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Beyond background noise: underutilized sonic choice architecture in hospitality

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Hospitality and consumer environments are undoubtedly multisensory, yet auditory stimuli remain underutilized as intentional components of choice architecture. This mini-review synthesizes evidence from psychology, neuroscience, and behavioral economics examining how soundscapes—particularly micro-auditory cues such as door clicks and elevator tones—are undervalued in their functions as behavioral nudges that influence guest perception and decision-making within bounded rationality frameworks. Current evidence demonstrates that auditory stimuli activate affective priming, processing fluency, and associative memory mechanisms that systematically bias consumer judgments of value and satisfaction, yet research predominantly examines macro-level interventions while micro-auditory cues and biometric methods remain underexplored. Smart technologies now enable adaptive, personalized sonic ecosystems that could respond dynamically to guest and consumer states, presenting opportunities for experience-enhancing nudges and ethical risks regarding manipulation and consumer autonomy. This review identifies critical research gaps and proposes future directions emphasizing micro-level interventions, biometric methods, and ethical frameworks for auditory choice architecture in hospitality environments.

KEYWORDS

auditory stimuli, choice architecture, consumer environments, environmental psychology, hospitality, micro-auditory stimuli, sound, soundscapes

1 Introduction

Behavioral economics emphasizes that individuals rarely make decisions as perfectly rational agents. Instead, their choices are systematically shaped by bounded rationality, heuristics, and contextual cues (Kahneman, 2011; Thaler and Sunstein, 2008). Within consumer environments such as hospitality, multisensory inputs function as subtle forms of choice architecture that can bias judgment and behavior without conscious awareness. While visual stimuli have been extensively researched and traditionally prioritized in design considerations, the role of auditory stimuli, especially micro-auditory stimuli, remains comparatively underexplored within behavioral economics. Neuropsychological research has demonstrated that environmental perception is not a linear process of isolated sensory inputs (Koelsch, 2014). Instead, it is a synthesis occurring in higher-order brain regions, resulting in integrated emotional, cognitive, and behavioral responses that can directly affect consumer behavior (Kemp et al., 2019).

Evidence from psychology and neuroscience demonstrates that sound influences not only perception but also mood regulation, temporal judgment, memory, and decision-making under uncertainty (Enström and Schmaltz, 2017; Palazzi et al., 2019). These mechanisms map directly onto behavioral economic processes: affective

priming can bias risk assessments, associative memory activation can frame consumer choices, and distortions of time perception can shift intertemporal preferences. Yet, in applied fields such as hospitality, auditory inputs are still treated as passive background decoration rather than deliberate interventions shaping economic behavior.

Existing research tends to emphasize macro-level soundscapes, such as background music genres or mode (e.g., major or minor key), often measured through self-report or observed purchasing behavior (North et al., 2003; Kemp et al., 2019). While informative, this approach overlooks two critical dimensions central to behavioral microfoundations: (1) the influence of subtle micro-auditory cues (e.g., the tonal qualities of door locks, elevator tones, and acoustic textures), which operate below awareness and may bias decision-making via processing fluency—the ease with which a stimulus is perceived, and (2) the potential of biometric and neuroeconomic methods to capture in-the-moment affective and cognitive responses, thereby offering more valid insights into the mechanisms of bounded rationality.

With the hospitality sector's growing integration of smart technologies and IoT-enabled systems (Scutaru and Stoica, 2025), there is now unprecedented capacity to design adaptive auditory environments that respond to guest states in real time. This mini-review situates soundscapes—and more importantly: micro-auditory soundscapes—within the domain of behavioral microfoundations, reframing them as intentional tools that exploit biases, heuristics, and perceptual limits to influence consumer behavior and economic choices within hospitality environments.

2 Psychological and behavioral economic mechanisms of auditory stimuli

Non-linguistic auditory communication, exemplified by music, represents a universal human characteristic that has evolved to facilitate social connection, cooperation, and attachment (Koelsch, 2014). The human auditory system has developed not merely as a passive recipient of environmental signals but as an active social and affective regulator, capable of inducing physiological states that prepare the organism for adaptive behavior. While early sensory processing models often isolated hearing from other perceptual senses, cognitive neuroscience reveals that the auditory cortex plays a more integrative role than previously assumed, interacting directly with visual and somatosensory pathways to influence multisensory perception and higher-order cognitive evaluations (Koelsch, 2014).

