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DIGITAL MARKETING

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VIZUALINIŲ IR GARSO STIMULIŲ ĮTAKA EMOCINIAM PREKĖS ŽENKLO PRISIRIŠIMUI TARP Z KARTOS VARTOTOJŲ SKAITMENINĖSE PREKĖS ŽENKLO SĄSAJOSE	THE INFLUENCE OF VISUAL AND AUDITORY STIMULI IN DIGITAL BRAND INTERFACES ON EMOTIONAL BRAND ATTACHMENT AMONG GEN Z CONSUMERS
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INTRODUCTION

Sensory marketing is an innovative way in the increasingly digital marketing environment, and brands are exploring a combination of methods to immerse consumers into a multiple sensory experience, including perception, judgment, and behavior (Krishna, 2012). It has gained importance as a strategy for creating a memorable brand experience. From the perspective of the most common and widespread vision and audio marketing (Jongmans et al., 2022; Lindstrom, 2006) found that rich visual content alone can significantly influence a user's impressions of a website's usability, and when combined with audio cues, the effect tends to a higher level of immersion and enjoyment (Gustafsson, 2015; Hagtvedt & Brasel, 2016) confirmed that auditory elements like music, sound, and sonic logos can affect brand recognition, emotional bonds, and consumer experience. (Krishna et al., 2016) summarized in their literature review that multi-sensory stimulation increases the perceived taste, or imagined touch, can impact evaluation and behavior, and the sense of smell can improve recall and reactions to ads.

Such sensory strategies not only enrich the immediate experiences but also foster long-term consumer brand bonds, creating a greater satisfaction, higher brand loyalty, and even a sense of emotional attachment over time (Lindstrom, 2005; Rodríguez-Ulcuango et al., 2025). Indeed, early supporters of this approach noted that combining sight, sound and other cues across touchpoints can make a brand more memorable and stand out in consumers' minds (Lindstrom, 2005), while contemporary studies confirm that multi-sensory marketing enhances user engagement and positive brand attitudes (Jongmans et al., 2022; Rodríguez-Ulcuango et al., 2025).

However, there is also recent literature that different dimensions of brand experience can influence loyalty both directly and indirectly (Sang & Cuong, 2025). In some contexts, intense sensory or affective stimulation may backfire. For example, a case study by Sang and Cuong shows that an overly strong emotional experience online decreased brand loyalty in the e-commerce setting, A sharp contrast to the generally positive outcomes observed in more experiential domains. Similarly, sensory inputs need to be carefully balanced: mismatched pairings (like pleasant imagery with jarring sound) can weaken the user's experience (Hagtvedt & Brasel, 2016), highlighting the importance of cross-modal consistency. It's worth

noting that as multi-sensory marketing evolves into the world of digital commerce, a clear transition from earlier focus areas such as hospitality and neuroscience to contemporary themes centered on consumer behavior and virtual reality (Rodríguez-Ulcuango et al., 2025). So the new challenges and research gaps have shown. Brands struggle to bring touch or smell cues to virtual environments, which means sight and sound often carry more of a full sensory experience online (Krishna, 2012; Rodríguez-Ulcuango et al., 2025).

Cultural and generational differences further complicate the market, as consumers' emotional responses to sensory stimuli can make differences across different audiences. Generation Z is the first generation of true digital natives. They are surrounded by screens and social media growing up, and switch between channels and devices without effort. "This behavior distinguishes their media consumption as 'fast-paced, platform-fluid and heavily reliant on rich, immersive content experiences' (Kayyal & Hasan, 2025). Research suggests that Gen Z likes fast speed, seamlessness, and interacts in the interfaces. They follow engagement and value patterns that differ from older generations (Ismail et al., 2020). Hence, the same sensory cues are not proper to pass across generations. Empirical research on digital disruption shows that interactive and social pathways have a strong influence on the attitudes of digital natives, highlighting the fact that Generation Z expects immediacy and reciprocity in their interactions with brands (Chang & Chang, 2023). These evidences show that visual and auditory stimuli can influence attention, memory, and evaluation, with coherence strengthening the overall impact (Gustafsson, 2015; Hagtvedt & Brasel, 2016; Krishna et al., 2016), like the widely accepted sensory marketing concept.

A review of prior research discovers ways to enhance brand loyalty and improve the user experience, both of which play an important role in the marketing environment. The importance of brand loyalty in the long-term development of the brand is self-evident. Emotional brand attachment (EBA) is defined as a deep emotional bond between a consumer and a brand that goes beyond mere satisfaction. It is rooted in the brand's integration with the consumer's sense of self and manifests as long-term loyalty and advocacy (Fedorikhin et al., 2008; Park et al., 2006; Thomson et al., 2005). In theory, EBA is conceptualized as an emotional connection characterized by feelings of affection and passion, and a sense of unity with the brand. In essence, the brand becomes an extension of the self (Shimul, 2022a;

Thomson et al., 2005). Empirical research shows that stronger emotional brand attachment (EBA) is linked to durable relationship outcomes. Consumers with high EBA report greater repurchase intentions and stronger commitment. They are also more resilient to negative information that goes beyond what ordinary satisfaction can yield (Shimul, 2022; Thomson et al., 2005).. In contexts that include online, and offline, recent experiments review suggest that immersive multisensory brand experiences can help build attachment. Generation Z is the most suitable group for it, since they value interactive, authentic, and personalized engagement (Lindstrom, 2005; Rodríguez-Ulcuango et al., 2025).

High quality visual design can raise usability and pleasure. That improvement supports later evaluations and can create touchpoints that support attachment. To deepen sensory enjoyment, adding audio or even haptic elements is a better way (Jongmans et al., 2022; Lindstrom, 2005). Online and offline can work together, like including engaging social content, intensive reality tries one, and experiential retail. These journeys offer an improvement in self-congruity, which is a known antecedent of EBA (Escalas & Bettman, 2003; Japutra et al., 2018; Park et al., 2006). They also strengthen experience to outcome paths that have been observed in e-commerce (Sang & Cuong, 2025). Several psychological mechanisms are at work. Key ones include self-congruity, narrative identity, trust built through consistent and transparent interactions, and hedonic pleasure. When brands deliver experiences that are human centered and also align with consumers' values and desired identity, they satisfy both utilitarian needs and deeper emotional desires. Therefore, there is a possibility of attachment growth and establishment of a long-term connection with brands. (Escalas & Bettman, 2003; Hemsley-Brown, 2023; Jongmans et al., 2022; Park et al., 2006).

Research gap and problem statement

Although sensory marketing has been developing for a long time and has a relatively complete operating mechanism, we still have a notable gap at the intersection of these topics with emotional brand attachment in digital contexts. The first and most obvious issue is that most multisensory work focuses on physical atmospherics or advertisements. There is a lack of rich research isolating the effects of visual and auditory cues in online platforms on deeper emotional outcomes (Gustafsson, 2015; Jongmans et al., 2022; Krishna et al., 2016; Shimul,

2022), such as brand attachment. Furthermore, brands use stunning images or catchy music to instantly stimulate consumers to strengthen their brand attachment to the brand. It also includes other sensory stimuli, which are usually short-term effects and lack long-term empirical evidence. It is not yet fully understood how visual and auditory cues foster or have any effects on brand attachment, as well as the limitations and possibilities that impact consumers' emotional bonds with brands. Second, brand attachment research has traditionally centered on brand-level factors (such as brand personality, quality, and consumer satisfaction) or on personal factors (such as self-brand congruence and involvement) as antecedents of attachment (Shimul, 2022; Ugalde et al., 2024). These studies have enriched our understanding of why consumers become attached. For example, when a brand symbolizes important aspects of one's identity or consistently delivers high quality, attachment tends to grow. However, the role of sensory design elements, especially in a digital interface where the consumer continuously interacts with visual layouts and sounds, is underexplored as a potential antecedent to emotional attachment.

Recent work calls for approaches that link sensory and experiential factors to brand relationship outcomes (Biswas, 2019). Yet there is little empirical evidence on how Gen Z forms emotional attachment through digital experiences. Gen Z prefers dynamic visuals, interactive media, and authentic storytelling, so the sensory and aesthetic quality of a brand's digital interface may be important, but this link is still under examined. Scholars point out a lack of standardized measurements or frameworks for evaluating multi-sensory impacts, which makes it difficult to compare results and fully understand cross-model effects in the digital era (Gao & Lan, 2020). New tools such as the Online Sensory Marketing Index try to standardize website level assessment (Hamacher & Buchkremer, 2022). Reviews also highlight a few truly multisensory experiments and unresolved links between phenomenal and behavioral measures, which limit comparability across studies (Motoki et al., 2023; Rodríguez-Ulcuango et al., 2025a; Spence, 2022).

In summary, existing literature has not fully addressed how visual and auditory stimuli in digital brand interfaces contribute to the formation of emotional brand attachment among Gen Z consumers. **This gap leads to the following research problem:** In what ways do visual and auditory sensory elements in digital brand interfaces influence the development of

emotional brand attachment in Generation Z consumers? By formulating this question, the study pinpoints the need to investigate the mechanisms through which the look and sound of digital brand touchpoints (such as websites and apps) can evoke emotional responses and foster enduring emotional bonds with Gen Z audiences. Addressing this problem will extend current knowledge by integrating insights from sensory marketing and brand attachment research and will provide more specific guidance on engaging a digitally native consumer group.

Research aim and objectives

Given the above background and identified gap, **the aim of this research is** to examine how visual and auditory stimuli in digital brand interfaces evoke emotional responses and foster emotional brand attachment among Generation Z consumers.

To achieve this goal, **the research will follow these objectives:**

1. **To critically review the existing literature** on sensory marketing, digital brand interfaces, emotional brand attachment, and Generation Z in order to develop a conceptual model and formulate testable hypotheses.
2. **To design a research instrument** (questionnaire) based on validated measurement scales, addressing constructs such as pleasure, immersion, trust, and emotional brand attachment.
3. **To collect empirical data** through an online survey targeting Generation Z consumers, capturing both demographic characteristics and digital interaction scenarios.
4. **To assess Gen Z consumers' emotional responses** (e.g., pleasure, arousal, mood) to visual and auditory stimuli in digital brand interfaces.
5. **To examine the relationship** between these emotional responses and the formation of emotional brand attachment.
6. **To compare differences across design styles and platform contexts** in shaping emotional connections, and to derive actionable design recommendations for brands.

Through these objectives, the research will systematically move from identifying

sensory strategies to measuring Gen Z's emotional reactions and finally to linking those reactions with the deeper outcome of brand attachment. Such an approach ensures that we capture both the stimulus and response sides of the equation.

1. THEORETICAL BACKGROUND

1.1 Foundation of sensory marketing in digital contexts

Early research established sensory marketing as a strategy to engage consumers' five senses in order to shape their perceptions, judgments, and behaviors. Krishna (2012) defines sensory marketing as "marketing that engages the consumers' senses and affects their perception, judgment, and behavior." It emphasizes elements that can trigger basic sensory responses. By embedding these cues, marketers can create a richer brand experience in consumers' subconscious and keep it in their memory.

Multisensory marketing is the most effective method for building an emotional connection between consumers and products, with the coordinated function of the five senses (visuals, sounds, scents, textures, tastes) cues being crucial to it. Lindstrom (2005) seminal Brand Sense study found that a staggering 99% of brand communication focused only on sight and sound, yet truly emotional connections were "effectively made with a synergy of all five senses." Brands that adopt this approach not only improve consumer-brand connections but also strengthen their memories and loyalty to brands. In other words, a strong emotional response can be caused by a close integration of sensory stimuli. Building on Hultén (2011) multi-sensory brand-experience concept, which argues that sensory tactics create emotional/psychological linkages in the consumer's mind, empirical research shows that such experiences can foster emotional brand attachment and, in turn, loyalty (Lindstrom, 2005). In short, the basic theory of sensory marketing shows that the more a brand can engage the full spectrum of senses in a meaningful way, the more likely they can evoke emotions to construct a consistent consumer attachment.

However, in the purely digital online realm, what consumers can see and hear becomes a key concern for marketers. Because the types of sensory stimuli available are limited in the virtual environment. Traditional e-commerce and social media marketing most rely on graphics, layouts, colors, music, voice, and sound effects. Krishna (2012) indicated that almost every modern marketing depends on image and sound cues. In fact, Rodríguez-Ulcuango et al., (2025) and bibliometrics show research migration to digital commerce, VR, AR, and AI, and most of those directions are displayed by both visual and auditory senses;

imagination has replaced the stimulating experiences of other feelings to a large extent. Hence, when it is impossible to provide real stimulation, simulate touch and taste through text and visual effects, such as vivid images, videos, and descriptive content, to stimulate consumers' imagination. For example, Roschk et al., (2017) demonstrated that detailed pictorial and verbal descriptions of a product's material or flavor can evoke mental imagery of touch and taste, helping online shoppers "feel" a product virtually. Likewise, studies have found that video advertisements with ASMR cues that combine visual stimuli with suggestive sound effects can induce immersive emotional states and increase purchase intention, even without physical touch (Gotsch & Gasser, 2025). These tactics leverage consumers' imaginative capacity to fill in sensory gaps. An approach supported by recent findings that imagination can indeed compensate for missing tactile input in virtual product experiences, leading to positive attitudes despite the absence of real touch (Ruusunen et al., 2023). New technologies create new ways to transfer senses online. Virtual reality boosts spatial presence and immersion, and brand benefits also increase at any time (Alexander et al., 2025; Balaban et al., 2025; Kim et al., 2025). Reviews also show that sensory marketing is moving into immersive, technology-driven settings (Pandey & Tripathi, 2025; Rodríguez-Ulcuango et al., 2025b). When touch isn't possible, 360° virtual scenes and guided imagery can help to some extent (Ruusunen et al., 2023), allowing for more immersive emotional engagement even when consumers interact with brands remotely through screens.

So far, most research has examined such sensory effects on the short term, which is immediate consumer reactions, like enjoyment, purchase intention or brand attitude. But brand loyalty or attachment is the one that keeps consumers staying longer. For example, many sensory market studies report how multisensory settings affect immediate effects, such as the time spent on a website, the likelihood of adding a product to the shopping cart, or satisfaction with the experience (Eklund & Helmfalk, 2021; Helmfalk & Berndt, 2018; Helmfalk & Hultén, 2017; Spence et al., 2014). Although they are invaluable, they only capture the short-term impact of sensory stimuli. Few studies focus on how these repeated integration experiences form a long-term emotional brand attachment (EBA). Emotional brand attachment is a deep connection between consumers and brands, characterized by feelings of affection, passion and connection (Rodríguez-Ulcuango et al., 2025). Thomson et al. define it as a tie that goes

beyond mere brand linking or satisfaction. Scholars describe it as not only a tie, but it is kind of a bond where the brand becomes part of the consumer's identity and evokes genuine love or fondness (Park et al., 2006). Such attachment is strongly linked to loyalty behaviors. Research shows that consumers with high brand attachment normally tend to stay loyal, advocate for the brand, and even resist alternatives (Belaid & Temessek Behi, 2011; Ugalde et al., 2024). However, the role of sensory marketing in cultivating this kind of attachment remains a new and exciting direction. An experiment completed by Shahid et al., (2022) explained that sensory marketing cues (such as visual, auditory, olfactory, etc.) in the luxury retail environment can enhance consumers' brand experience by strengthening emotional attachment, and emotional attachment further significantly promotes brand loyalty, in other words, sensory experience does not directly make customers loyal, but is achieved by first stimulating a sense of attachment. This suggests that the emotional uplift from engaging sensory experiences can translate into enduring brand relationships when sustained over time.

