food and beverage packaging. Cognitive Research: Principles and Implications, *7*, 42. https://doi.org/10.1186/s41235-022-00391-9; https://rdcu.be/cNr41

Spence, C., & Di Stefano, N. (2023). Sensory translation between audition and vision. *Psychonomic Bulletin & Review*. https://doi.org/10.3758/s13423-023-02343-w

Spence, C., Di Stefano, N., Reinoso-Carvalho, F., & Velasco, C. *Marketing sonified fragrance: Designing soundscapes for scent. i-Perception*. Manuscript submitted for publication.

Spence, C., Reinoso-Carvalho, F., Velasco, C., & Wang, Q. J. (2019). Extrinsic auditory contributions to food perception & consumer behaviour: An interdisciplinary review. *Multisensory Research*, *32*, 275–318. https://doi.org/10.1163/22134808-20191403

Spence, C., Wang, Q. J., Reinoso-Carvalho, F., & Keller, S. (2021). Commercializing sonic seasoning in multisensory offline experiential events and online tasting experiences. *Frontiers in Psychology*, *12*, 740354. https://doi.org/10.3389/fpsyg.2021.740354

Stevens, S. S. (1957). On the psychophysical law. *Psychological Review*, *64*(3), 153–181. https://doi.org/10.1037/h0046162

Suchman, P. (2024). 5 ways that audio will be transformed by technology. AdAge. Retrieved January 16, 2024, from https://adage.com/article/media/5-ways-audio-will-be-transformed-technology/2536896

Sunaga, T., Moriguhi, T., Nishii, M., & Spence, C. The effect of semantic congruency between instrumental timbre and visual design features on consumer decision-making. *Journal of Business Research*. Manuscript submitted for publication.

Sunaga, T., Moriguchi, T., Nishii, M., & Spence, C. (2021). Assessing multisensory semantic congruence involving instrumental timbre. *EMAC*, (May).

Sundar, A., & Noseworthy, T. J. (2016a). Too exciting to fail, too sincere to succeed: The effects of brand personality on sensory disconfirmation. *Journal of Consumer Research*, *43*(1), 44–67. https://doi.org/10.1093/jcr/ucw003

Sundar, A., & Noseworthy, T. J. (2016b). When sensory marketing works and when it backfires. *Harvard Business Review*. Retrieved May 19, 2016, from https://hbr.org/2016/05/when-sensory-marketing-works-and-when-it-backfires?referral=03758&cm_vc=rr_item_page.top_right

Sundbo, J. (2013). *Handbook on the experience economy*. Elgar.

Takada, M., Mori, H., Sakamoto, S., & Iwamiya, S. (2019). Structural analysis of the value evaluation of vehicle door-closing sounds. *Applied Acoustics*, *156*, 306–318. https://doi.org/10.1016/j.apacoust.2019.07.025

Taylor, C. R. (2023a). The need to be heard: Why sonic branding is growing in importance. *Forbes*. https://www.forbes.com/sites/charlesrtaylor/2023/07/31/the-need-to-be-heard-why-sonic-branding-is-growing-in-importance/?sh=7d3a5d54673a

Taylor, C. R. (2023b). Why companies should associate their brands with sounds. *Forbes*. https://www.forbes.com/sites/charlesrtaylor/2023/09/28/why-companies-should-associate-their-brands-with-sounds/?sh=6a371684230a

Techawachirakul, M., Pathak, A., & Calvert, G. A. (2022). That sounds healthy! Audio and visual frequency differences in brand sound logos modify the perception of food healthfulness. *Food Quality and Preference*, *99*, 104544. https://doi.org/10.1016/j.foodqual.2022.104544

Techawachirakul, M., Pathak, A., Motoki, K., & Calvert, G. A. (2023a). Sonic branding of meat-and plant-based foods: The role of timbre. *Journal of Business Research*, *165*, 114032. https://doi.org/10.1016/j.jbusres.2023.114032

Techawachirakul, M., Pathak, A., Motoki, K., & Calvert, G. A. (2023b). Influencing brand personality with sonic logos: The role of musical timbre. *Journal of Business Research*, *168*, 114169. https://doi.org/10.1016/j.jbusres.2023.114169.

Tenenbaum, J. B., Kemp, C., Griffiths, T. L., & Goodman, N. D. (2011). How to grow a mind: Statistics, structure, and abstraction. *Science*, *331*, 1279–1285. https://doi.org/10.1126/science.1192788

Thayer, R. E. (1989). *The origin of everyday moods: Managing energy, tension and stress*. Oxford University Press.

Trainor, L. J., & Trehub, S. E. (1992). The development of referential meaning in music. *Music Perception*, *9*(4), 455–470. http://www.jstor.org/stable/40285565

Tran, J., & Getz, L. M. (2023). Attention required for advertisement pitch, tempo, and timbre to influence the perception of product features. *Music Perception: An Interdisciplinary Journal*, *41*(1), 59–73. https://doi.org/10.1525/MP.2023.41.1.59

Treasure, J. (2007). *Sound business*. Management Books 2000 Ltd.

Tzeng, O. C. S., & May, W. H. (1975). More than E, P and A in semantic differential scales. *International Journal of Psychology*, *10*(2), 101–117. https://doi.org/10.1080/00207597508247324

Unger, S. (2017). *More than noise: Sonic branding and the power of sound*. https://www.paramount.com/news/content-and-experiences/more-than-noise-sonic-branding-and-the-power-of-sound.

Ungoed-Thomas, J. (2016, June 12). Fake growl gives family cars hoarse power. The Sunday Times (News).

Van Esch, P., & Stewart Black, J. (2021). Artificial intelligence (AI): Revolutionizing digital marketing. *Australasian Marketing Journal*, *29*(3), 199–203.