Functional magnetic resonance imaging (fMRI) studies demonstrate that the superior temporal sulcus (STS) synthesizes convergent inputs from visual, auditory, and somatosensory cortices into coherent perceptual events (Calvert et al., 2000). This integration elucidates why auditory cues can significantly alter the perception of visual environments. Such findings suggest that in hospitality, sound should not be treated as a separate design layer but as an equally important sensory input that shapes the

brain's integrated evaluation of environments and, by extension, the consumer's economic behavior.

At the neurobiological level, intense auditory pleasure has been linked to dopamine release in the mesolimbic reward system, encompassing both dorsal and ventral striatal regions. This phylogenetically ancient neural circuitry, originally evolved to reinforce behaviors with direct biological utility, now demonstrates remarkable plasticity in engaging aesthetic stimuli through individual perceptual processes independent of direct biological and chemical necessities (Salimpoor et al., 2011). Functional neuroimaging studies further demonstrate increased regional cerebral blood flow (rCBF) in the amygdala, hippocampus, and ventral striatum during exposure to emotionally positive auditory experiences (Blood and Zatorre, 2001). Concurrently, the rCBF in the amygdala's threat-processing circuits is reduced, suggesting that auditory input can "gate" emotional states (Blood and Zatorre, 2001). This gating mechanism has direct implications for hospitality, where reducing ambient stress for guests may increase openness to new experiences, willingness-to-pay, and brand engagement. These findings demonstrate how affective states influence perception and decision-making, illustrating the affect heuristic as a mechanism through which bounded rationality shapes decision-making (Wheeler, 2024; Loewenstein and O'Donoghue, 2004).

These neural mechanisms underpin the ability of sound to regulate emotions, modulate physiological arousal, trigger autobiographical memory, and shape subjective temporal perception (Janata et al., 2007; Juslin et al., 2014). For instance, tempo manipulations can alter autonomic responses, with faster tempos increasing heart rate and perceived energy, whereas slower tempos can slow respiration and induce calmness (Van der Zwaag et al., 2011). Mode (major versus minor), percussiveness, and harmonic complexity each activate distinct neural circuits, producing differentiated emotional signatures. In the hospitality context, such parameters can be systematically adjusted to align with desired guest states (e.g., energizing breakfast service with faster, major-key arrangements and easing transitions to the evening with slower, harmonically warm pieces). Importantly, these sensory manipulations often work below conscious awareness, activating processing fluency mechanisms in which ease of perceptual processing translates into positive affective judgments and greater willingness-to-approach (Alter and Oppenheimer, 2009). Guests and consumers do not calculate why they feel more comfortable in a space; they simply experience higher satisfaction and may reward the firm with repeat patronage or higher spending.

Critically, the psychological implications of mood regulation via auditory stimuli extend beyond emotional experiences to decision-influencing mechanisms. Affective priming elicited by soundscapes can substantially modulate risk-taking propensities, decision-making processes, and social behavioral patterns (Enström and Schmaltz, 2017; Palazzi et al., 2019). From a behavioral economics perspective, this aligns with the affect heuristic, in which positive or negative mood colors judgments of risk and value (Slovic et al., 2007). Similarly, experimental evidence shows that affective cues can alter how consumers assign value to goods, leading to systematically different economic choices depending on mood states (Hsee and Rottenstreich, 2004). Within

hospitality, such findings imply that subtle soundscapes can nudge guests toward perceiving services as more valuable or experiences as more rewarding.

Finally, research on multisensory atmospherics underscores that auditory cues rarely operate in isolation. Instead, they interact with visual and tactile elements to create coherent consumer environments that drive purchasing behavior and satisfaction (Spence et al., 2014). This reinforces the point that sound should not be conceptualized as mere decorative background, but as an intentional and scientifically grounded mechanism of choice architecture capable of predictably shaping perceptual, affective, and behavioral landscapes (Kemp et al., 2019).