Generation Z is a particularly suitable group for studying these dynamics. As digital natives, Gen Z consumers usually encounter brands for the first time through digital interfaces, most often through screens and speakers. This means their brand relationships are established in digital environments. They also tend to value experience and authenticity (Fitriati et al., 2024). Surveys show that Gen Z shoppers are "looking for unique experiences that match their values." (Ismail et al., 2020). Experts believe that only by providing experiences that are hard to forget and rich in sensory stimulation can brands win their loyalty (Priporas et al., 2017). Therefore, applications, websites, and social media need carefully designed visual and auditory cues to trigger emotions and lead to attachment. Rodríguez-Ulcuango et al., (2025) stressed the need to study how visual and auditory stimulation in digital media jointly influence young consumers' emotional brand attachment. In situations where there is no direct physical contact, emotional responses triggered by screen aesthetics, animations, music, or sound effects may be the main driving factors for Gen Z to form connections with brands. Looking forward, scholars call for more longitudinal and holistic research to understand how these sensory experiences in digital media can not only drive one-time purchases but also foster long-term emotional attachment (Pandey & Tripathi, 2025; Shimul, 2022a; Stead et al., 2022; Suraj & Joseph, 2025). By identifying both short-term and

long-term effects of sensory-driven brand attachment, we can better understand and use digital sensory marketing as a tool to cultivate deep and loyal brand relationships with Gen Z.

1.2 Roles of visual and auditory design cues

In digital interfaces, visual design elements like color, imagery, composition, and layout serve as the first language of emotion between a product and its user. Even before a word is read or a button clicked, a design's colors and overall look trigger feelings in the viewer. Studies have shown that in the initial few seconds of encountering a new interface or product, people form impressions based on visual cues to a large extent (Lindgaard et al., 2006). Singh (2006) stated that up to 90% of snap judgments about products can be based on color alone. Color usually contains a psychological hint, and brands use it to evoke specific feelings in consumers' minds. For instance, colors like reds and oranges, these types of warm tone often arouse excitement and passion, whereas cool tones like blue tend to soothe and reassure (Elliot & Maier, 2014; Valdez & Mehrabian, 1994). Such color associations can influence brand personality impressions and even purchase intentions. An experiment about color was designed by Mirzaei (2025) who found that the warm colors (65%) generate higher engagement than cool colors (35%), highlighting that how color tone and warm vibes influence people's emotional reactions. For Gen Z, who are steeped in vibrant digital media, bold and unconventional color palettes are especially impactful. Because they see it as part of the brand's personality and tend to present the design of individuality and mood with color (Georgiadou et al., 2024; Ibrahim & Aljarah, 2023). This reflects that rich visual effect is the main factor driving Gen Z's online engagement, whereas auditory cues alone have far more limited effects (Mardhatilah et al., 2023).

Besides color, images and figures can instantly set an emotional scene in a frame, a carefully selected picture tells stories or sparks a feeling more directly than text. Research in advertising has long confirmed that visuals carry affective power, putting photos in content will significantly affect the audience's moods and how they process information (Edell & Staelin, 1983). Gen Z users who scroll through image-rich feeds in daily life, they share candid photos, memes, or dynamic illustrations with each other, this emotional bond increases their engagement with brands or interfaces (Utari et al., 2025).

Finally, the compensation and layout of a digital interface shaped users' emotional comfort profoundly. Layout is like an arrangement of visual elements, guiding the user's eye and feelings, a clean and well-constructed frame with balanced blank space and clear hierarchy, creating a stable and trustworthy place where the user enjoys the experience. Conversely, a cluttered or chaotic layout introduces stress and confusion (Jongmans et al., 2022; Suraj & Joseph, 2025). The research also indicates that users have a more positive emotional impression of a website that contains simple visual effects and a familiar structure. That is because websites with low complexity and high plateau characteristics are considered more aesthetically pleasing and easier to be accepted (Tuch et al., 2012). Gen Z is getting used to slick apps and modern websites, they are expecting an intuitive working flow, especially when a design "just feels right." They normally appreciate it. It's establishing the confidence of users secretly, while the content is arranged logically and attractively, the buttons are where they subconsciously expect. In essence, an emotional stage is settled by visual design, designers can subtly influence whether the user feels excited, calm, curious or trusting.

If visual is the first language of emotion design, sound is the invisible rhythm for enriching and deepening emotional conversation. Auditory design cues play a unique role in stirring emotions and shaping user experience (Spence et al., 2014). Normally from a brand's melodic sound logo to the background music and voice prompts in an app (Kemp et al., 2024). Different from visuals that are processed in a blink, sound unfolds over time and usually works on a subconscious level. A simple sound logo, such as an audio logo or sonic signature, can immediately let listeners recall brand recognition and feeling (Kemp et al., 2024; Puligadda & VanBergen, 2023). Think about the famous five-note Intel jingle or Nokia's classic phone tune, these brief melodies instantly bring the brand to people's minds and carry years of association. Audio fragments can be designed to identify a brand's sonic signature and distill its essence into a few notes. Ayada and Ragab (2024) found that brand emotional attachment and brand recall can be significantly enhanced by sonic logos. When the sonic logo is placed in a prominent position, it is more likely to be heard by consumers and thus easier to remember and recognize. They also pointed out that the potential of sound and music in influencing consumers' emotions and memories and establishing emotional attachment is underestimated.

Brands should view the sonic logo as part of their identity system, giving it equal weight to their visual identity. By consistently hearing a distinctive sound logo, clients formed a memory that can connect the sound and the brand's value and personalities (Puligadda & VanBergen, 2023). For Gen Z, what they hear from device startups or in advertisements, the impact is immediate. Well-designed ads voice let them immerse in that scenario, feel as familiar as a friend's voice.

Background music functions as a powerful auditory cue in digital experiences. Just like film soundtracks amplify emotional intensity, background music sets the tone for user engagement in apps or videos, energetic tracks spark excitement or urgency, while softer ambient sounds foster calm and approachability (Krishna et al., 2016; Wu et al., 2010). The research also shows that music tempo and genre influence listeners' emotions, behavior duration, and even actions (Garlin & Owen, 2006). Fast-paced music is more likely to enhance arousal, while slower or familiar music is more likely to increase pleasure and dwell time. Digital context also applies to this principle; a fitness app might use faster-paced beats to boost motivation; in contrast, a meditation app might use gentle tunes to soothe the user. Playing music from streaming media is attractive and suitable for Gen Z who use this as the background of their daily life. However, wrong or improper music, like annoyingly repetitive or too loud, might drive them away. (Ausín et al., 2021; Kayyal & Hasan, 2025; Spence, 2022).

In a limited digital frame, designers intend to create a virtual assistant voice or a voice notification that is more appropriate to the situation to increase the human touch for customers. A friendly, clear voice prompt can make an app feel caring and personalized. Who would not feel relaxed after listening to this greeting? "Welcome back! What would you like to do today?" Research in human-computer interaction demonstrates that people apply social rules to computer voices, attributing personality traits and reacting to tone much as they would with human speakers (Singh, 2006). Hence, brands will carefully choose voice actors or voice styles that match their identity. A bank application may use a calm and trustworthy tone, yet a game platform might use an enthusiastic, youthful voice. For people who always interact with voice assistants and voice content, a consistent brand voice becomes like an auditory persona they recognize.

1.3 Multisensory integration and affective response theories

After analyzing the two major elements of vision and audio separately, if they combine and work together, the sensory impact is amplified beyond either one (Pandey & Tripathi, 2025; Spence & Keller, 2024). This audio and visual coordination creates an immersive experience where each sense reinforces the other (Spence & Keller, 2024). When both cues convert a consistent mode on messenger humans naturally integrate sight and sound, the brain thinks the whole experience is more intense and unified (Hagtvedt & Brasel, 2016). In design logic, that might mean matching an animation with a corresponding sound effect or matching background music to visual content. Such as a button that clicks with a satisfying “tick” at the exact moment, and a peaceful landscape paired with gentle melodies. When such cues are congruent, the emotional resonance can be powerful.

Research supports this synergy. One study by sensory researchers demonstrated that when the soundtrack of a video perfectly fit the visuals, viewers’ emotional response was amplified dramatically (Vatakis & Spence, 2006). In practical terms, a product ad or a tutorial video will leave a much stronger impression if the rises and falls of its music align with the action on screen, compared to an ad where sound and picture are out of step. The sum is greater than the parts when design elements are synchronized. We see this clearly in modern multimedia platforms, where those memorable moments frequently happen when the beat drops exactly when the visual cuts in a well-edited TikTok or YouTube clip. Besides intensifying immediate impact, audio-visual consistency also aids memory (Chen et al., 2025; Knoeferle et al., 2016; Yang et al., 2025). Experimental support for audio-visual congruence comes from studies such as Yang et al., (2025), who found that congruent combinations of auditory emotional arousal and visual variation significantly increase engagement in short videos; and Knoeferle et al., (2016), who demonstrated that sound cues congruent with a visual target accelerate visual search and attention allocation.

Simply put, when our eyes and ears are stimulated simultaneously, our brain will remember the information more intelligently. When a brand successfully achieves this, it can create a personalized and unified identity (Gustafsson, 2015; Lindstrom, 2005; Spence & Keller, 2024). When a brand consistently matches its logo or visual elements with music of the same style or recurring sound effects, viewers will start to associate these elements with their

memories. Over time, sound itself can evoke images, and images can bring back sound, forming a multi-sensory "signature" of the brand (Ayada & Ragab, 2024). This is why modern brand manuals often go beyond the prescribed colors and fonts, including sound elements such as tone, voice, or short audio labels (Spence & Keller, 2024; L. Zhang et al., 2022). In addition, audio-visual coordination helps to form a coherent brand identity (Gustafsson, 2015; Lindstrom, 2005; Spence & Keller, 2024). When a specific music style or a particular sound effect always matches the brand's logo and image, these elements will form a sense of belonging in the minds of the audience. Designers use this guideline not only for brand color and font, but also for brand voice (Spence & Keller, 2024; L. Zhang et al., 2022). Adjusting the visuals and sounds in the design not only makes the experience more attractive, but it also builds a stronger and more memorable impression for the brand's character and message (Li et al., 2022; Pandey & Tripathi, 2025).

Multisensory stimulation is superior to individual sensory stimulation in generating intense emotional responses in consumers. Comparing studies in multisensory and single-sensory, both indicate that multisensory stimuli normally arouse more intense and positive emotions, better memory, and greater desire, such as purchases and sharing. For instance, in a retail environment dominated by visual elements, Helme Falk & Hultén, (2017) found that introducing three senses (sight, sound, and smell) produces a significant improvement in users' positive mood and shopping actions, compared to when people are only allowed to enjoy with one of their senses, even compared with merely adding more visual stimulation, multisensory consistent cues still are perceived by consumers as more effective. Spence et al., (2014) claimed that different sensory stimuli can produce interactive effects, often amplifying each other, this be called synergistic effects, enhancing the overall experience and emotional response rather than simply adding them up.

Besides, coordinated multi-sensory cues can enhance positive emotions, store reviews, brand perception, purchase intention and loyalty. On the contrary, inconsistent or excessive stimulation may cause confusion or negative emotions. Subsequent experiments in 2018, Helme Falk and Berndt (2018) further observed that a carefully configured multisensory atmosphere significantly enhances customers' positive emotional responses, purchase intentions, and actual stay time. All these examples verified the intuition that humans are

multisensory creatures, and a combination of punches can always create more captivating and unforgettable experiences.

In the real marketing world, Starbucks coffee shop aims to envelop a full sensory feast for its coffee buyers. They decorate the retail store with warm colors, fostering a cozy atmosphere with ambient music. When people enter the store, they can smell the rich coffee aroma, and the furniture is as inviting as home, bringing you an all-around brand experience. Digital marketers are adapting this principle nowadays, although they are limited to only two to assemble. An illustrative example is major Chinese e-commerce platforms, such as Taobao have long integrated autoplay video feeds within their apps and are intensifying use of video content to drive conversions. Digital retailers embed short-form product videos and live streams to enhance sensory richness and drive conversion. On Taobao, “mini-detail” short videos and live e-commerce streams have been shown to increase perceived playfulness, usefulness and purchase intention (Liu & Zhang, 2024). Jongmans et al., (2022) showed that a website is kind of like a meal. If the “plating” looks good, like the colors, the pictures, the layout, people feel it is easier to use and nicer. So, people think better of the site and want to come back or tell others about it. The study was mostly about visuals, but they also suggested that adding other “spices,” like sound, could make the whole experience even more fun. Overall, a key principle of traditional and digital areas is that multisensory experiences create a deeper emotional connection with customers than isolated stimuli.

Multiple senses often work together, and as a result, we have different feelings. In a specific environment, such as when various sensory inputs like light, sound, smell and touch are combined. It will affect a person's emotional state. Researchers employed several emotion theories to explain how these combined stimuli trigger emotions. A widely used method is to rely on key dimensions to describe emotions. For instance, the Happiness-Awakening-Dominance (PAD) model proposed by Mehrabian and Russell in the 1970s describes emotional responses to the physical environment from three core dimensions. It measures a person's positive or negative feelings (sense of pleasure), the calmness or excitement of the environment (sense of excitement), as well as the sense of control and dominance it triggers (sense of domination). These dimensions provide a simple outline of a person's feelings in a multi-sensory environment (Mehrabian & Russell, 1974, as cited in Suárez & Alfonso, 2024).

Another influential framework is the cognitive evaluation theory of emotions. According to assessment theory, emotions arise from how we interpret or evaluate events related to our happiness (Scherer, 2001; as cited in Suárez & Alfonso, 2024). In other words, the brain assesses the importance of combined sensory cues. If a multi-sensory scene can trigger positive emotions, it will be evaluated as pleasant, but if it is opposite, then it will appear harmful or threatening (Bakker et al., 2014). For instance, when soft music is combined with lighting of a similar style, the public may consider it safe and soothing, and evoke a sense of calm, while sudden loud noises and bright flashes might be regarded by humans as dangerous and cause fear. Both PAD and the evaluation perspective help explain how complex multi-sensory experiences shape our emotional responses. Research shows that when cues from different senses all convey similar emotional information, like consistent stimuli, the effect can amplify the resulting emotions (Schreuder et al., 2016; Sharma & Chan, 2017). On the other hand, mismatched or inconsistent sensory signals usually lead to weaker or more negative emotional responses. In this way, multi-sensory integration can enhance or alter our emotions.

1.4 Emotional brand attachment and consumer brand relationships

Brand attachment refers to a person having a deep emotional bond that connects a consumer with a brand on a personal level. It's not only merely satisfaction or habitual loyalty. It's an emotion. It's an effective connection that lets the brand feel it is not replaceable and integral to the consumer's life (Shimul, 2022). In the academic world, Thomson et al., (2005) describe brand attachment as a strong emotional tie characterized by feelings of affection, passion, and connection toward the brand. Likewise, Park et al., (2006) define it as "the strength of the bond connecting the brand with the self," indicating that an attached consumer comes to regard the brand as part of their own identity. This concept distinguishes attachment from other relationship constructs, a customer might feel satisfied with a brand's performance or keep their loyalty out of convenience, but only customers who have an attachment to the brand have a deep emotional resonance and psychological dependence on the brand.

Empirical experiments support this distinction, for example, Thomson et al., (2005) advanced the construct of emotional brand attachment by proposing a multidimensional framework, through a multi-study program, they developed and validated a scale consisting of

three key dimensions, respectively are affection, passion, and connection, demonstrating that brand attachment is distinct from related constructs such as satisfaction, involvement, or brand attitude. Importantly, their findings showed that higher attachment predicts stronger consumer commitment, willingness to pay a price premium, and greater resistance to negative brand information. The depth of brand attachment means that a lasting connection that is laden with emotion and personal meaning is formed for a consumer. With the positive experience accumulated, and the brand becomes associated with consumers' self-concept values and memories, such attachment often develops over time (Park et al., 2006). In fact, some researchers argue that cultivating brand attachment is more important than fostering a long-term simple loyalty in customer relationships. Because of its capacity to drive true commitment and advocacy (Japutra et al., 2018). Customers with strong brand attachment might feel anxiety or pain just because of losing contact with the brand, much like the separation distress seen in interpersonal attachment bonds (Thomson et al., 2005). These individuals get emotional safety and satisfaction from brand relationships, and they are generally willing to go out of their way for their beloved brand. Even facing more attractive choices or negative situations, they remain committed to it, reflecting a level of devotion that exceeds what utilitarian satisfaction alone can explain (Belaid & Temessek Behi, 2011; Thomson et al., 2005). In other words.