Van Leeuwen, T. (1999). *Speech, music, sound*. Palgrave Macmillan.

Vandana, T., Kalyani, N., & Santhi Sree, K. (2019). Music mood categorization: A survey. In V. Gunjan, V. Garcia Diaz, M. Cardona, V. Solanki, & K. Sunitha (Eds.), *ICICCT 2019 – System reliability, quality control, safety, maintenance and management*. Springer. https://doi.org/10.1007/978-981-13-8461-5_14

Velasco, C., Barbosa Escobar, F., Spence, C., & Olier, J. S. (2023). The taste of colours revisited. *Food Quality & Preference*, *112*, 105009. https://doi.org/10.1016/j.foodqual.2023.105009

Vidal-Mestre, M. (2017). Branding sonoro. El sonotipo como impulso emocional y mnemotécnico en las marcas. [Tesis doctoral] Barcelona: Universidad Abat Oliba CEU. http://hdl.handle.net/10637/11604

Vidal-Mestre, M., Freire-Sánchez, A., Calderón-Garrido, D., Faure-Carvallo, A., & Gustems-Carnicer, J. (2022). Audio identity in branding and brand communication strategy: A systematic review of the literature on audio branding. *El Profesional de la información*, *31*(5), e310504. https://doi.org/10.3145/epi.2022.sep.04

de Villers, M. V., Chinomona, R., & Chuchu, T. (2018). The influence of store environment on brand attitude, brand experience and purchase intention. *South African Journal of Business Management*, *49*(1), 186. https://doi.org/10.4102/sajbm.v49i1.186

Wallmark, Z. (2019). Semantic crosstalk in timbre perception. *Music & Science*, *2*, 1–18. https://doi.org/10.1177/2059204319846617

Wang, Q., Woods, A. T., & Spence, C. (2015). "What's your taste in music?" A comparison of the effectiveness of various soundscapes in evoking specific tastes. *i-Perception*, *6*(6), 204166951562200. https://doi.org/10.1177/2041669515622001

Wang, Q. (J.), Keller, S., & Spence, C. (2017). Sounds spicy: Enhancing the evaluation of piquancy by means of a customised crossmodally congruent soundtrack. *Food Quality & Preference*, *58*, 1–9. https://doi.org/10.1016/j.foodqual.2016.12.014

Wang, X., Wei, Y., & Yang, D. (2022). Cross-cultural analysis of the correlation between musical elements and emotion. *Cognitive Computation and Systems*, *4*(2), 116–129.

Wang, Y. S., Shen, G. Q., Guo, H., Tang, X. L., & Hamade, T. (2013). Roughness modelling based on human auditory perception for sound quality evaluation of vehicle interior noise. *Journal of Sound and Vibration*, *332*(16), 3893–3904. https://doi.org/10.1016/j.jsv.2013.02.030

Watt, R., & Quinn, S. (2007). Some robust higher-level percepts for music. *Perception*, *36*(12), 1834–1848. https://doi.org/10.1068/p5663

Wazir, M. I., & Wazir, O. (2015). Effects of sonic logo on brand recognition of the advertised brand. *City University Research Journal*, *5*(2), 327–337.

Wienrich, C., Carolus, A., Markus, A., Augustin, Y., Pfister, J., & Hotho, A. (2023). Long-term effects of perceived friendship with intelligent voice assistants on usage behavior, user experience, and social perceptions. *Computers*, *12*, 77. https://doi.org/10.3390/computers12040077

Windsor, W. L. (2004). An ecological approach to semiotics. *Journal for the Theory of Social Behaviour*, *34*(2), 179–198. https://doi.org/10.1111/j.0021-8308.2004.00242.x

Wolkomir, R. (1996). Decibel by decibel, reducing the din to a very dull roar. *Smithsonian Magazine*, (February), 56–65.

Woods, A. T., Velasco, C., Levitan, C. A., Wan, X., & Spence, C. (2015). Conducting perception research over the internet: A tutorial review. *PeerJ*, *3*, e1058. https://doi.org/10.7717/peerj.1058

Wright, T., & Ward, J. (2013). The evolution of a visual-to-auditory sensory substitution device using interactive genetic algorithms. *Quarterly Journal of Experimental Psychology*, *66*(8), 1620–1638. https://doi.org/10.1080/17470218.2012.754911

Xi, N., & Hamari, J. (2021). Shopping in virtual reality: A literature review and future agenda. *Journal of Business Research*, *134*, 37–58. https://doi.org/10.1016/j.jbusres.2021.04.075

Yandoli, K. L. (2023). Studios can now make AI clones of your favorite actors. *Rolling Stone*. https://www.rollingstone.com/tv-movies/tv-movie-news/sag-aftra-amptp-studios-contract-artifial-intelligence-details-1234877093/

Yeoh, J., & Spence, C. (2023). Background music's impact on patients waiting in surgery and radiology clinics. *HERD*, *16*, 278–290. https://doi.org/10.1177/19375867231161094

Yeoh, J. P. S., Han, M. G., & Spence, C. (2023). The impact of musical fit and sound design on consumers' perception of a luxury car ad. *Luxury*, *9*(2–3), 165–184. https://doi.org/10.1080/20511817.2022.2224496

Zacharakis, A., Michail, I., & Pastiadis, K. (2023). Scent of a timbre: Cross-modal correspondences between synthetic timbres and essential oil aromas. *Proceedings of Timbre 2023, 3rd International Conference on Timbre*, Thessaloniki, Greece.

Zoghaib, A., Luffarelli, J., & Feiereisen, S. (2023). Branding with music: How can music contour and tonality enhance perceived brand innovativeness and brand evaluations? *Psychology & Marketing*, *40*(10), 1965–1985. https://doi.org/10.1002/mar.21875

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