3 Sound within the traditional context of hospitality

Despite substantial neuroscientific evidence, research in the field of hospitality has predominantly focused on auditory influences at a macro level. The field has yet to systematically investigate the effects of individual or collective micro-auditory stimuli (e.g., the tonal qualities of door locks, elevator tones, and acoustic textures) or employ biometric and neuroimaging methodologies to capture real-time guest responses to these stimuli *in situ*. While macro-level auditory interventions (e.g., music genre selection) are often consciously noticed by guests, the psychological mechanisms through which they influence behavior remain largely outside conscious awareness. In contrast, micro-auditory cues operate predominantly beneath perceptual thresholds, enabling environmental design that shapes behavior without invoking deliberate cognitive scrutiny. This distinction is critical for understanding how bounded rationality operates in service contexts: individuals cannot resist or adjust for biases they do not consciously detect, as heuristics operate automatically and subconsciously, leaving individuals unaware of the biases resulting from their simplified perception of reality (Tyson, 2013). Research demonstrates that distinct tonal qualities of sounds can significantly impact states of mind (Van der Zwaag et al., 2011), providing a basis for a hypothesis that aggregate effects of micro-auditory cues within a hospitality environment could produce apparent and consistent results. In the absence of such data, opportunities are missed to create environments that dynamically respond to guests' neurophysiological states, thereby optimizing emotional and cognitive outcomes in a precision-targeted manner. From a behavioral economics perspective, this gap limits our understanding of how bounded rationality and heuristic-driven judgments operate in service settings, since many auditory influences are subtle, unconscious, and therefore particularly powerful in shaping behavior.

Empirical research indicates that music with positive emotional valence—characterized by major key modes, faster tempos, and consonant harmony structures—consistently enhances consumer mood within service settings. Kemp et al. (2019) found that such auditory conditions led to increased ratings of product quality, service satisfaction, and perceived experience duration. These findings align with mood congruence theory (Knight et al., 2016), demonstrating that individuals preferentially interpret and encode

information congruent with their prevailing affective state. In behavioral economics, this parallels the affect heuristic (Slovic et al., 2007), wherein current mood biases perceptions of risk, quality, and value. This explains why a positive soundscape within hospitality environments can systematically shift consumer judgments of service experiences and increase willingness-to-pay (Kemp et al., 2019). Yet, these studies often rely on aggregate measures rather than validating mechanisms through biometric or neuroeconomic methods, leaving open questions about the precision and scalability of such interventions.

Beyond emotional modulation, implicit cognitive mechanisms further elucidate how soundscapes shape consumer purchase behavior. A notable field study by North et al. (1999) found that consumers were more likely to purchase wines congruent with the national origin of the background music being played (French or German), despite being unaware of the auditory influence. Such outcomes suggest the activation of associative memory networks, where music primes specific schemas that guide purchasing behavior through non-conscious goal activation. These findings exemplify how consumers, operating under bounded rationality, make context-dependent decisions that deviate from the assumption of stable, rational preferences.

North et al. (2003) further demonstrated the potential of intentional soundscapes in consumer environments on a macro level, revealing a hierarchy in consumer spending within restaurants when paired with different genres of music—with classical music generating the highest expenditure, followed by pop music, and the control (silence). With a clear difference in efficiency between distinct genres, this study highlights how intentional soundscape selection can systematically influence psychological and behavioral outcomes in different consumer environments. Such an effect is likely mediated by classical music's semantic associations with sophistication and luxury, which activate evaluative filters that elevate perceived product and service quality. This mechanism resonates with Appraisal Theory (Scherer, 1999), wherein individuals interpret stimuli not only through raw sensory input but through evaluative filters shaped by prior experiences, expectations, and goal relevance.

Such findings underscore the extent to which auditory cues interact with pre-existing cognitive schemas, dynamically modulating consumers' emotional states and purchasing behaviors. Yet, the reliance on macro-level manipulations limits the depth of insight; behavioral microfoundations research requires moving beyond broad categories to examine subtle, low-salience auditory nudges (e.g., timbre, pitch, reverberation) and their measurable physiological and behavioral consequences. Integrating biometric methods (e.g., skin conductance, heart rate variability, EEG) with behavioral outcomes would allow researchers to directly link moment-to-moment affective responses to economic decisions. Such approaches would also connect hospitality research more closely to choice architecture frameworks (Thaler and Sunstein, 2008) by identifying which specific auditory cues function as nudges and how they operate under real-world conditions of bounded rationality.