EBA as a bond that the brand usually takes on personal significance, it evokes strong feelings of love, affection, or connection. This deep emotional connection is a key driver of enduring loyalty and positive behaviors, since it creates a sense of belonging between consumer and brand that can sustain the relationship through time and adversity. Research has also confirmed this description. Emotional brand attachment is a strong predictor of loyalty-related outcomes, beyond what traditional customer satisfaction can achieve (Fedorikhin et al., 2008; Japutra et al., 2014). Thomson et al., (2005) further demonstrated that consumers scoring high on attachment exhibit greater commitment and willingness to invest in the brand relationship, underscoring how attachment fuels long-term loyalty. All in all, brand attachment is an "emotional glue" in consumer and brand relationships.

Studies found that brand attachment is one of the key elements of forming brand loyalty. Since then, research has focused on how brand attachment is formed, and several key factors

have been identified. Brand personality, self-relevant brand associations, and continuous positive experience with the brand are the three factors that can roughly explain the reasons. One key antecedent is the brand's personality, just like the set of human characteristics associated with the brand. Recent research indicates that when the brand's personality resonates with the consumer's self or ideal personality. It can evoke powerful, stronger emotional bonds (Laophon & Khamwon, 2018), and consumers are more likely to become attached to brands that reflect who they are or who they aspire to be. Research supports this mechanism. Emotional brand attachment is higher or even more when the brand's personality matches the consumer's actual self-image or ideal self-image (Escalas & Bettman, 2003; Sheeraz et al., 2018; Shimul, 2022a). Similarly, brands with a distinct and appealing personality are more attractive for customers, because it invoke their feelings, trust, and even friendship, thereby nurturing attachment (Swaminathan et al., 2009). So, brand personality can set up a foundation for attachment.

Another critical factor in attachment formation is the consumer's self-association with the brand. This concept is similar like brand personality, but consumer self-association is marketers trying to shift the attention to customers from themselves. The more consumer links the brand to their self-concept, the stronger the attachment tends to be (Escalas & Bettman, 2003). This connection is evident when consumers see the brand as part of their identity or use it as self-expression. Escalas & Bettman, (2003) refer to this overlap between the consumer and the brand as a self-brand connection. When a person strongly identifies with the value or image of a brand, they will internalize this brand as a part of themselves, which in turn will generate an emotional attachment. For example, an athlete who views a particular sports appeal brand as empathetic to their lifestyle will feel a personal bond with that brand. Study shows that this type of consumer is a potential driver of attachment formation.

In addition to identity alignment, continuous positive experiences with the brand are essential in building attachment. Repeated favorable interactions gradually create trust and affection for the brand, such as consistent product quality, enjoyable usage experiences, and positive customer service. Over time, that build-up of satisfaction becomes the emotional link connecting the consumer with the brand. Research indicates that when consumers find that the relationship between buyers and sellers is always satisfying, they tend to stay with this

brand to develop their brand attachment (Belaid & Temessek Behi, 2011). The historical positive experience remains a long-term memory for customers, so they won't change to try a new one that might ruin the expectation because the old brand has proven to be reliable and rewarding. Continuous satisfaction also forced the brand to build brand trust, further deepening emotional commitment (Esch et al., 2006). In fact, all interact functions as long as they can please customers or improve their emotional delight, contribute to a persistent sickness that keeps consumers devoted (Tsai, 2011). Each positive contact reinforces the emotional connection, whether a product meets existing expectations or an alternative service, conversely, negative or inconsistent experiences weaken my attachment.

Strong emotional brand attachment has several important outcomes for both the customer and the brand. First, it significantly enhances loyalty and commitment. Customers who are emotionally attached to a brand tend to stay loyal over time, usually purchasing products from this brand repeatedly and trying to avoid replacement products (Thomson et al., 2005). They develop a confirm statement. A study found that an attached consumer will willingly make sacrifices or endure inconveniences for their favorite brand. This level of devotion is beyond what is seen with mere satisfaction or habitual buying (Fedorikhin et al., 2008; Japutra et al., 2014). Thomson et al., (2005) similarly observed that highly attached consumers invest more in brand relationships and are reluctant to replace brands. This intense loyalty is more flexible and enduring because it is driven by emotions and personal connections, rather than merely rational preferences. Beyond loyalty, brand attachment also drives positive word-of-mouth with enthusiasm. Consumers with strong attachment often become unofficial "ambassadors" of brands, enthusiastically sharing praise and recommendations with friends, family, or online communities (Kwon & Mattila, 2015). Because this brand means great significance to them personally, they have the motivation to talk about it and promote it on their behalf. Research shows that attachment consumers not only give high praise to brands but also actively maintain them in conversations. This protective promotion becomes obvious when loyal fans refute criticism or correct incorrect information about the brand (Park et al., 2010).

Perhaps one of the most notable outcomes of attachment is the ability to resist negative information about a brand. Consumers with strong attachment types prefer "their"

brands, which makes them less likely to believe negative news, comments or be swayed by rumors. On the contrary, they tend to assume that the brand is innocent and wait for an explanation or improvement. Studies show that customers with emotional attachment will defend the brand when it is criticized and are more likely to forgive the brand's mistakes or failures (Fedorikhin et al., 2008; Japutra et al., 2014). For instance, if there are negative reports or product malfunctions, attachment consumers are more inclined to defend them, such as "This is a one-off issue" or "The brand will solve it", rather than giving up their loyalty. Japutra et al., (2018) described it as a kind of resilience, pointing out that attachment individuals show obvious resistance to negative information and even feel uncomfortable when hearing others speak ill of the brand. In fact, this emotional bond can be so strong that it can provide a buffer for bad news. This means that companies with a stable customer base usually need to maintain a certain degree of goodwill during crises or disputes, otherwise, it will damage consumers' trust. So consumers with a high emotional attachment have a high value to the brand. They are loyal repeat customers and spread positive word-of-mouth for the brand. Even in negative circumstances, they will not "run-away".

How to accurately measure brand attachment is of vital importance to the marketing industry. Several scales have been developed to quantify this profound emotional bond. One of the most widely used tools is the Emotional Brand Attachment Scale introduced by Thomson et al., (2005). This scale uses a series of Likert scale items to capture the intensity of consumers' emotional attachment to a brand, characterized by three potential dimensions: emotion, passion and connection. In fact, the scale requires respondents to rate statements that reflect their feelings towards the brand. For instance, the project includes descriptions such as "I have a deep affection for this brand", "I am passionate about this brand", and "I feel a strong connection with this brand". Thomson et al.' s scale consists of approximately ten such items, which capture these emotions. High scores in these items indicate a strong emotional attachment. Thomson et al., (2005) demonstrated that this scale has high reliability and validity. It shows excellent internal consistency and can predict related behaviors, such as brand investment commitment and willingness. They also confirmed that the emotional attachment measured by this scale is different from related structures such as brand satisfaction or brand attitude, which further confirms that this scale does indeed touch upon a

unique emotional bond.

Another prominent measurement method is the attachment scale developed by Park et al., (2006), which conceptualizes brand attachment into two components, namely brand self-connection and brand prominence. Brand self-connection refers to the cognitive and emotional connection between the brand and the consumer's self. Essentially, it is the degree of integration between the brand and the personal identity. Brand prominence, on the other hand, reflects the frequency and ease with which the brand appears in the consumer's mind, that is, the brand's prominence in memory and emotional recall. They measured these components by asking about the degree of connection between personal feelings and the brand as well as the frequency of the brand's spontaneous emergence.

This two-pronged approach not only seizes the connection between individuals and brands but also captures the prominent position of brands in consumers' lives. Like the Thomson scale, the measurement by Park et al. has also been empirically verified. It helps distinguish brand attachment from simple brand attitude by focusing on self-connection elements. The researchers also adjusted these scales according to different backgrounds. For instance, simplicity use a shorter version or adjust the project wording according to a specific brand or culture while retaining its core focus. The key point is that any attachment scale should reflect the emotional intensity and personal significance of brand relationships. The scale of Thomson et al., (2005) remains a benchmark because it directly focuses on the feelings of love, affection, and connection. When these scales are used in research, researchers and practitioners can quantify the degree of consumers' attachment to brands, and examine the relationship between these attachment scores and important outcomes, such as loyalty and promotion.

1.5 Characteristics of Gen Z in brand interactions.

If there is one place where Generation Z lives, it is the small screen. They scroll, click and make decisions within seconds, which makes simplicity and clarity no longer a creative choice but a survival rule for brands. Some studies do not view transient attention as a defect but rather consider it to be like an adaptive filter, granting privileges of immediate association, smooth processing, and stimulus combination, thereby feeling coherent on mobile devices

(Suraj & Joseph, 2025). In fact, this means a compact narrative, clear navigation, and multi-sensory hooks that do not slow downloading times or cause interruptions. Evidence from live streaming and short-video commerce explains why this works. When streaming media is vivid and creates a sense of "being there", viewers infer higher credibility and report greater trust, which in turn predicts repeat purchase intentions on platforms such as TikTok (Wang et al., 2025). Flow is also very important. Professional, interactive and entertaining leads can increase traffic. Once users enter this state, they are more likely to act impulsively, especially in communities that encourage independent expression (Xin et al., 2025).

Mobile-first is not only about the device, but also about the pace of usage. Banking and payment habits illustrate this shift: in the Gen Z sample, trust, self-efficacy and enjoyment shape perceived usefulness and ease of use, which together drive the intent and actual use of mobile services (Fitriati et al., 2024). Meanwhile, social discovery, creator content and real-time feedback loops back into brand evaluation. Qualitative research on GenAI-driven personalization has found that the responses of Gen Z audiences are a double-edged sword, being both curious and cautious. However, in the presence of accuracy and transparency, it can still range from more precise targeting to stronger engagement and connection (Guerra-Tamez et al., 2024; Peter et al., 2025). Sensory needs lie beneath these behaviors. Generation Z is attracted by multimedia formats, in which vision, sound, presence and playback are combined, whether through head-mounted displays in education and entertainment or through a lighter interactive layer in feeds (Surugiu et al., 2025). The specific form of the stimulus package is also very important. Research on the audio-visual complexity in short advertisements indicates that richer sounds and textures can enhance engagement, while a chaotic array of objects does the opposite. This serves as a useful reminder that sensory intensity is only rewarded when organized (Z. Zhang et al., 2025).

There is also a response to the attentiveness story in the classroom. Rosen and his colleagues documented how information-induced task transitions undermine attention and performance, a finding that helps explain why Generation Z prefers experiences that minimize friction and integrate actions over those that disperse them (Rosen et al., 2011). Simply put, they won't conflict with your interface. They will leave. When brands adapt to this style - short Windows of meaning, responsive interaction, credible social proof and the rhythm of mobile

adjustment - the results will improve. When a brand aligns with the self, the value trade-off is clear, and even the identity process can affect loyalty. As shown in the sample of Generation Z, brand engagement in self-concept and value awareness is linked to loyalty (Thomson et al., 2005). The main thread of these studies is straightforward: designing rapid entry, maintaining flow, winning trust through transparent signals, and using multi-sensory cues as guidance rather than noise (Suraj & Joseph, 2025; Wang et al., 2025; Xin et al., 2025).

Authenticity is the center of gravity in Gen Z brand relationships, and it is expressed through consistency between stated values and lived behavior in digital channels (Ofosu-Boateng & Jose, 2025; Prasanna & Priyanka, 2024). According to the research of Ofosu-Boateng and Jose, (2025), indicators such as honesty, inheritance, and consistency have transformed into trust and loyalty among young consumers in emerging markets. Social commerce research echoes this logic, indicating that visibility, interactivity, and authenticity on live streaming platforms enhance perceived value and emotional engagement (Liu & Zhang, 2024). Researchers add that identity and social presence foster affection and trust, but these effects depend on the perceived fit between the individual and the brand story (Pinto & Paramita, 2021; Rajput & Gandhi, 2024). When the collaboration appears misaligned with brand promises, strong attachment can even backfire into harsher judgments, which underscores how sensitive Gen Z is (Bentley et al., 2025).

Young users are curious and interested in highly personalized advertisements, so accuracy, transparency and a smooth experience are crucial for maintaining their trust (Guerra-Tamez et al., 2024; Peter et al., 2025). In addition to information, identity work is also very important, which is related to the loyalty of Generation Z. Value awareness can enhance the process from self-participation to commitment (Ismail et al., 2020). In fact, the authenticity of this group is not a single claim, but rather an open, consistent, and cross-touchpoint responsive behavioral pattern. Brands that invite users' voices, disclose their operation methods, and display consistency between content, community, and business tend to receive lasting reviews, even if the content is well-crafted. Inconsistent execution will be detected and quickly filtered out (Ofosu-Boateng & Jose, 2025; Prasanna & Priyanka, 2024).

Immersion and interactivity operate as relational engines for Gen Z because they turn exposure into felt experience and shared agency. Evidence shows that usefulness, enjoyment,

and flow can predict adoption among young users, especially in the experience of virtual reality and immersive devices. Immersion can leave both immediate and delayed effects on user's attitude and memories (Balaban et al., 2025; Surugiu et al., 2025). In e-commerce purchasing, vividness heightens credibility and trust, which makes consumers want to repeat purchase (Wang et al., 2025). Within avatar rich environments, identification increases self-presence, and that psychological proximity relates to purchase and brand behaviors for younger cohorts who see the space as part of their social life (Kim et al., 2025). Live streaming research shows that professional cues, interaction cues, and entertainment cues build flow, and flow then lifts impulse actions, especially for independent self-construal's that are common in many online communities (Xin et al., 2025).

Digital platforms are the primary arena where Gen Z encounters, evaluates, and stays with brands, which invites a reconsideration of traditional brand building models. Classic frameworks that equate repetition with memory and program loyalty as a stable segment are being challenged by evidence that loyalty emerges from relationship quality and must be re-earned with each interaction in fluid feeds (Desveaud et al., 2024; Hemsley-Brown, 2023; Japutra et al., 2014). Foundational attachment work still matters because attachment predicts difficult behaviors better than attitude strength, yet reviews emphasize that new contexts like social, live, and immersive media call for updated mechanisms and measures (Hemsley-Brown, 2023; Shimul, 2022a). Subscription research on Gen Z highlights the role of social media influence, performance expectations, and brand equity for retention, while the environment of close others plays a smaller role than expected, which suggests that digital signals and product value dominate habitual renewal decisions (Škudienė et al., 2025). Digital disruption research also warns that platform and context can blur generational gaps, so theories should specify when age differences persist and when task constraints flatten them (Chang & Chang, 2023). Sensory branding advances give additional levers that older models did not integrate well: saturation can cue potency, lightness can cue youth, and sonic systems can stabilize recognition and emotion across formats when they are designed with the visuals as one identity (Labrecque et al., 2025; Spence & Keller, 2024; Zeng et al., 2025). Meanwhile, influencers and community dynamics require fit, as well as value consistency, because misfit can trigger a stronger negative response among attached consumers than among ordinary

followers (Bentley et al., 2025). The literature supports a reconstruction in which digital first-time experiences, sensory consistency, co-creation, and transparent values become operational drivers for Gen Z brand building, while traditional principles such as positioning clarity and consistent identity are retained but expressed through a journey of interaction, mobility, and social embedding (Desveaud et al., 2024; Spence & Keller, 2024; Suraj & Joseph, 2025).

Classic brand building usually assumes that stable exposure, functional satisfaction and accumulated memory will increase loyalty over time. Some of them remain correct, but the evidence surrounding Generation Z complicates the situation. Distinguishing attachment from attitude is a good start (Park et al., 2006). Park and his co-authors believe that attachment is understood as a bond connecting the brand and the self, and it is more capable of predicting difficult behaviors than attitude strength and has been shown to predict demanding behavior. For instance, the willingness to invest energy or defend a brand at a cost (Fedorikhin et al., 2008; Thomson et al., 2005). This core view holds true, but in digital, social and immersive environments, the path of attachment looks different. Comments over the past few years have pointed out that the current prerequisites include identity work, co-creation, social presence and transparency, elements that were underestimated or not valued at all by earlier models (Hemsley-Brown, 2023; Shimul, 2022a). When modeling loyalty on a large scale, meta-synthesis reveals four broad drivers - offer, alliance, experience, and connection - rather than a single path from awareness to repeat purchase. These drivers vary with context and group (Desveaud et al., 2024).

The data of Generation Z further promotes this. In subscription Settings, the retention rate of young users is related to social media influence, performance expectations, and brand equity, while the direct environment of being close to others plays a smaller role than people would expect from earlier relationship scripts (Škudienė et al., 2025). Identity-based engagement is also important: the interaction between brand engagement in self-concept and value awareness can predict the loyalty of Gen Z samples, indicating that relationship quality is partly self-project and partly value calculus (Ismail et al., 2020). New fields like virtual retail and virtual influencer ecosystems have added more active components. Case studies and experiments have shown that virtual avatar recognition and self-existence can be transformed

into purchase intention and brand behavior, and immersive formats enhance the immediate and delayed effects of influencer information (Alexander et al., 2025; Balaban et al., 2025; Kim et al., 2025). These are not marginal notes; They have changed the design of contact points and the rhythm of relationship maintenance.

There are also warnings at the same time. When execution goes against expectations, the attachment is bidirectional. Consumers with a sense of attachment may respond more severely to the discomfort of collaborating with influencers, magnifying negative reactions compared to ordinary followers (Bentley et al., 2025). On the contrary, strong brand respect can buffer negative information, which indicates a specific elastic lever beyond the frequency of exposure (Wiese et al., 2025). In emerging markets, authenticity is a prerequisite for the loyalty of young consumers, which redefines the role of values in both theory and practice (Ofosu-Boateng & Jose, 2025). In conclusion, these findings challenge the simple pipeline from awareness to preference and then to repeated selection. A more suitable framework for Generation Z is to view loyalty and attachment as dynamic outcomes obtained in every interaction, negotiated in the public social space, and determined by fit, transparency and participatory experience design (Desveaud et al., 2024; Shimul, 2022). The old principles have not been abandoned - clear positioning and consistent identity remain important - but they are expressed through different mechanisms. Brands communicate with users rather than speak to them. Their design is for a sense of presence, not merely for memory. They plan for resilience by integrating commitment with the life interactions that Gen Z actually experiences on their digital journey (Hemsley-Brown, 2023; Shimul, 2022a; Škudienė et al., 2025).

1.6 Conceptual models

This study develops a conceptual research model, grounded in the Stimulus–Organism–Response (S–O–R) paradigm (Mehrabian & Russell, 1974), where visual and auditory design cues (stimuli) influence Gen Z consumers' emotional and cognitive responses (organism), leading to emotional brand attachment (response), with Gen Z consumer traits acting as a boundary condition (moderator). Within this framework, the present research is set as follows:

Independent Variables (Stimuli)

- Visual cues, (colors, imagery)
- Auditory cues (music, sound effects, tone)

Mediating Variables (Organism)

The “organism” stage included the psychological reactions elicited by the sensory stimuli. Two distinct yet complementary forms of internal responses are included.

- Affective responses (pleasure, arousal, mood)

Emotional reactions experienced during or immediately after interaction with an interface, captured in this study through pleasure, arousal, and mood. Specifically, pleasure was measured by participants’ feelings of pleasantness after viewing or listening to the content (AR_1), arousal was captured through feelings of excitement or energy (AR_2), and affective resonance was assessed by the extent to which the content resonated with participants’ personal values or preferences (AR_3). These represent short-term emotional states and align with core affect theory, which suggests that sensory stimuli evoke immediate emotional valence and intensity.

- Cognitive responses (perceived brand identity, trust, authenticity)

Psychological evaluations through which users interpret meaning, cues, and message credibility, represented here by perceived brand identity, trust, and authenticity. Perceived authenticity (CR_1) measured whether the brand was viewed as genuine, trust (CR_2) captured perceived reliability and confidence in the brand, and perceived brand identity (CR_3) assessed the clarity with which the interface communicated the brand’s identity. Unlike affective responses, which are emotional, cognitive responses reflect thought-based judgments that influence the perceived legitimacy and reliability of a brand in the user’s mind.

Affective and cognitive reactions are considered complementary mechanisms in explaining how sensory cues shape brand attachment. Research indicates that sensory brand experience arising from visual, auditory, and other sensory cues significantly influences consumers’ overall brand experience and emotional responses, which are linked to stronger attachment and loyalty outcomes in marketing contexts (Zha et al., 2025). In addition, brand attachment has been conceptualized as involving both emotional engagement and cognitive evaluations of the brand, indicating that emotional reactions alone may not fully account for

long-term attachment without cognitive appraisal processes (Shimul, 2022). Therefore, both affective and cognitive responses are necessary to capture the full psychological process through which sensory stimuli translate into lasting emotional brand attachment.

Dependent Variable (Response)

- Emotional Brand Attachment (connection, separation distress, self–brand connection, commitment), Emotional Brand Attachment is conceptualized here as the enduring outcome of consumers’ affective and cognitive responses, rather than a temporary emotional state. The scale included items assessing emotional connection (EBA_1), anticipated loss or separation distress (EBA_2), self–brand integration (EBA_3), and preference for the brand over comparable alternatives (EBA_4).

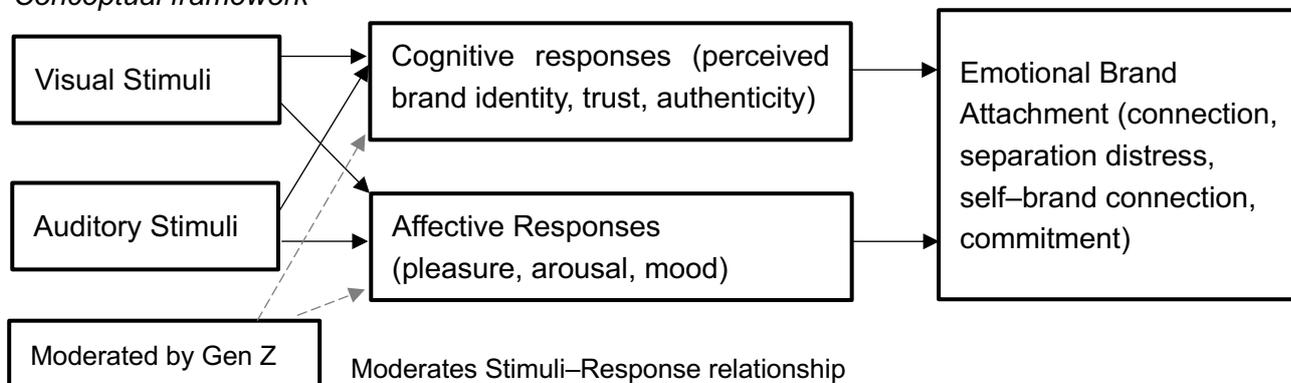
The detailed information of the questionnaire is in the appendix.

Moderating Context (Boundary Conditions)

- Gen Z Consumer Traits (digital nativity, preference for multimedia, authenticity-seeking, short attention span, social identity needs).

Figure 1

Conceptual framework



Source: Author’s conceptual framework based on the S–O–R paradigm and prior studies on sensory branding.

2. METHODOLOGY

2.1 Hypotheses development

Based on the previous evidence, the following hypotheses are proposed:

H1: Visual stimuli in digital brand interfaces positively influence affective responses among Generation Z consumers.

H2: Auditory stimuli in digital brand interfaces positively influence affective responses among Generation Z consumers.

H3: Visual stimuli in digital brand interfaces positively influence cognitive responses among Generation Z consumers.

H4: Auditory stimuli in digital brand interfaces positively influence cognitive responses among Generation Z consumers.

H5: Affective responses to digital brand interfaces positively influence emotional brand attachment among Generation Z consumers.

H6: Cognitive responses to digital brand interfaces positively influence emotional brand attachment among Generation Z consumers.

H7: Generation Z characteristics (digital nativity and multimedia preference) moderate the relationship between visual and auditory stimuli and affective responses.

H8: Generation Z characteristics (digital nativity and multimedia preference) moderate the relationship between visual and auditory stimuli and cognitive responses.

2.2 Rationale for quantitative research

Based on the former analysis, this study adopts a quantitative research design combining an online experiment and a structured questionnaire to examine how visual and auditory stimuli in digital brand interfaces influence emotional responses and Emotional Brand Attachment (EBA) among Generation Z consumers. This chapter aims to explain the methodological logic guiding the study, the structure of the experimental design, and the overall rationale for using this approach to test the proposed conceptual model.

The research employed a fully online quantitative, between-subjects experimental design conducted entirely online. A 2 × 2 factor structure is adopted to control visual quality (high vs low) and auditory stimulation intensity (high vs low). Participants were randomly

divided into four experimental groups. Each group saw a different mix of high or low visual and audio stimulation. After watching the interface video, they answered a questionnaire. The questionnaire measured how they felt about the visual and audio quality, their emotional and thinking responses, their emotional attachment to the brand, as well as some check questions and basic personal information. This design made it possible to carefully study how visual and audio stimuli influence emotions and thinking. By changing visual and audio cues in a standard brand interface, the experiment copied the sensory environment that people often experience in digital marketing, such as on websites, mobile apps, and online advertisements. The online setting also matched the real media habits of Generation Z, who mostly interact with brands through screens and multimedia content. The choice of experimental methods is based on this study's conceptual frame, which is SOR. This study holds that environmental cues (S) can trigger inter emotional and cognitive states (O), further influence actions or attitudinal results (R). Visual design elements, such as layout, color or images, as well as auditory elements, such as background music or sound effects, all serve as external stimuli that can alter participants' perception and emotional responses. These internal states will ultimately affect the extent to which users develop an emotional attachment to the brand. Experiments are particularly suitable for sensory-result-response (S-O-R) studies because they allow for the direct manipulation of environmental stimuli and the inference of the causal relationship of their subsequent effects. This is due to the controlled manipulation of independent variables and the ability to draw causal conclusions from observed differences in dependent variables under experimental conditions (Imai et al., 2013).

In addition, the digital brand interface itself has the function of multi-sensory stimulation, and thus is suitable for measuring the immediate response after contact. As this thesis aims to understand how sensory cues embedded in digital design trigger emotional attachment, it is necessary to present controllable visual and auditory stimuli to the participants and capture their responses immediately after exposure. This logic is consistent with previous studies on multi-sensory and digital brands, which emphasized that brand emotions arise during the interaction process rather than in retrospect.

This study used an online experiment instead of a laboratory study for both practical and theoretical reasons. First of all, online Settings better reflect the way consumers usually

interact with brands. In real life, people usually come across websites, mobile applications and digital advertisements on their mobile phones or computers. These are all daily environments that are beyond full control. Therefore, conducting experiments online creates a more natural situation and enhances the external validity of the results, especially for digital brand environments.

An online format is also suitable for reaching Generation Z, who were the main target group of this research. Gen Z participants are very familiar with online surveys, video content, and multimedia interfaces, and they often take part in such activities through student groups or social media. Online distribution makes it easier to collect data from this population and to include participants from different countries. In addition, the experiment used short video clips or interface recordings that combined visual and auditory cues. Online survey tools such as Google Forms allow these media to be embedded in a stable way, helping to keep the timing, image quality, and sound as consistent as possible across conditions. These platforms also support automatic random assignment, simple questionnaire logic, and secure storage of responses, which is helpful for maintaining the internal validity of a between-subjects design where each participant should only see one version of the stimulus. Using a digital environment also fits the research aim of studying digital sensory cues, because the method is closely linked to the real digital contexts the thesis is interested in.

The study followed basic ethical principles for research with human participants. Participation was completely voluntary, and informed consent was obtained on the first page of the online form. The introduction explained the purpose of the study, the approximate time needed, the minimal level of risk, and participants' rights, including the right to stop at any time without any negative consequences. No directly identifiable personal data were collected, except for optional demographic information such as age or country. All responses remained anonymous and were stored securely, and the data were used only for academic purposes related to this master's thesis. The visual and auditory stimuli did not include any sensitive or harmful content, they showed only typical digital brand elements and background music. Finally, participants were reminded to complete the experiment in a quiet place, and better to use headphones. This was intended both to increase their comfort and to improve the quality of the auditory manipulation in the study.

2.3 Sampling and participants

Because Gen Z digital users are the main study population in this research. Therefore, the target audience includes individuals who frequently interact with the brand through websites, mobile applications and social platforms and aged between 18 and 28, The reason for choosing this age group is that previous studies have consistently shown that Gen Z consumers can quickly form impressions, react strongly to audio-visual cues, and actively create and share brand-related content online. Due to these habits, they are a suitable group for studying.

Table 1

The Sample Sizes of Previous Similar Studies

Author (Year)	Topic	Method	Sample Size
Li & Pan (2023)	Visual & auditory signals effect on purchase (AISAS)	Experimental Design (2×2)	120
Wu & Chen (2022)	Sensory imagery & online advertising effectiveness (EEG + survey)	Survey + EEG	166
Kantono, K et al. (2016)	Influence of auditory & visual stimuli on food pleasantness	Experimental Design	90
Jūratė, B et al. (2025)	Aroma, music, visual aesthetics & purchasing	Mixed survey	100–110
Vanitha & GOWRI (2024)	Sensory marketing effects in restaurants	Online survey	179
Mean			133

Source: developed by author

Based on the previous studies summarized in Table 1, sample sizes in these studies range from over 90 to around 200 participants, with several examples close to the present research's 120 valid responses, such as Li & Pan's 120 survey respondents and a Jūratė, B et al. (2025) study with ~100–110 respondents. Other studies with larger samples around 179 further show that both moderate and larger sample sizes can reveal significant sensory effects in consumer behavior research.

The average sample size across these studies is approximately 133, which indicates that a target sample size of ~150 respondents is methodologically aligned with prior literature and statistically adequate for SEM analysis. Therefore, a target sample of 150 responses in

this study falls within the empirically observed range in sensory marketing literature and is sufficient to test theoretical structural paths in the research model.

Sampling is carried out by combining convenience sampling and snowball sampling. The survey links are shared through university student groups, social media communities (such as Facebook online form groups), and personal connections. However, this method is common and suitable for experimental research in digital interface studies, where the main goal is to examine psychological processes rather than estimate population-level parameters. For example, S-O-R mechanisms, mediating pathways or cross-group comparisons. A target of 150 cases was established to ensure that the analysis involving multiple variables had sufficient statistical power, including the mediation model and inter-group comparisons in the 2×2 experimental design.

In the early stage, an attention check question is used to ensure the quality of the responses. Respondents who did not follow the instructions were removed from the final dataset. Basic demographic information was collected to help contextualize the sample and support the analysis later in the next chapter. These variables include age group, gender, current country or region of residence, daily use of smartphones, familiarity with digital interfaces, and whether participants have received any formal music training - an additional factor that may affect the sensitivity to auditory stimulation perception. Collecting these features enables the research to describe the composition of the sample, assess the diversity of respondents' digital experiences, and consider whether specific demographic attributes can be used as control variables in subsequent statistical modeling.