Finally, the fact that many of these influences occur without consumer awareness raises critical questions about autonomy and welfare. Hausman and Welch (2010) argue, nudges must

be evaluated not only for their effectiveness but for their ethical implications. Within hospitality, auditory environments can enhance experiences and satisfaction, but they can also exploit biases in ways that may not align with consumer welfare. This tension highlights the need for more nuanced, micro-level studies that not only document the effects of auditory cues but also consider their normative implications.

4 Further auditory intentionality in hospitality

The prevailing use of auditory stimuli in hospitality settings, often relegated to passive background decor, underutilizes their potential as tools for shaping economic behavior. Drawing on evidence from psychology, neuroscience, and behavioral economics, we argue that intentional auditory elements can be reconceptualized as adaptive nudges—precise interventions that dynamically interact with bounded rationality, affective states, and consumer heuristics.

Beyond background music, micro-auditory cues—such as door chimes, elevator tones, digital notifications, and ambient acoustic textures—play critical roles in influencing appraisals and decision-making. For instance, Four Seasons trains housekeeping and engineering teams to tune the sound of room doors closing so that the auditory feedback conveys safety and reliability (Solomon, 2016). Acoustic textures—the material-dependent resonant qualities of environmental surfaces—similarly encode brand meaning. Consider the sounds produced when window blinds are used (pitch and timbre vary by material and mechanism) or the acoustic signature of footsteps across different flooring types (e.g., hardwood creates a crisp sound, whereas carpet absorbs sound, creating muted, intimate acoustics). Although these may appear as minor details, it demonstrates how brands leverage auditory design to foster subconscious associations. Similar strategies are long established in other industries: in automotive design, the acoustics of door closure, indicator clicks, and even engine frequency profiles have been deliberately engineered to significantly influence purchase decisions (McLeod, 2021; Spence and Keller, 2024). Such interventions reflect a form of signal framing, where auditory details activate cognitive schemas that bias consumer judgments of value and trustworthiness.

These micro-level auditory features activate associative learning processes: repeated exposure in meaningful contexts strengthens memory encoding, emotional attachment, and ultimately brand loyalty. From a behavioral economics perspective, these cues function as affective primes that shape consumer heuristics. Reber et al. (2004) demonstrate that processing fluency generates positive affect, which in turn biases evaluation. When auditory cues are consistent with brand identity, they increase fluency and therefore enhance consumer satisfaction and perceived value. The effect is magnified when auditory inputs are multisensory congruent with visual and olfactory stimuli, reinforcing a coherent brand narrative and strengthening context-dependent preferences (Spence et al., 2014).

The effectiveness of such intentional auditory design also illustrates the limits of rational choice. Consumers do not explicitly calculate why a certain door click conveys security or why a

background tone conveys exclusivity; rather, judgments are shaped by non-conscious associative processes. This is bounded rationality in practice: decision-making shortcuts that allow individuals to navigate complex environments, but that can be strategically influenced through subtle sensory manipulations.

However, the success of these interventions depends on individual variability. Responses to auditory stimuli are mediated by personality traits, sensitivity to sound, and cultural norms (Kemper and Danhauer, 2005). A uniform auditory strategy risks misalignment across diverse guest profiles, potentially creating dissonance rather than fluency. Thus, while current research priorities involve establishing the effects of micro-level auditory cues, the next frontier lies in personalized and adaptive soundscapes. Advances in IoT, biometric sensing, and AI enable environments that adjust soundscapes in real time to contextual information such as time of day, occupancy levels, or individual guest profiles. Such systems embody the concept of dynamic choice architecture, where nudges are no longer static but fluid, tailored to moment-to-moment states and behaviors.