2.4 Experimental design and procedure

This study employed a 2 × 2 between-subjects experimental design to examine how visual and auditory stimuli in a digital brand interface influence emotional responses and Emotional Brand Attachment (EBA). The two manipulated factors were:

- Visual quality of the interface: high vs. low
- Auditory stimuli strength: high vs. low

Crossing these factors resulted in four experimental conditions:

- Group A: high visual quality – high audio presence

- Group B: high visual quality – low audio
- Group C: low visual quality – high audio presence
- Group D: low visual quality – low audio

Each participant was exposed to one of these conditions only, making the design strictly between-subjects. The experimental stimuli consisted of short brand interface clips presented in video format. All clips portrayed the brand and communicated a comparable core message, but differed systematically in terms of visual and auditory quality according to the assigned condition.

Under the condition of high visual quality, the clips feature carefully selected visual effect advertisements with high contrast and harmony, clean and balanced layouts, and high-resolution images, conveying professional aesthetics consistent with modern digital brand identities. Low visual quality clips use less harmonious colors, simpler or less refined layouts, and images that are less vivid or immersive, without being deliberately distracting.

As for the auditory test, high auditory strength consists of clear and salient audio tracks aligned with the brand's mood, often synchronized with the visual effects to enhance user engagement. Low auditory strength involves sounds with low saliency, reducing auditory stimulation so that the experience is primarily visual. This design enables the study to isolate the effects of auditory presence and the interaction between visual and auditory cues.

To verify whether the operation was understood as expected, several operation check items were embedded in the questionnaire. In terms of visual quality, participants used a 7-point Likert scale to rate statements such as "vivid and eye-catching visual effects (color, layout, images)", "balanced layout and easy to follow", and "the overall visual design is very attractive". For auditory stimulation, participants evaluated items such as "audio (music/sound/sound) matching visual effects", "the audio quality felt clear and pleasant", "rhythm/rhythm felt suitable for the brand", and "I could identify a unique sound logo or audio signature".

These projects will be used to test whether high visual conditions indeed produce higher perceived visual quality than low visual conditions, as well as whether high audio conditions produce higher perceived audio quality than low audio conditions, thereby confirming the effectiveness of the experimental operation.

The experiment was administered entirely online using a structured Google Forms questionnaire integrated with the experimental stimuli. The procedure followed several sequential steps, ensuring that all participants went through the same general experience with only the experimental condition varying.

First, participants entered the study through links posted on university channels, social media and personal networks. They will read the purpose of this research and the basic instructions at first. Researchers also reminded participants to complete the study in a quiet environment and to use headphones if possible or adjust the volume of their devices appropriately.

After reading the introduction, they are required to agree to participate voluntarily and be between 18 and 28 years old. The additional screening questions examined the age group and the country or region where they currently reside, as well as whether their environment is quiet enough to listen to the audio content. It also comes with attention checks. Those who failed the attention check or did not meet the basic criteria were subsequently excluded from the final dataset.

Following the screening section, participants were directed to one of the four experimental groups (A, B, C or D), corresponding to four combinations of visual × audio conditions. The form is configured so that participants are only assigned to one group and the meaning of each label is unknown. This setting is similar to a random allocation under four conditions, which is essential for maintaining internal validity in experiments among subjects.

In the group section they designated, participants were shown a short brand interface clip with a brief description (for example, "Next, you will watch a very short brand clip.") If possible, please put on your headphones and adjust the volume. " They were asked to watch the entire clip and listen carefully to the accompanying sounds or music where appropriate.

After watching the video, the participants immediately completed the main part of the questionnaire. Next, participants are required to rate their perception of visual and auditory quality. The questionnaire is set up with several test dimensions, measuring responses to emotional responses (such as feeling happy and excited) and cognitive assessment items (such as authenticity, credibility, and clarity of brand identity). Then they answered questions about emotional brand attachment, including emotional connections, perceived brand

importance, and preferences for alternatives. Finally, they completed projects related to digital habits and preferences (for example, comfort with digital interfaces, daily use of smartphones, preferences for combined audio-visual content) and demographic information (age group, gender, education level, employment status, music training and residential area).

All attitude and perception items used a 7-point Likert scale, ranging from "strongly disagree" to "strongly agree", making subsequent reliability analysis and multivariate modeling possible. Given the voluntary nature of this study, no monetary rewards were offered.

3. RESULTS OF THE EMPIRICAL STUDY

3.1 Sample description

After excluding incomplete input and failed attention checks, this study ultimately collected N = 123 valid responses. Only 1 response was removed because it did not pass the attention check. All participants were between 18 and 28 years old, qualified with the target population of this research, and all of them confirmed that they had completed the study in a good environment to fill in the form, ensuring a standard condition for visual and audio stimuli. At the same time, gender, education, and music training have also been added as factors to be considered.

The study settled 4 different groups, each representing a different combination of visual and auditory brand stimuli, and collected 29 responses in Group A, 29 in Group B, 34 in Group C, and 31 in Group D. Descriptive statistics and were calculated for all main constructs included in the study, including visual stimuli perception, auditory stimuli perception, affective responses, cognitive responses, and emotional brand attachment. Table 2 presents the means and standard deviations of each construct across the total sample.

Table 2

Descriptive Statistics of Key Research Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Visual Stimuli	123	9	48	33.95	7.173
Auditory Stimuli	123	4	27	18.92	4.582
Affective Response	123	3	21	14.73	3.671
Cognitive Response	123	3	21	14.74	3.269
Emotional Brand Attachment	123	4	28	19.18	5.423
Moderated by Gea Z	123	14	34	25.68	4.703

Source: developed by author

As shown in Table 2, the key variables use a valid sample of 123 participants, with a focus on the mean and standard deviation. The data show that the mean value of the independent variable visual stimulation is 33.95 (SD = 7.17), while the mean value of auditory stimulation is 18.92 (SD = 4.58), indicating that the respondents perceived different degrees of stimulation intensity from the experimental materials. In terms of mediating variables, the means of emotional response and cognitive response were very similar, being 14.73 (SD =

3.67) and 14.74 (SD = 3.27), respectively. This indicates that when consumers are exposed to stimuli, their emotional and cognitive evaluation levels are comparable. The average value of the dependent variable emotional brand attachment was 19.18 (SD = 5.42).

Overall, the standard deviations of all variables indicate a good degree of data dispersion, with no severe upper or lower limit effects. Therefore, the data variability meets the statistical requirements of subsequent correlation and regression analyses.

To assess the internal consistency of the measurement scales, reliability analysis was performed in SPSS, and Cronbach's alpha coefficients were calculated for all multi-item constructs.

Table 3

Reliability Analysis Statistics of Variables

Variable	Reliability Statistics	
	Cronbach's Alpha	N of Items
Visual Stimuli	0.885	7
Auditory Stimuli	0.855	4
Affective Response	0.86	3
Cognitive Response	0.785	3
Emotional Brand Attachment	0.908	4
Moderated by Gea Z	0.83	5
TOTAL	0.954	26

Source: developed by author

As shown in Table 3, Cronbach's alpha coefficient was used in this study to measure the internal consistency of the table. The results show that the questionnaire as a whole has extremely high reliability. This can be confirmed by the Cronbach's alpha of the total scale reaching 0.954. For individual variables, the alpha coefficients of all structures ranged from 0.785 to 0.908, always exceeding the recommended threshold of 0.7 (Nunnally, 1978). Among them, the reliability of emotional brand attachment was the highest (alpha = 0.908), demonstrating good measurement stability. Other variables also performed very well, with coefficients exceeding 0.85.

Therefore, both the individual dimensions and the overall scale used in this study have robust reliability. The data quality is reliable and suitable for subsequent statistical analysis. Content validity was ensured through the adaptation of measurement items from established

scales in previous studies related to sensory marketing, brand perception, and emotional brand attachment. All items were reviewed and adjusted to fit the context of digital brand interfaces and Generation Z users. In addition, the results of the reliability analysis further support the construct validity of the scales, as high internal consistency indicates that the items within each construct measure the same underlying concept.

3.2 Manipulation checks and control analyses

To verify the effectiveness of the experimental operation and ensure that the audio and visual stimuli of the four groups met the experimental standards, the researcher used an independent sample t-test for operation checks. The aim is to examine whether the participants perceive the differences between visual and auditory stimuli under different experimental conditions.

Table 4

Manipulation Check Results for Visual and Auditory Stimuli

Variable	t	df	p
Visual Stimuli_Avg	-0.25	116.27	0.802
Auditory Stimuli_Avg	-2.46	114.41	0.015

Source: developed by author

Although the perception results of auditory stimulation were very effective ($t = -2.46$, $p < 0.05$), the data showed that the differences among the four groups in the perception of visual stimulation ($t = -0.25$, $p > 0.05$) were not so significant.

Results of the manipulation check indicated that participants did not consciously perceive a significant difference between the high- and low-visual quality conditions. This suggests that the visual manipulation was relatively subtle and did not reach a level of explicit awareness. However, subsequent regression analyses based on perceived visual stimuli scores reveal that visual perceptions still significantly predicted affective responses. These analyses revealed that participants' subjective visual perceptions still significantly predicted affective responses, indicating that visual stimuli can influence emotional responses at a more implicit or automated level, even in the absence of explicit awareness of the manipulation. Therefore, while causal inferences based solely on experimental condition assignment should be made with caution, the subjective perception of visual quality remains a meaningful

predictor of emotional responses.

In addition, to comprehensively assess how individual backgrounds shape consumers' emotional connections with brands, the researcher employed a suite of inferential statistical tests. Specifically, independent samples t-tests also were also utilized for binary demographic variables (e.g., gender, music training history), while one-way analysis of variance (ANOVA) was applied to compare means across groups with three or more categories (e.g., educational attainment, occupation, and levels of screen usage time). This analytical approach was designed to systematically examine the potential impact of these key demographic characteristics on the dependent variable, emotional brand attachment.

Table 5

Statistical Analysis of Differences by Demographic Characteristics

Variable	Category	N	Mean	Std. Deviation	F/t	p
Controls_GENDER	Male	65	19.43	5.163	0.544	0.588
	Female	58	18.9	5.733		
Controls_EDU	High school	23	18.83	5.449	3.021	0.021
	Bachelor	65	19.92	4.424		
	Master	27	17.85	6.803		
	Doctorate	7	20.71	4.923		
	Other	1	4	.		
Controls_SCREEN	1-2h	25	19.76	5.666	0.639	0.53
	3-5h	38	18.37	5.851		
	6h+	60	19.45	5.064		
Controls_MUSIC	No	80	19.06	5.795	-0.323	0.747
	Yes	43	19.4	4.711		
Controls_OCC	Student	26	16.15	6.781	9.092	<0.001
	Employed	96	20.13	4.55		
	Other	1	7	.		

Source: developed by author

It is clearly seen from Table 5 that there are a few differences in scores between the two variables, education ($F=3.021$, $p=0.021$) and occupation ($F=9.092$, $p < 0.001$). In detail, within the career group, the average score of respondents with jobs ($M=20.13$) was higher than the student group ($M=16.15$), indicating that career status has a positive impact on the Emotional Brand Attachment. In terms of education, participants with different educational backgrounds also showed irregular differences in their scores. However, gender ($t=0.544$, $p = 0.588$), screen time ($F=0.639$, $p = 0.530$), and music training habit ($t=-0.323$, $p = 0.747$) had

no remarkable effect on the variable score, which means that the variable remained stable in these demographic characteristics.

3.3 Hypothesis testing

H1. Visual stimuli in digital brand interfaces positively influence affective responses among Generation Z consumers.

H2. Auditory stimuli in digital brand interfaces positively influence affective responses among Generation Z consumers.

To test Hypotheses H1 and H2, Multiple Linear Regression Analysis was conducted, with perceived visual stimuli and auditory stimuli as independent variables, and affective response as the dependent variable, while controlling for variables such as Gender, Education, Screen Time, Music Habits, and Occupation.

Table 6

Regression Analysis Statistics of the Influence of Visual Stimuli and Auditory Stimuli on Affective Responses

Variables	Unstandardized Coefficients		Standardized Coefficients			VIF
	B	Std. Error	Beta	t	p	
Controls_GENDER	-0.123	0.355	-0.017	-0.345	0.731	1.061
Controls_EDU	-0.383	0.214	-0.086	-1.791	0.076	1.047
Controls_SCREEN	0.132	0.23	0.028	0.575	0.567	1.087
Controls_MUSIC	0.416	0.371	0.054	1.123	0.264	1.053
Controls_OCC	0.212	0.419	0.024	0.505	0.614	1.055
Visual Stimuli	0.27	0.031	0.528	8.761	< 0.001	1.635
Auditory Stimuli	0.346	0.049	0.432	7.11	< 0.001	1.666
R^2			0.745			
Adjusted R^2			0.729			
R^2 Change			0.729			
F Change			164.229***			

Source: developed by author

The statistical data indicate that the fitting effect of this regression model is good ($R^2 = 0.745$, Adjusted $R^2 = 0.729$). Moreover, the statistical results of the entire model are significant (F Change = 164.229, $p < 0.001$). This explains that when combining the independent variables put into the model can account for approximately 74.5% of the changes in the dependent variable, which is the emotional response. Reach also examined some control

variables, demographic factors such as Gender, Education, Music Training, and Screen Time did not demonstrate a significant impact on the dependent variable ($p > 0.05$), thereby ruling out interference from confounding variables. So it is assumed that these factors have not interfered with the relationship that this study mainly wants to look at.

The most crucial discovery is that Visual Stimuli has a very obvious positive promoting effect on Affective Response ($\beta = 0.528$, $t = 8.761$, $p < 0.001$). Similarly, Auditory Stimuli also has a significant positive impact on Affective Response ($\beta = 0.432$, $t = 7.110$, $p < 0.001$). If comparing the standardized coefficients (β), the β value of visual stimulation (0.528) is slightly higher than that of auditory stimulation (0.432). This means that the role played by vision might be slightly greater. Besides, the model also checked whether it had the problem of "multicollinearity, The inspection result shows that the Variance Inflation Factor (VIF) for all variables is less than 2 (with a maximum value of 1.666), so that the model is free from severe multicollinearity issues. However, this result must be comprehensively interpreted in combination with methodological findings. Although the statistical model suggests a strong correlation of visual cues, the failure of the formed manipulation test indicates that the specific visual manipulation scheme in the experiment itself may not be the sole or direct cause driving this statistical relationship.

There are several possible explanations for this. Firstly, visual stimuli may affect emotions in a more implicit and automated way, to the extent that the self-report of the subjects at the conscious level (i.e., the manipulation test questionnaire) fails to accurately capture them. Emotional response measurement may capture this subtle influence more sensitively than direct manipulation test problems. Secondly, to maintain the authenticity and ecological validity of the experimental materials, the differences in visual stimuli we use may be compromised in intensity and fail to reach a level that is clearly perceived subjectively by the subjects.

However, the accumulated, subtle differences are still sufficient to statistically influence the aggregated emotional responses. There are other unmeasured variables that covary with the visual stimulus conditions, for example, certain visual materials unintentionally trigger stronger associations or cognitive processing, and these variables are the true cause of the difference in emotional responses. As the manipulation test is not significant, we cannot

completely rule out this possibility.

In summary, Hypothesis H2 is fully supported for auditory stimulation. Both the manipulation check and regression analysis indicate a significant positive effect on affective responses. For visual stimuli, Hypothesis H1 receives partial support. While the manipulation check did not confirm conscious perception of visual differences, perceived visual quality significantly predicted affective responses, suggesting an implicit emotional influence of visual stimuli. The successful manipulation test for auditory stimuli allows us to attribute the enhancement of emotional responses to the experimental manipulation of auditory elements. For visual stimuli, even the manipulation check did not clearly perceive a significant difference. However, regression analyses showed that visual stimuli still significantly predicted affective responses. This suggests that visual cues also can influence emotional responses at an automatic level. So, the results highlight the importance of visual stimuli in shaping emotional responses.

H3: Visual stimuli in digital brand interfaces positively influence cognitive responses among Generation Z consumers.

H4: Auditory stimuli in digital brand interfaces positively influence cognitive responses among Generation Z consumers.

To validate Hypotheses H3 and H4, the same model as Hypotheses H1 and H2 was constructed to test.

Table 7

Regression Analysis Statistics of the Influence of Visual and Auditory Stimuli on Cognitive Responses

Variables	Unstandardized Coefficients		Standardized Coefficients			VIF
	B	Std. Error	Beta	t	p	
Controls_GENDER	-0.379	0.299	-0.058	-1.265	0.209	1.061
Controls_EDU	-0.086	0.18	-0.022	-0.475	0.635	1.047
Controls_SCREEN	0.134	0.194	0.032	0.693	0.49	1.087
Controls_MUSIC	0.13	0.312	0.019	0.417	0.677	1.053
Controls_OCC	0.355	0.353	0.046	1.007	0.316	1.055
Visual Stimuli	0.296	0.026	0.649	11.391	< 0.001	1.635
Auditory Stimuli	0.227	0.041	0.319	5.54	< 0.001	1.666
R^2			0.772			

Continuation of Table 7

Variables	Unstandardized Coefficients		Standardized Coefficients			VIF
	B	Std. Error	Beta	t	p	
R^2 Change	0.762		0.319	5.54	< 0.001	1.666
F Change			191.706***			

Source: developed by author

After confirming the significant impact of sensory stimuli on emotional responses, the study further examined their effects on cognitive responses. The Table 7 results show that the regression model for cognitive response also performed well ($R^2 = 0.772$, adjusted $R^2 = 0.758$), and the overall effect was significant ($F = 191.706$, $p < .001$). Similar to the analysis results of emotional responses, the influence of demographic variables (such as gender and educational level) on cognitive responses remains insignificant, which once again enhances the reliability of our model's conclusions. However, in the comparison of the influence of core variables, a more enlightening pattern emerged: the impact of visual stimulation on cognitive response remained extremely strong (beta = 0.649, $p < .001$), but the influence of auditory stimulation was relatively weakened (beta = 0.319, $p < .001$). The influence of visual stimulation (0.649) is approximately twice that of auditory stimulation (0.319). This gap is significantly greater than the gap when they influence emotional responses (visual beta=0.528 vs. Auditory beta=0.432). Interpreting these findings for H3 and H4 requires integrating the methodological caveat discussed earlier.

For Auditory Stimuli, the data provide robust support. The successful manipulation check allows for a stronger inference that the experimental auditory manipulation causally contributed to the observed increase in cognitive response. So H4 is fully supported for auditory stimulation.

For Visual Stimuli, Hypothesis H3 receives partial support. The manipulation check indicated that participants did not consciously perceive the difference between high- and low-visual conditions. This constrains causal inferences based solely on experimental assignment. However, a significant beta value (0.649) reflects the influence of visual cues on cognition at the perceptual rather than condition-driven level, even without the manipulation of explicit consciousness. Although causal claims based on conditional allocation should be made with caution, the results emphasize the significant role of perceived visual quality in the formation

of cognitive responses.

H5: Affective responses positively influence emotional brand attachment among Gen Z consumers.

The analysis of the first two parts has confirmed that auditory stimuli can effectively stimulate the emotional and cognitive responses of Generation Z consumers, while visual stimuli also significantly predicted both affective and cognitive responses, despite participants not consciously perceiving differences between high- and low-visual conditions. This suggests that visual cues can influence emotional and cognitive processing at an implicit or automatic level. Then, a more practical question is whether these triggered, immediate emotional responses can be further transformed into deeper and more lasting brand loyalty?

This is precisely the core that Hypothesis H5 aims to test. To answer this question, the study established a new regression model. Took emotional brand attachment as the ultimate variable to be explained (dependent variable), emotional response as the main influencing factor (independent variable), while still controlling for background information such as gender, educational level, and occupation.

Table 8

Regression Analysis Statistics of the Influence of Affective Responses on Emotional Brand Attachment

Variables	Unstandardized Coefficients		Standardized Coefficients			VIF
	B	Std. Error	Beta	t	p	
Controls_GENDER	-0.361	0.72	-0.033	-0.501	0.617	1.045
Controls_EDU	-0.322	0.436	-0.049	-0.738	0.462	1.045
Controls_SCREEN	0.02	0.464	0.003	0.044	0.965	1.061
Controls_MUSIC	0.039	0.755	0.003	0.051	0.959	1.049
Controls_OCC	2.253	0.841	0.176	2.678	0.008	1.021
Affective Response	0.99	0.097	0.67	10.211	< 0.001	1.016
R^2			0.509			
Adjusted R^2			0.483			
R^2 Change			0.442			
F Change			104.271***			

Source: developed by author

The results show that the fitting effect of this model is good. ($R^2 = 0.509$), Overall significance of the model was very high ($F = 104.271$, $p < 0.001$), indicating that the variables

in the model combined could explain approximately 50.9% of the changes in emotional brand attachment. Among all the control variables, only occupation had a remarkable positive impact on emotional brand attachment ($\beta = 0.176$, $p = 0.008$). Other variables such as gender and educational attainment, did not show noteworthy effects. The most important discovery is that affective responses have a positive impact on emotional brand attachment ($\beta = 0.670$, $p < 0.001$), which means that for Gen Z consumers, if sensory experiences can trigger more positive and intense emotional fluctuations, the emotional bond between them and the brand will be stronger. And the VIF values of all independent variables are close to 1.0, far below the warning line, indicating that the model does not have a multicollinearity problem and the results are reliable. So H5 is fully supported.

H6: Cognitive responses positively influence emotional brand attachment among Gen Z consumers

After verifying the validity of the emotional path, the study continued to explore whether brand attachment is also driven by rational cognition.

Table 9

Regression Analysis Statistics of the Influence of Cognitive Responses on Emotional Brand Attachment

Variables	Unstandardized Coefficients		Standardized Coefficients			VIF
	B	Std. Error	Beta	t	p	
Controls_GENDER	-0.156	0.738	-0.014	-0.211	0.834	1.044
Controls_EDU	-0.642	0.447	-0.098	-1.436	0.154	1.041
Controls_SCREEN	0.084	0.476	0.012	0.177	0.86	1.06
Controls_MUSIC	0.372	0.774	0.033	0.481	0.631	1.046
Controls_OCC	2.251	0.864	0.176	2.606	0.01	1.021
Cognitive Response	1.074	0.111	0.648	9.646	< 0.001	1.01
R ²			0.482			
Adjusted R ²			0.456			
R ² Change			0.415			
F Change			93.046***			

Source: developed by author

The research method adopted an analytical approach similar to that for testing H5, except that the core independent variable was replaced from "affective response" to "cognitive response". The results from Table 8 show that this model also has good explanatory power

($R^2 = 0.482$, $F = 93.046$, $p < 0.001$). The occupational variable still maintained a significant positive influence in this model ($\beta = 0.176$, $p = 0.01$). And the data analysis clearly demonstrated that cognitive response is a strong predictor of emotional brand attachment ($\beta = 0.648$, $p < 0.001$). That is to say, the good perception and rational evaluation formed by a brand in the minds of consumers can independently and effectively promote emotional attachment. The VIF values of all variables are also very low, indicating that the model results are reliable. So far, the research has verified the "dual path" of brand attachment formation. Both immediate affective response (H5) and in-depth cognitive response (H6) are powerful factors in predicting the emotional brand attachment of Generation Z consumers. Suppose H6 is thus fully supported.

H7: Generation Z characteristics (digital nativity and multimedia preference) moderate the relationship between visual and auditory stimuli and affective responses.

To verify Hypothesis H7, this study employed hierarchical regression analysis to examine.

Table 10

Statistical Analysis of the Moderating Effect of Gen Z Traits on the Relationship between Visual and Auditory Stimuli and Affective Responses

Variables	Visual Stimuli (B / Beta / t / p / VIF)	Auditory Stimuli (B / Beta / t / p / VIF)
Controls_GENDER	-0.288 / -0.039 / -0.74 / 0.461 / 1.054	0.288 / 0.039 / 0.633 / 0.528 / 1.058
Controls_EDU	-0.343 / -0.077 / -1.448 / 0.150 / 1.061	-0.234 / -0.053 / -0.852 / 0.396 / 1.051
Controls_SCREEN	0.396 / 0.085 / 1.585 / 0.116 / 1.060	-0.172 / -0.037 / -0.583 / 0.561 / 1.097
Controls_MUSIC	0.373 / 0.049 / 0.905 / 0.367 / 1.075	0.174 / 0.023 / 0.359 / 0.720 / 1.093
Controls_OCC	0.502 / 0.058 / 1.099 / 0.274 / 1.036	-0.167 / -0.019 / -0.306 / 0.760 / 1.090
Main Effect	3.644 / 0.993 / 13.343 / <0.001 / 2.062	2.813 / 0.766 / 10.243 / <0.001 / 1.537
Moderated by GenZ	-1.317 / -0.359 / -4.437 / <0.001 / 2.437	-0.114 / -0.031 / -0.373 / 0.710 / 1.921
In_Stimuli × Gen Z	-0.648 / -0.191 / -3.300 / 0.001 / 1.254	-0.424 / -0.114 / -1.630 / 0.106 / 1.334
Model 1	$R^2 = 0.016$	$R^2 = 0.016$
Model 2	$R^2 = 0.665$ $\Delta R^2 = 0.649$ $\Delta F = 111.332$ ($p < 0.001$)	$R^2 = 0.575$ $\Delta R^2 = 0.559$ $\Delta F = 75.717$ ($p < 0.001$)
Model 3	$R^2 = 0.694$ $\Delta R^2 = 0.029$ $\Delta F = 10.888$ ($p = 0.001$)	$R^2 = 0.585$ $\Delta R^2 = 0.010$ $\Delta F = 2.658$ ($p = 0.106$)

Source: developed by author

Table 10 presents the combination regression results of visual and auditory stimuli. Overall, visual stimulation has a stronger impact on affective responses than auditory stimulation. However, the moderating effect of Generation Z characteristics only has a stronger impact on visual stimulation. These results provide initial background support for H7.

For visual stimuli, in Model 1, the study first incorporated control variables. In Model 2, the study further incorporated visual stimuli and Gen Z traits. At this point, the explanatory power of the model has significantly improved ($R^2 = 0.665$). In Model 3, the study introduced the interaction term "visual stimulation \times Gen Z traits". The results showed that the F value of the model changed ($p = 0.001$). The interaction term itself also reached a statistically significant level (beta = -0.191, $t = -3.300$, $p = 0.001$). It should be noted that the standardization coefficient of this interaction term is negative (-0.191). This result indicates that the traits of Generation Z play a negative moderating role in the relationship between the two. However, due to the manipulation check for the visual stimulus was not significant. While we can confidently discuss the statistical interaction between the experimental condition and the measured trait, we cannot conclusively attribute the "visual stimulation" effect in this interaction to the intended perceptual quality of our manipulation. Hence, the traits of Generation Z play a significant regulatory role between visual stimulation and emotional response.

For audio stimuli, the results showed that auditory stimulation had a significant positive impact on emotional responses (beta = 0.766, $p < 0.001$). Model 2 introduced auditory stimulation as an independent variable. Model 3 further added the interaction term "auditory stimulation \times Generation Z characteristics". This shows that this interaction term has not reached a significant level (beta = -0.114, $t = -1.63$, $p = 0.106$). The change in model 3 in the F value of the model after adding the interaction term was not significant ($\Delta F = 2.658$, $p = 0.106$). These results indicate that the impact of auditory stimulation on emotional responses remains relatively stable at different levels of Gen Z characteristics. The characteristics of Generation Z have not significantly altered the relationship between the two.

In general, the results indicated a significant moderation effect for visual stimuli, suggesting that the impact of visual cues on affective responses varies depending on Gen Z traits. But the auditory stimuli were not. These findings partially support Hypothesis 7.

H8: Generation Z characteristics (digital nativity and multimedia preference) moderate the relationship between visual and auditory stimuli and cognitive responses.

Following the previous analysis of the regulatory effect, we further examined whether the characteristics of Generation Z also play a regulatory role in the cognitive response pathway, which is hypothesized as H8.

Table 11

Statistical Analysis of the Moderating Effect of Gen Z Traits on the Relationship between Visual and Auditory Stimuli and Cognitive Responses

Variables	Visual Stimuli (B / Beta / t / p / VIF)	Auditory Stimuli (B / Beta / t / p / VIF)
Controls_GENDER	-0.479 / -0.073 / -1.563 / .121 / 1.054	0.010 / 0.001 / 0.023 / .981 / 1.058
Controls_EDU	-0.030 / -0.008 / -0.163 / .871 / 1.061	0.039 / 0.010 / 0.157 / .875 / 1.051
Controls_SCREEN	0.309 / 0.074 / 1.573 / .119 / 1.060	-0.182 / -0.044 / -0.676 / .500 / 1.097
Controls_MUSIC	0.109 / 0.016 / 0.338 / .736 / 1.075	-0.018 / -0.003 / -0.042 / .967 / 1.093
Controls_OCC	0.525 / 0.068 / 1.462 / .146 / 1.036	0.143 / 0.019 / 0.288 / .774 / 1.090
Main Effect	3.235 / 0.990 / 15.069 / <.001 / 2.062	2.188 / 0.669 / 8.732 / <.001 / 1.537
Moderated by GenZ	-0.940 / -0.288 / -4.030 / <.001 / 2.437	0.201 / 0.061 / 0.717 / .475 / 1.921
ln_Stimuli × Gen Z	-0.639 / -0.212 / -4.140 / <.001 / 1.254	-0.661 / -0.199 / -2.785 / .006 / 1.334
Model 1	R ² = 0.010	R ² = 0.010
Model 2	R ² = 0.726 ΔR ² = 0.716 ΔF = 150.108 (p<0.001)	R ² = 0.534 ΔR ² = 0.524 ΔF = 64.753 (p<0.001)
Model 3	R ² = 0.762 ΔR ² = 0.036 ΔF = 17.137 (p<0.001)	R ² = 0.564 ΔR ² = 0.030 ΔF = 7.754 (p=0.006)

Source: developed by author

This study uses a hierarchical regression model to test the pathways of visual stimulation and cognitive response. After controlling for relevant variables and introducing the main effect of visual stimulation (Model 2), Model 3 added the interaction term "visual stimulation × Z-generation characteristics". The results showed that this interaction term was significant (beta = -0.212, $p < 0.001$), and the explanatory power of the model was significantly enhanced ($\Delta F = 17.137$, $p < 0.001$), indicating that the characteristics of Generation Z do

indeed have a moderating effect on the cognitive response of visual stimuli. However, the coefficient of the interaction term is negative, and the adjustment direction is inconsistent with the prediction: although the main effect of visual stimulation has a strong positive impact on cognitive response ($\beta = 0.99$), this impact is actually weakened among consumers with more typical characteristics of Generation Z. This means that the reaction patterns of Generation Z may not be as sensitive to visual cues as expected, but rather there exists some kind of "visual stimulation threshold" or usage fatigue effect. In addition, it should be noted that the visual stimulus operation test in this study did not reach significance. Therefore, although the results show statistical accommodation, they should not be directly attributed to visual differences and may involve other psychological or situational mechanisms.