5 Future directions

The existing body of research on sound within the hospitality sector has convincingly demonstrated that auditory stimuli significantly influence moods, perceptions, and consumer behaviors. However, the predominant focus of contemporary studies remains on macro-level manipulations—such as adjusting background music by genre or mode (e.g., major or minor keys)—while micro-auditory areas, which may offer the greatest potential for precision and personalization, remain largely unexplored. Paring micro-auditory choice architecture with intentionally calibrated auditory soundscapes could greatly enhance hospitality environments as spaces designed to actively modulate guest emotional, wellness, cognitive ease, and physiological recovery. While the outcome of such auditory directions could be inferred, rigorous empirical research is essential to substantiate and quantify their effects. With the industry's growing investment in smart technologies and AI innovation (Scutaru and Stoica, 2025), it is now more feasible than ever to shift hospitality environments from static, one-size-fits-all ambience toward fluid, responsive sonic ecosystems that adapt in real time to factors such as time of day, user behavior, or pre-existing guest profiles.

For behavioral economics, this presents a unique empirical opportunity. Micro-auditory interventions can serve as naturalistic experiments for testing theories of bounded rationality, affective priming, and decision-making under risk and ambiguity. For example, adaptive soundscapes could be used to study how affective cues alter intertemporal choice, willingness-to-pay, or cooperation in group settings. By integrating biometric and neuroeconomic methods—such as skin conductance, EEG, or fMRI field-compatible tools—researchers can link moment-to-moment affective responses to economic behaviors, bridging the gap between laboratory findings and ecological validity.

This agenda also calls for investigating heterogeneity in responses. Cultural sound preferences, personality traits, and differential sensitivity to auditory stimuli imply that auditory nudges may not be universally effective, suggesting that matching

segment preferences could provide opportunities for further brand differentiation (Kemper and Danhauer, 2005; Nicolau et al., 2025). Research could explore segmentation strategies that tailor soundscapes to subgroups, or even personalized nudges that adapt dynamically to individual biometric feedback. Such advances would extend the study of choice architecture into real-world service contexts, providing both theoretical insight and practical value.

5.1 Cross-industry possibilities

Paralleling visual partnerships between luxury fashion designers and hospitality brands (Liu, 2023), strategic audio partnerships have the potential to transform the average hospitality soundscape from passive decor to active brand communication and identity. Modeled after established collaborations between premium audio brands and luxury automakers—e.g., Bang & Olufsen with Bentley and Audi (Olufsen, 2025)—hospitality groups could integrate similar high-end sound engineering to create brand specific, scientifically informed sonic experience from patrons. Such partnerships, when paired with micro-auditory and biometric research, could define the next frontier in multisensory hospitality branding.

5.2 Embedding auditory influence within multisensory frameworks

Neuropsychological research demonstrates that environmental perception relies on the synthesis of all senses in higher-order brain regions (Kemp et al., 2019). As understanding of auditory influence within consumer and hospitality environments becomes more nuanced, this opens opportunities to compare and integrate auditory interventions with other forms of sensory manipulation—such as visual, olfactory, gustatory, and tactile stimuli—that operate through similar affective and cognitive mechanisms. Consider how lavender aromas have been shown in research to increase guest meal duration and spending within restaurants—compared to the control (no scent)—whereas lemon aroma did not (Guéguen and Petr, 2006); how might these results diverge or be amplified when paired with classical music, which has demonstrated similar effects on guest spending and meal duration (North et al., 2003)? Backed by further empirical research, multisensory frameworks for hospitality environments will allow researchers and practitioners to more precisely predict how sound, scent, lighting, and material tactility function as coordinated components of choice architecture within hospitality environments that operate synergistically rather than as a collection of isolated design elements.

5.3 Emphasis on ethics

Finally, as sound becomes increasingly intentionalized, questions of ethics and welfare must be addressed. On the one hand, adaptive auditory ecosystems could optimize guest experiences, enhancing well-being, satisfaction, and even prosocial behavior. On the other, increasingly sophisticated interventions

may cross into manipulative design, raising questions about autonomy and consumer welfare (Hausman and Welch, 2010; Sunstein, 2015). The use of adaptive soundscapes raises normative questions: To what extent should firms design environments that capitalize on unconscious biases? How can we balance brand goals with consumer autonomy? Future research should therefore not only evaluate effectiveness but also develop frameworks for ethical auditory choice architecture, ensuring that these interventions remain aligned with consumer welfare. The frontier for auditory in hospitality lies not simply in personalization, but in embedding sound within the broader research agenda of behavioral economics and neuropsychology—testing theories of bounded rationality in ecologically valid environments, while carefully considering the ethical implications of using sound as a tool of economic influence.

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