Furthermore, in the auditory stimulation and cognitive response pathways, this study also conducted hierarchical regression tests. After introducing the main effect of auditory stimulation (Model 2) and adding the interaction term "auditory stimulation \times Z-generation characteristics" (Model 3), the statistical results showed that the explanatory power of the model was significantly enhanced ($\Delta F = 7.17$, $p = 0.006$), and the interaction term was significant ($\beta = -0.199$, $p = 0.006$). This discovery indicates that the characteristics of Generation Z also influence the effect of auditory stimulation on cognitive responses, but the direction remains negatively weakened. That is, auditory stimulation itself has a significant positive impact ($\beta = 0.669$), but this impact gradually weakens in the typical Generation Z group. It can be seen from this that in digital sensory experience scenarios, generational characteristics such as a strong sense of self-expression, rapid information processing habits, or distraction patterns may produce a compression effect in the cognitive processing stage, reducing the effectiveness of the stimulus.

In summary, hypothesis 8 is statistically supported in terms of the existence of a moderation effect, as Generation Z characteristics significantly interact with both visual and auditory stimuli in predicting cognitive responses. However, the direction of moderation is negative, which differs from the theoretically expected enhancing pattern. Therefore, H8 can be regarded as partially supported, demonstrating a significant yet weakening moderation effect.

To sum up the analysis, which can get below hypotheses test results:

H1 and H2 are fully supported.

The auditory part is fully supported, which is Hypothesis 2. Successful manipulation tests enable us to be relatively certain that auditory stimulation has a positive causal effect on emotional and cognitive responses.

Hypothesis 1, the visual part is fully supported as well. The data show that the "visual stimulus" variable has a very strong positive correlation with both responses (and the effect value is greater than that of hearing), but due to the unsuccessful of the manipulation test, we cannot attribute it to the visual perception difference preset in the experiment. This discovery is highly enlightening, but its exact causal nature awaits verification through future research.

H3 is partial support

Visual stimuli show a strong positive statistical association with cognitive responses among Gen Z consumers. But because unsuccessful manipulation check, this effect remains uncertain.

H4 is fully supported.

Auditory stimuli demonstrate a significant positive causal effect on cognitive responses, reinforced by a successful manipulation test, allowing stronger confidence in the directional interpretation. This indicates that auditory design elements in digital brand interfaces can effectively enhance cognitive processing among Gen Z users.

H5 is fully supported.

Affective responses show a remarkable positive effect on emotional brand attachment, indicating that stronger emotional reactions lead to a higher level of attachment toward the brand among Gen Z consumers.

H6 is fully supported.

Cognitive responses demonstrate a significant positive influence on emotional brand attachment, indicating that rational evaluations and cognitive processing play an important role in fostering emotional connections between Gen Z consumers and brands in digital interface contexts.

H7 is not supported in the hypothesized direction.

Although Generation Z characteristics significantly moderate the influence of visual and auditory stimuli on affective responses, the moderation appears in a weakening rather

than an enhancing direction. This suggests that while Gen Z traits do shape how digital sensory cues are emotionally processed, the effect reduces rather than amplifies stimulation impacts among consumers exhibiting stronger Gen Z characteristics.

H8 is not supported in the hypothesized direction.

A significant moderating effect is found in the sensory–cognition pathway, indicating that Generation Z characteristics do influence how visual and auditory stimuli translate into cognitive responses. However, similar to H7, this moderation is negative in direction, meaning that the cognitive impact of sensory stimulation becomes weaker among individuals with more prominent Gen Z traits. Therefore, H8 is considered supported in terms of the presence of moderation.

It should be noted that these moderation hypotheses are secondary to the core S–O–R relationships examined in this study; therefore, while the directional mismatch is theoretically meaningful, it does not undermine the primary evidence supporting the main effects of sensory stimuli on affective and cognitive responses, nor the downstream influence on emotional brand attachment.

CONCLUSIONS AND PROPOSALS

Key findings and main effects

Through the analysis of this study, the following main conclusions can be drawn. Firstly, auditory stimulation has a significant positive impact on the affective and cognitive responses of Generation Z consumers in digital brand interfaces. This conclusion is supported by a successful manipulation check, participants clearly perceived the auditory stimulus. And the regression analysis also demonstrated that auditory cues affect affective and cognitive responses. These dual layers of evidence make the auditory effect more robust than the visual effect, which showed weaker or inconsistent effects in comparison. Research has found that music, rhythm and sound texture can effectively stimulate users' positive emotions such as pleasure, interest or trust, and also enhance users' understanding and cognitive evaluation of brand information. In short-term brand experiences, auditory information can enhance users' sense of immersion. Even if visual information is not prominent, auditory stimulation can still independently trigger emotional experiences. This indicates that in digital brand interface design, auditory elements are not merely auxiliary but key factors with independent emotional value.

Secondly, this study confirmed the significant role of affective and cognitive responses in emotional brand attachment. Positive affective experiences can help consumers establish an emotional connection with the brand, enhance their favorable impression and loyalty intentions. Cognitive responses, such as a clear understanding of brand information, logical judgment and credibility evaluation, provide rational support and stability guarantee for emotional attachment. It can be said that the emotional path plays a leading role in the formation of emotional brand attachment, while the cognitive path serves as an auxiliary. The two work together to promote the long-term relationship between users and brands.

Despite limitations related to visual manipulation, the study highlights the theoretical and practical significance of multi-sensory design in digital brand interfaces. Importantly, the findings demonstrate that even in the absence of strong visual effects, auditory stimulation alone can significantly influence users' psychological states and brand-related outcomes. This suggests that multi-sensory digital experiences are not exclusively dependent on visual dominance and that non-visual channels can independently shape consumer responses.

In addition, this study also reveals the theoretical and practical significance of multi-sensory design in digital brand interfaces. Even if visual manipulation is not successful, auditory stimulation can still significantly drive users' psychological and brand responses, indicating that in the digital environment, multi-sensory information is not entirely dependent on visual dominance but can independently influence user experience through non-visual channels such as hearing. This provides important inspiration for brands in interface design: in a digital environment rich in content and dense in information, the rational use of auditory elements can not only enhance user experience but also make up for the limitations or weakening of visual elements.

Finally, this study provides preliminary insights into the characteristics of Generation Z users. Although the moderating effect of visual pathways has not been verified, theoretically, user characteristics may influence the perception of multi-sensory stimuli and psychological responses. For instance, characteristics such as personalization, digital native habits, and information processing preferences may interfere with the emotional stimulation effect of visual information, while having a relatively minor impact on auditory stimulation. This assumption provides a direction for subsequent research. In the future, it is possible to explore the differential effects of different user characteristics on visual, auditory and compound multi-sensory pathways, thereby optimizing the personalized design strategy of digital brand interfaces.

Overall, this study emphasizes the following core viewpoints:

1. Auditory stimulation has a significant positive effect on digital brand experiences and can independently trigger emotional and cognitive responses.
2. Emotional and cognitive responses jointly promote emotional brand attachment, among which the emotional path is the main channel, and the cognitive path provides auxiliary support.
3. The effect of visual stimulation was not verified in this study, and the limitations of the experiment suggest that the visual manipulation scheme needs to be improved in future research.
4. The significance of multisensory design should be interpreted conditionally: its benefits primarily emerge in digital brand interfaces where auditory cues are purposefully

embedded and align with the intended experiential goals, rather than across all digital contexts.

5. The characteristics of Generation Z users may have a moderating effect on the visual stimulation pathway, and this direction is worth further exploration.

Theoretical implications

This research makes multiple contributions at the theoretical level. Its core value lies not only in verifying the relationships among specific variables, but also in expanding and deepening the existing theoretical framework of digital marketing and consumer behavior. Specifically, the theoretical significance of this study can be summarized into the following three interrelated levels: the advancement of the multi-sensory integration research paradigm, the redefinition of intergenerational characteristics as complex situational factors, and the revelation of the asymmetric mechanism of sensory effects in digital interfaces. These findings together constitute a powerful supplement to the existing knowledge system.

Firstly, this study systematically advanced the multi-sensory research paradigm in the field of digital brand experience. Previous theoretical discussions and empirical studies have often focused on the independent effects of a single sensory channel (such as visual design or auditory signage), or simply regarded multi-sensory experiences as the superposition of effects. This paper breaks through the research limitations of a single sense by simultaneously examining the differentiated influence paths of visual and auditory stimuli on emotion, cognition, and even ultimate brand attachment within the same research framework. Research shows that in the specific medium of digital interfaces, vision and hearing do not simply coexist but jointly shape the user experience in a collaborative yet competitive manner.

Secondly, this study has greatly enriched and deepened our understanding of the boundary conditions of sensory stimulation effects by introducing and testing the moderating role of "Generation Z characteristics". Although existing literature often takes age or generation as categorical variables, it rarely delves deeply into how the group psychological characteristics of a specific generation can act as a dynamic situational factor to systematically alter the intensity and direction of core marketing stimuli. This study operationalizes the characteristics of Generation Z as a continuous variable and examines its moderating effect, which is a valuable attempt both methodologically and theoretically. A particularly crucial theoretical finding is that this feature does not unidirectionally enhance the stimulus effect as

intuitively assumed. Instead, it shows a significant negative moderating (weakening) effect in both the dual paths where visual stimuli influence emotions and cognition. This "weakening effect" holds significant theoretical cautioning significance: it directly challenges the linear thinking that "digital natives are inevitably more susceptible to digital sensory stimuli", suggesting that intergenerational characteristics may contain some critical, habitual or higher-threshold information processing patterns. This forces theoretical researchers to abandon the homogenization assumption about the young consumer group and instead adopt a more complex and dialectical perspective to construct a theoretical model of the nonlinear and conditional influence between generational characteristics and digital interaction design.

Finally, and most theoretically, this study reveals the possible "structural asymmetry" of multi-sensory stimulation in the digital brand experience mechanism and the selective regulation of Generation Z characteristics on different stimulation pathways. This asymmetry is mainly reflected in two aspects. Firstly, in the empirical results of this study, auditory stimulation has shown significant effects on both emotional and cognitive responses. However, due to the ineffective implementation of manipulation, the main effects of visual stimulation have not been verified, and thus its relative intensity in multi-sensory experiences cannot be determined. This suggests that future research needs to further examine the relative influence of visual and auditory stimuli in digital brand interfaces. Secondly, regarding the moderating effect, this study found that the Generation Z characteristic has no significant moderating effect on the emotional pathway of auditory stimulation, but shows a relatively weak negative moderating effect on the cognitive pathway. Due to the failure of visual manipulation, this study was unable to directly examine the moderating effect of Generation Z characteristics on the visual pathway. However, it can be theoretically speculated that visual information processing may be more susceptible to the long-term formed digital habits, cognitive styles or generational characteristics of users, while the immediate emotional responses triggered by hearing may be more common and stable among groups. This model indicates that in the psychological mechanism of digital brand communication, different sensory information may act on user behavior through different processing channels. Some paths may be relatively stable, while others are more susceptible to interference from individual characteristics or situational factors.

In conclusion, the theoretical contributions of this study possess interdisciplinary and

multi-dimensional characteristics. Firstly, it empirically verified the relationship between multi-sensory stimulation and brand attachment, especially the significant role of auditory stimulation in the emotional and cognitive responses of Generation Z consumers in the digital brand experience. More importantly, this study explores three core phenomena. The potential asymmetry of sensory stimulation mechanisms, the selective regulation of stimulation pathways by Generation Z characteristics, and the dominant role of emotional pathways in the formation of brand attachment have proposed directions for the revision and deepening of existing sensory marketing theories and intergenerational consumer behavior theories.

Practical implications

Based on the empirical findings of this study, we can provide a series of valuable and directly operational inspirations for brand operators, interface and experience designers, and digital product managers. These inspirations are not general design principles but suggestions based on the differentiated responses of Generation Z consumers to specific sensory stimuli, which can help practitioners make wiser decisions in the complex digital environment.

Firstly, this study offers significant practical implications for visual design strategies. The traditional view holds that in order to attract the attention of young digital native users, visual design often requires the use of stronger and more dazzling stimuli (Petit, et al., 2019). However, this study reminds designers that blindly pursuing the absolute intensity of visual stimulation when targeting user groups with typical Generation Z characteristics may not be the optimal strategy. Overly complex, highly saturated or frequently flashing dynamic effects do not necessarily enhance user experience; instead, they may lead to habitual neglect or even psychological resistance.

It should be emphasized that the visual manipulation in this study did not reach statistical significance in the experiment, which means that the participants may not have fully perceived the visual differences presented in the experiment. Therefore, there are two possible explanations for the phenomenon we have observed that the so-called "Gen Z feature may weaken the effect of visual stimulation".

1. User characteristic explanation: Generation Z users may have developed a "tolerance" or higher critical judgment towards high-intensity digital visual content, so high visual stimulation has a limited effect on their emotional and cognitive stimulation.

2. Explanation of the stimulus itself: The intensity or discrimination of the visual stimulus provided by the experiment may not be sufficient to trigger universal emotional and cognitive responses. Therefore, the so-called "weakening effect" may partly stem from the insufficiency of the visual stimulus itself.

Nevertheless, in digital interface design, "effective difference" is more important than "absolute strength". Designers should pursue visual designs that are highly consistent with brand goals and can create meaningful contrasts among interface elements, rather than merely pursuing cool effects. Such differences should be functional or narrative rather than purely decorative. In addition, testing and verification are of vital importance. Before large-scale application of visual design schemes, conducting small-scale usability tests and effectiveness verifications is an indispensable step. Design should not only be aesthetically pleasing but also ensure that the target users can perceive and understand the design content as expected. Especially for Generation Z users, visual design needs to cross a higher "perception and recognition threshold". Plain and unremarkable designs are clearly ineffective, but "high stimuli" that fail to exceed the threshold can also become invalid noise. A successful design should precisely fall above the threshold, being novel and eye-catching enough, capable of conveying value, and at the same time avoiding rejection due to excessive or exaggerated design.

Secondly, the research findings have affirmed the irreplaceable value of auditory design in shaping a stable emotional atmosphere. Although auditory stimulation is less direct than visual stimulation, research has revealed two major advantages: First, the positive emotional responses stimulated by hearing are relatively stable and less likely to be weakened by individual differences among Generation Z; Secondly, in terms of promoting cognitive responses, hearing is also an effective path. This points out the direction for brand and product managers: sound should not be an aftertaste but should be regarded as a fundamental brand asset and experience dimension for strategic planning. In practice, this means that a systematic auditory recognition system for the brand needs to be constructed, such as designing recognizable and pleasant interactive sound effects, background ambient music or brand melodies. In scenarios where users need to focus, relax or immerse themselves, appropriate sound design can steadily create the desired emotional tone in a non-intrusive

way, enhancing the overall comfort and favorability of users. Especially in today's world where visual attention has been overly exploited, the auditory channel offers brands a subtle yet efficient communication path.

Finally, and most crucially, this study advocates a design philosophy of "sensory restraint and consistency" for future digital brands. The "asymmetry" and "weakening effect" revealed by the research findings jointly point to one conclusion: for the well-informed and highly sensory threshold Generation Z, the simplistic and brutal sensory bombardment strategy has already failed. What they need is not more and stronger stimulation, but a more precise, coordinated and meaningful overall experience. This raises the comprehensive capabilities of the practitioners. Brand managers need to define and manage multi-sensory experiences from a new perspective as a whole, ensuring that the visual styles, auditory tones, and even tactile feedback that may be involved in the future convey a unified brand core value and personality, and avoiding conflicts among sensory signals. When product and experience designers conceive functions and interfaces, they should take into account the "sensory load" of users. This means that careful selection and arrangement are needed. At critical moments, sensory elements of appropriate intensity (such as important visual cues or emotional sound feedback) should be used, while at other times, bold blank Spaces should be left to create a soothing cognitive space for users.

Interaction designers should have a deep understanding of the characteristics of different sensory channels and conduct cross-sensory collaborative design. For instance, while providing visual confirmation feedback, supplementing it with crisp auditory feedback can jointly enhance the sense of certainty and pleasure of the operation, and this multi-sensory redundancy is beneficial to the robustness of the experience.

In conclusion, the practical implications of this study can be summarized as a shift in thinking from "stimulus-driven" to "experience-driven". It tells all the builders of the digital ecosystem: In the battlefield of competing for the minds of Generation Z, the key to victory does not lie in having the most dazzling special effects or the loudest voices, but in whether one can control multi-sensory elements in a restrained, intelligent and holistic way to create a truly comfortable, trustworthy and emotionally engaging digital brand environment for them. This is a more advanced and sustainable form of competitiveness.

Limitations and Future Research

This study has several limitations. These limitations mainly stem from the practical constraints of the research design, which provide a clear path for future exploration.

First and foremost, and most crucially, the limitation lies in the construction and validity of the experimental stimulus materials. Although the researcher carefully designed four experimental groups with different sensory combinations to test the hypothesis, the acquisition and matching of the stimulating materials themselves faced huge challenges in practical operation. This study adopted brand advertising videos of about ten seconds as the carrier. However, it is extremely difficult to find ready-made materials in the market that fully conform to the ideal theoretical combinations such as "high visual - low auditory" and "pure auditory". For instance, it is almost impossible to find a commercial advertisement that has a high visual impact but deliberately uncoordinated or plain background music, as this goes against the creative logic of commercial advertisements themselves. Therefore, the researcher must make certain subjective adjustments and compromises in material selection and later matching. This directly led to a key result: in the subsequent manipulation tests, the manipulation of visual stimuli failed to reach a statistically significant level. This means that the preset visual differences between groups may not have been perceived strongly enough by the participants. This limitation makes our conclusion that "the characteristics of Generation Z weaken the effect of visual stimulation" need to be interpreted more carefully: Does it reflect the true "tolerance" of Generation Z users to strong visual stimulation, or is it partly due to the "insufficient effectiveness" of the visual stimulation provided by this study itself not exceeding their perceptual threshold? The unresolved issue highlights the extreme importance of conducting rigorous pre-testing and validity validation of stimulant materials in multi-sensory marketing experiments.

Secondly, the geographical and cultural backgrounds of the samples in this study are relatively concentrated. All participants come from specific regions and cultural environments. As a global phenomenon, the digital behavior and aesthetic preferences of Generation Z are deeply influenced by local social and cultural factors. Therefore, this study finds that its universality needs to be tested in a broader and more diverse cultural context, especially the conclusion regarding the moderating role of intergenerational characteristics.

Based on the above limitations, future research can seek breakthroughs in the following directions. First, adopt more cutting-edge methods in the development of stimulating materials. Future research can abandon the path of seeking ready-made advertisements and instead adopt computer-generated images, virtual reality environments or controllable interactive prototypes to construct stimulating materials. This method enables researchers to precisely manipulate and independently change the visual complexity, color, dynamics, pitch, rhythm and coordination of auditory elements at the pixel level, thereby truly achieving "pure" manipulation of a single sensory variable and fundamentally solving the problem of material validity. Second, carry out systematic cross-cultural comparative studies. To explore whether the sensory action patterns and intergenerational regulatory effects discovered in this study are stable among Gen Z groups with different cultural backgrounds. This helps to distinguish the universal laws of digital native psychology from the influence of cultural particularity, providing refined guidance for the brand's globalization strategy and localization execution. Third, introduce multimodal data to deepen the measurement level. In addition to self-reporting scales, future research can simultaneously collect physiological and behavioral data such as eye movement trajectories, facial expression coding, skin electrical responses or electroencephalograms. These data can objectively and promptly reflect users' attention allocation, emotional arousal and cognitive load, and form a triangular verification with subjective reports, providing richer and more fundamental insights into users' inner experiences. Fourth, explore real scenarios and long-term effects. Extend the experimental environment to real digital platforms and track over a longer period how sensory experiences affect users' long-term brand behaviors, such as repurchase, word-of-mouth recommendations, and community engagement. This can lead the research conclusion from "instantaneous response" to "relationship construction", possessing higher ecological validity and practical value.

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SUMMARY IN ENGLISH

VILNIUS UNIVERSITY BUSINESS SCHOOL

DIGITAL MARKETING

LIYUE, LE

THE INFLUENCE OF VISUAL AND AUDITORY STIMULI IN DIGITAL BRAND INTERFACES ON EMOTIONAL BRAND ATTACHMENT AMONG GEN Z CONSUMERS

Supervisor – Associate professor, Indrė Razbadauskaitė-Venskė

Master's thesis (project) was prepared in Vilnius, in 2026

Scope of Master's thesis (project) – 83 pages.

Number of tables used in the FMTP - 11 pcs.

Number of figures used in the FMTP - 1 pcs.

Number of bibliography and references - 104 pcs.

The FMTP described in brief:

This research investigates whether visual and auditory elements in digital brand interfaces shape emotional brand attachment among Generation Z. A 2×2 survey experiment with 123 participants shows that both sensory cues significantly enhance affective and cognitive responses, which subsequently increase emotional brand attachment. However, Gen Z traits moderate these pathways in a weakening, rather than strengthening direction, suggesting reduced sensitivity among highly digital-native consumers. The findings clarify the affective–cognitive mechanism of digital sensory design and offer insights for brands and UX designers developing Gen-Z-oriented digital experiences.

Problem, objective and tasks of the FMTP:

Despite rapid digitalisation, brands still struggle to build emotional bonds with Gen Z in virtual environments. This FMTP aims to examin

e how visual and auditory stimuli evoke emotional and cognitive responses and how these states lead to emotional brand attachment. Key tasks included literature review, model and hypothesis development, questionnaire design, data collection, sensory-response measurement, causal testing, and deriving design suggestions.

Research methods used in the FMTP:

A 2×2 online survey-based experiment was conducted, and statistical tools included descriptive analysis, t-tests, factor analysis, ANOVA, and hierarchical regression, using validated scales for emotional and cognitive constructs.

Research and results obtained:

Both sensory stimuli significantly influenced emotional and cognitive responses. Auditory effects show causal certainty, whereas visual effects require interpretive caution due to manipulation-check limitations. Emotional and cognitive reactions significantly predict emotional brand attachment. Moderation by Gen Z traits is significant but weakening in direction.

Conclusions of the FMTP:

Digital sensory cues influence brand attachment via affective and cognitive mechanisms. This FMTP extends S–O–R theory to digital contexts and provides practical UX/UI implications. Future research should strengthen visual operationalisation and explore additional multisensory dimensions.

SUMMARY IN LITHUANIAN

VILNIAUS UNIVERSITETO VERSLO MOKYKLA

SKAITMENINĖ RINKODARA

LIYUE, LE

**VIZUALINIŲ IR GARSO STIMULIŲ ĮTAKA EMOCINIAM PREKĖS ŽENKLO
PRISIRIŠIMUI TARP Z KARTOS VARTOTOJŲ SKAITMENINĖSE PREKĖS ŽENKLO
SĄSAJOSE**

Vadovas– Docentas, Indrė Razbadauskaitė-Venskė

Magistro baigiamasis darbas (projektas) parengtas Vilniuje, 2026 m.

Magistro baigiamojo darbo (projekto) apimtis – 83 psl.Lentelių skaičius FMTP - 11 vnt.Paveikslų skaičius FMTP - 1 vnt.Bibliografinių šaltinių skaičius FMTP - 104 vnt.**FMTP trumpas aprašymas:**

Šiame tyrime analizuojama, ar vizualiniai ir garsiniai elementai skaitmeninėse prekių ženklų sąsajose gali formuoti emocinį Z kartos vartotojų prisirišimą prie prekių ženklo. 2x2 apklausos–eksperimento dizainas (n = 123) atskleidė, kad abu sensoriniai stimulai reikšmingai sustiprina afektines ir kognityvines reakcijas, o tai savo ruožtu didina emocinį prisirišimą prie prekių ženklo. Tačiau Z kartos savybės moderuoja šiuos ryšius priešinga, silpninančia kryptimi, kas leidžia daryti prielaidą, jog aukšto skaitmeninio gimtumo vartotojai yra mažiau jautrūs skaitmeniniams sensoriniams stimulams. Tyrimas padėjo išaiškinti afektinį–kognityvinį mechanizmą ir pateikti įžvalgų prekių ženklo bei UX/UI dizaineriams, kuriantiems skaitmenines patirtis Z kartai.

Problema, tikslas ir uždaviniai:

Nepaisant spartėjančios skaitmenizacijos, prekių ženklo vis dar sunku sukurti emocinį ryšį su Z kartos vartotojais virtualioje aplinkoje. Šio FMTP tikslas – išnagrinėti, kaip vizualiniai ir garsiniai stimulai sukelia emocines ir kognityvines reakcijas bei kaip šios reakcijos lemia emocinį prisirišimą prie prekių ženklo. Pagrindiniai uždaviniai apėmė: literatūros analizę,

konceptualaus modelio ir hipotezių kūrimą, klausimyno sudarymą, duomenų surinkimą, sensorinių reakcijų įvertinimą, priežastinio mechanizmo tikrinimą ir praktinių dizaino rekomendacijų parengimą.

Tyrimo metodai:

Buvo atliktas 2×2 internetinės apklausos pagrindu paremtas eksperimentas, skirtas Z kartos vartotojams. Duomenys analizuoti naudojant aprašomąją statistiką, t-testus, faktorinę analizę, ANOVA ir hierarchinę regresiją. Emocinėms ir kognityvinėms konstrukcijoms vertinti buvo taikytos validuotos skalės, užtikrinančios patikimumą ir validumą.

Tyrimo rezultatai:

Tyrimas parodė, kad vizualiniai ir garsiniai stimulai reikšmingai veikia afektines ir kognityvines reakcijas. Garsiniai stimulai pasižymi tvirtesniu priežastingumo patvirtinimu, o vizualinių stimulų interpretacijai reikalingas atsargumas dėl manipuliacinio patikrinimo ribotumų. Emocinės ir kognityvinės reakcijos reikšmingai skatina emocinį prisirišimą. Z kartos savybės statistiškai reikšmingai moderuoja sensorinių stimulų poveikį, tačiau moderavimas vyksta silpnėjančia kryptimi..

Išvados:

Skaitmeniniai sensoriniai stimulai, ypač vaizdas ir garsas, veikia emocinį prisirišimą per afektinius ir kognityvinius mechanizmus. FMTP prisideda prie akademinų žinių, praplėsdamas S–O–R teorijos taikymą skaitmeninių sąsajų kontekste ir identifikudamas ribines sąlygas, susijusias su Z kartos vartotojais. Praktinė nauda atsiskleidžia pateikiant UX/UI ir skaitmeninės rinkodaros rekomendacijas prekės ženklams. Ateities tyrimai galėtų toliau tobulinti vizualinių stimulų operacionalizavimą ir tirti papildomas multisensorines dimensijas, tokias kaip lytėjimo ar interaktyvusis dizainas.

ANNEXES

Appendix A. Questionnaire

This short study (about 6–8 minutes) explores how people perceive brands through design and sound.

To ensure a pleasant experience, please complete the research in a quiet environment. If you have headphones, please wear them. If you don't have headphones, please adjust the volume to an appropriate level and make sure it's quiet around you.

Important: If YouTube cannot load on your device or network, please switch to another network.

If it still doesn't work, please do not continue, as the study requires watching the video.

1. Consent

Item Code	Item	Scale
CONSENT_1	I am 18–28 and I agree to participate in this academic study voluntarily.	<input type="radio"/> No <input type="radio"/> Yes

2. Screening

Item Code	Item	Scale
SCR_AGE	Please select your age.	Numeric (years)
SCR_COUNTRY	Where do you currently live?	Open / List
SCR_AUDIO	My environment is quiet.	1=Not quiet ... 7=Quiet
SCR_ATT	Attention check: please select "Strongly agree".	1=Strongly disagree ... 7=Strongly agree

3. Randomization

Item Code	Item	Scale
RAND_GROUP	System assignment to one of the stimuli conditions.	Auto

4. Manipulation Check

Item Code	Item	Scale
MC_VIS1	The visuals (colors, layout, imagery) were vivid and eye-catching.	1=Strongly disagree ... 7=Strongly agree
MC_VIS2	The visuals fit the brand's personality.	1=Strongly disagree ... 7=Strongly agree
MC_AUD1	The audio (music/voice/sound) matched the visuals.	1=Strongly disagree ... 7=Strongly agree
MC_AUD2	The audio quality felt clear and pleasant.	1=Strongly disagree ... 7=Strongly agree

5. Stimuli

- Visual Stimuli

Item Code	Item	Scale
VS_1	The layout was balanced and easy to follow.	1=Strongly disagree ... 7=Strongly agree
VS_2	The imagery was relevant to the brand message.	1=Strongly disagree ... 7=Strongly agree
VS_3	The overall visual design was attractive	1=Strongly disagree ... 7=Strongly agree

- Auditory Stimuli

Item Code	Item	Scale
AS_1	The background music/voice fit the brand.	1=Strongly disagree ... 7=Strongly agree
AS_2	The tempo/rhythm felt appropriate for the brand.	1=Strongly disagree ... 7=Strongly agree
AS_3	I could recognize a distinct sound logo or audio signature.	1=Strongly disagree ... 7=Strongly agree
AS_4	The audio enhanced my experience with the content	1=Strongly disagree ... 7=Strongly agree

6. Organism

- Affective Responses

Item Code	Item	Scale
AR_1	I feel pleasant after viewing/listening to this brand content.	1=Strongly disagree ... 7=Strongly agree
AR_2	I feel excited/energized.	1=Strongly disagree ... 7=Strongly agree
AR_3	The content resonates with my values or preferences.	1=Strongly disagree ... 7=Strongly agree

- Cognitive Responses

Item Code	Item	Scale
CR_1	This brand seems authentic to me.	1=Strongly disagree ... 7=Strongly agree
CR_2	I consider this brand trustworthy.	1=Strongly disagree ... 7=Strongly agree
CR_3	The design communicates a clear brand identity.	1=Strongly disagree ... 7=Strongly agree

7. Outcome

Emotional Brand Attachment

Item Code	Item	Scale
EBA_1	I feel emotionally connected to this brand.	1=Strongly disagree ... 7=Strongly agree
EBA_2	I would miss this brand if it were no longer available.	1=Strongly disagree ... 7=Strongly agree
EBA_3	This brand feels like a part of my life.	1=Strongly disagree ... 7=Strongly agree
EBA_4	I would choose this brand over others with similar features.	1=Strongly disagree ... 7=Strongly agree

8. Moderator

Item Code	Item	Scale
GZ_DN1	I am very comfortable navigating digital interfaces.	1=Strongly disagree ... 7=Strongly agree
GZ_DN1	I quickly adapt to new apps and platforms.	1=Strongly disagree ... 7=Strongly agree
GZ_MM1	I prefer content that combines visuals and audio.	1=Strongly disagree ... 7=Strongly agree
GZ_AU1	I value brands that feel honest and genuine.	1=Strongly disagree ... 7=Strongly agree
GZ_AT1	I decide within a few seconds whether to keep watching.	1=Strongly disagree ... 7=Strongly agree

9. Controls

Item Code	Item	Scale
CTRL_GENDER	Gender	Male / Female / Non-binary / Prefer not to say
CTRL_EDU	Highest education level	List
CTRL_SCREEN	Average daily smartphone use (hours)	1–2h / 3–5h / 6h+
CTRL_MUSIC	Have you received formal music training?	<input type="radio"/> No <input type="radio"/> Yes
CTRL_OCC	What is your current status?	Student / Employed / Other